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WORLD MARITIME UNIVERSITY

Malmö, Sweden

**Integrating requirements of Industry 4.0 into
maritime education and training:
Case study of Vietnam**

By

Tran Thi Nguyet Minh

(Vietnam)

A dissertation submitted to the World Maritime University in Partial
Fulfilment of the requirements for the award of the degree of

MASTER OF SCIENCE

In

MARITIME AFFAIRS

(MARITIME EDUCATION AND TRAINING)

2018

Declaration

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

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

(Signature):

A handwritten signature in blue ink, appearing to read 'Thymon', is written over a solid blue horizontal line. Below this line is a dotted horizontal line, which is part of a signature line.

(Date):

18 September 2018

Supervised by:

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Supervisor' affiliation:

World Maritime University

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ABSTRACT

Title of dissertation: **Integrating requirements of Industry 4.0 into maritime education and training: case study of Vietnam**

Degree: **Master of Science**

KEYWORDS: Industry 4.0, fourth industrial revolution, MET, maritime education, Vietnam.

In the history of humankind, three industrial revolutions have taken place. All these industrial revolutions affected not only on the production, but also the labor market and the education system. Right now, a fourth industrial revolution is taking shape, known through the term “Industry 4.0” and it is forecasted to have profound impacts on societies, and all economies. In maritime industry, Industry 4.0 with new technologies have brought the industry to the new era of the information technology platform and raised the need for adjusting maritime education and training.

Being characterized as a sea country, the Vietnamese Government highlighted the importance of sea economy towards the national development. Under this technological disruption, there is the need to investigate how Vietnam MET should react.

This dissertation research systematically examine industry 4.0 and its requirements, then give suggestions how to integrate requirements of industry 4.0 into Vietnam MET, taking into account the lessons and experiences of different countries and maritime education and training institutions around the world.

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List of abbreviations

| | |
|------------|--|
| 4IR | Fourth Industrial Revolution |
| AI | Artificial Intelligence |
| AIS | Automatic Identification System |
| ATM | Automated Teller Machine |
| CPD | Continuous professional development |
| CPS | Cyber-physical system |
| ECDIS | Electronic Chart Display and Information System |
| GDP | Gross Domestic Product |
| GNSS | Global Navigation Satellite Signals |
| GPS | Global Position System |
| IAMU | International Association of Maritime Universities |
| ICT | Information and Communication Technology |
| IMO | International Maritime Organisation |
| IoS | Internet of services |
| IoT | Internet of things |
| IT | Information Technology |
| MASS | Maritime Autonomous Surface Ships |
| MET | Maritime Education and Training |
| METI | Maritime Education and Training Institution |
| MOT | Ministry of Transport |
| STCW | International Convention on Standards of Training, Certification and Watchkeeping for Seafarers |
| UNIDO | United Nations Industrial Development Organisation |
| UT-HCMC | Ho Chi Minh City University of Transport |
| VINAMARINE | Vietnam Maritime Administration |
| VMU | Vietnam Maritime University |
| WEF | World Economic Forum |

1. Introduction

1.1 Background and problem statement

In the history of humankind, three industrial revolutions have taken place. The first industrial revolution of mechanization started in the second half of the 18th century and intensified throughout the entire 19th century, led by the invention of the steam engine. Nearly a century later at the end of the 19th century, the second industrial revolution was initiated with the introduction of electricity. The third industrial revolution, or digital revolution, started in the 1970s, when telecommunication and computers emerged. All these industrial revolutions affected not only on the production, but also the labor market and the education system as well. (Benešová & Tupa, 2017).

Right now, a fourth industrial revolution is taking shape, known through the term “Industry 4.0”. This term has been publicly known since 2011 when an initiative named “Industrie 4.0” promoted the idea as an approach to strengthening the competitiveness of the German manufacturing industry (Hermann et al, 2016). This fourth industrial revolution is characterized by “a much more ubiquitous and mobile internet, by smaller and more powerful sensors that have become cheaper, and by artificial intelligence and machine learning” (Schwab, 2016, p.12). It is forecasted to have profound impacts on societies, and all economies (UNIDO, 2017).

In maritime industry, Industry 4.0 with new technologies have brought the industry to the new era of the IT platform. Some technologies have been deployed with success and some are still to be introduced to shipping (Baba, 2018). For example, Internet of things (IoT) have been used by Maersk Group for container tracking and reefer monitoring. In November 2017, C-Worker 7 became the first semi-autonomous vessel to join the UK ship register as a multipurpose work-class vessel. More and more technologies are predicted to shake up the maritime industry, such as deep learning, artificial intelligence, blockchain, augmented reality, drones, robotics, cyborg crew, and so on.

“One of the most important duties of maritime education and training institutions is to prepare their cadets for the future” (Ziarati et al., 2010). However, there are not many researches that have been publicized so far about impacts on Maritime Education and Training (MET) of the Industry 4.0 and how MET should react toward this challenge.

In this research, Vietnam is used as a case study. Being characterized as a country of 3,260 km coastline and having an exclusive economic zone of over 1 million square kilometers, three times the land area, the Vietnamese Government highlighted the importance of sea economy towards the national development. In the Resolution 09-NQ/TW of the National Assembly on The ocean strategy for Vietnam towards 2020 (2007), it is emphasized that Vietnam should make all efforts to rise the sea economic contribution to Vietnam’s gross domestic product (GDP) up to 53%-55%. In addressing this objective, improving the quality of maritime education and training is very important.

Concerning the Industry 4.0, the Vietnamese Prime Minister has issued the Directive 16/CT-TTg in May 2017 on strengthening the capacity to tackle challenges posed by the Industry 4.0 as well as to harness this revolution for development. Among a number of prioritized missions, he mentioned the need for strengthening science, technology, engineering and math education at schools, enhancing the research and teaching capacity at higher education institutions, increasingly educating necessary skills for Industry 4.0. He also required Ministries, including the Ministry of Transport (MoT), which is in charge of monitoring all activities relating to transportation including maritime, to review their development strategies and make adjustments for the 4.0 Revolution. It can be said that the Vietnamese Government has paid certain attention towards seizing opportunities and minimizing negative impacts of Industry 4.0. However, there is no clear direction or guidance from MoT, as well as there is no published study so far on how Vietnam MET should react toward industry 4.0.

This research on integrating requirements of Industry 4.0 into MET: case study of Vietnam is timely because it focuses on answering the matters mentioned above, facilitating for the achievement of development goals of the country in general as well as supporting for the sustainable development of maritime industry and MET institutions (METIs) in Vietnam in particular.

1.2 Aim, objectives, outcomes of the research

Being aware of the gaps mentioned in section 1.1, the aim of this dissertation research is to systematically examine industry 4.0 and its requirements, then give suggestions how to integrate requirements of industry 4.0 into Vietnam MET, taking into account the lessons and experiences of other countries.

To achieve this aim, the objectives of this study are to:

- Examine systematically Industry 4.0 and its implications in general
- Understand implications of Industry 4.0 on maritime
- Investigate experiences of countries , institutions around the world on dealing with MET towards industry 4.0's requirements
- Analyse current situation of Vietnam MET
- Propose solutions for integrating requirements of Industry 4.0 into MET in Vietnam

1.3 Research questions

The study seeks to answer the following questions:

1. What is Industry 4.0 and its implications in general?
2. What are implications of Industry 4.0 on MET?
3. What are experiences of countries around the world on dealing with MET towards industry 4.0's requirements?
4. What are experiences of MET institutions around the world on dealing with Industry 4.0's requirements?
5. What is the current situation of Vietnam and Vietnam MET?
6. What lessons/ experiences can be adapted for Vietnam MET? And how to adapt?

1.4 Research methodology

1.4.1. Instruments

In consideration of the following factors: i) research objectives and questions, ii) the novelty of the topic iii) the feasibility to collect data for personal project, iv) limited time and resources, a literature review was used as the primary research method to answer research question 1, 2, and a part of research question 3,4, and 5. However, to examine the findings of the literature review, as well as to seek comprehensive answers for research question 3, 4 and 5, online questionnaires (Appendix 2), semi-structured structure interviews, and web search were used as a secondary research method. The author also collected information as case studies during field study trips to the Philippines, Norway, the UK and her trip to Netherland for reference. Based on the combined information obtained, the author suggests solutions for integrating requirements of Industry 4.0 into MET in Vietnam (research question 6). To increase the reliability and usefulness of these solutions, the author used expert consulting method with open questions at the last stage. In summary, this dissertation research was accomplished using both qualitative and quantitative methods.

It is important to note that all the research instruments were approved by the University's Research Ethics Committee. Ethical codes of conduct in qualitative interviewing are required because the interviews engaged human beings as interviewees. A consent form is developed in advance that outlines the research topic, the interviewer's detailed contact, the purpose of audio recording of the interview, and the rights of the interviewee. This consent form can be found in Appendix 1. This consent form is given to the interviewee with the information pointed out. The interviewer then asks the interviewee to read the form and sign it if he or she agrees to provide consent.

1.4.2. Selection of participants

All participants of online questionnaire and interview are from MET institutions or centers. Due to the fact that research questions mostly are relating to institutional/

organizational level and require good understanding about the education system, the researcher prefers to choose persons at managerial positions such as directors of curriculum development and upward.

1.5 Scope

MET implies two aspects, “maritime”, and “education and training”. Therefore, it is quite common to see a MET institution under control of two ministries, one in charge of maritime (eg. Ministry of Transport) and the other in charge of education and/ or training (eg. Ministry of Higher Education). Strategies, regulations, policies from both those ministries will affect METIs. However, in this dissertation, requirements of Industry 4.0 on MET will be mainly examined in the interrelation among university, industry, and the government, in particular the body in charge of maritime affairs.

1.6 Limitation

The online questionnaire have been sent directly to managerial positions of more than 70 institutions around the worlds to understand perspectives and practices around the world toward Industry 4.0. However, there were only 12 respondents, coming from 12 different institutions from the UK, the USA, Australia, Romania, Poland, Myanmar, Netherland, Ukraine, Poland and Korea. Because the number of online respondents is small, the questionnaire’s result is only used as an indicative instrument. However, this result is used in a combined analysis with the literature review, deep interview, and web search as a case study to get further understanding of the issues at hand.

Similarly, the author also met difficulties in collecting data on status quo of MET in Vietnam. Therefore, to increase the reliability and usefulness of suggested solutions, the author used expert consulting method with open questions at the last stage.

2. Literature Review

2.1 Introduction

Although there is a lack of literature about MET and Industry 4.0, there is an increasing list of publications relating to Industry 4.0 and education, necessary skills under the era of industry 4.0 in general. At the beginning of this section, the researcher systematically examines industry 4.0 and its implications, answering for the research question 1: “What is Industry 4.0? What are its implications of Industry 4.0 in general?”. Then, a review of literature on requirements on necessary skills and education under industry 4.0 is presented. These literatures place the theoretical background for discussing about MET and industry 4.0 in later sections.

2.2 Industry 4.0

While some literature use the term “Industry 4.0”, some others use “the fourth industrial revolution”. In the paper of United Nations Industrial Development Organization (UNIDO), they state that, “Industry 4.0 is one of the major drivers of the Fourth Industrial Revolution” (UNIDO, 2017, p.3). The word “Revolution” implies “a profound change in economic systems and social structures”, according to Schwab (2016, p.11). However, there is no literature that distinguish these two terms in detail. In this dissertation, “Industry 4.0”, and “the fourth industrial revolution” (4IR) are used interchangeably without difference in meaning.

Although Industry 4.0 is taking place at the present, “a generally accepted definition of the term does not exist” (Hermann et al, 2016, p.1). According to Hermann et al. (2016, p.11), industry 4.0 is “a collective term for technologies and concepts of value chain organization”.

Based on the findings of Hermann et al. (2016), technologies or components that are commonly mentioned as part of Industry 4.0 include smart factories, cyber-physical systems (CPS), the internet of things (IoT), and internet of services (IoS). However,

also important and related to industry 4.0 are concepts such as big data, human machines interface, cyber-security, advanced (autonomous) robotics, cloud computing, smart sensors, virtual and augmented reality, artificial intelligence (AI), blockchain, digital twin, etc. More explanation on these technologies can be found at Appendix 3.

Schwab (2016) share the similar idea when he underlines that industry 4.0 is not only about the “ubiquitous and mobile internet”, or smart factories. It is the fusion of emerging technologies (ie. AI, robotics, IoT, autonomous vehicles, 3D printing, nanotechnology, biotechnology, materials science, etc.) and their interaction across the physical, digital and biological domains.

Digital technologies are not new, but they are becoming “more sophisticated and integrated” in industry 4.0 and as a result, are transforming societies and the global economy. Digital technologies will manifest themselves with “full force” through automation and the making of “unprecedented things”. (Schwab, 2016, p.12)

In summary, it is not possible to define industry 4.0 with specific technological innovations as the previous three revolutions. Industry 4.0 is still happening with high probability of more innovations in the future - and is denoted by a complex combination of a variety of technologies, building on the digital power and will arguably impact our world in a way that the humankind has never experienced before.

2.2 Implications of Industry 4.0

Industry 4.0 is “leading to unprecedented paradigm shifts in the economy, business, society, and individually. It is not only changing the “what” and the “how” of doing things but also “who” we are.” (Schwab, 2016, p.8)

Regarding economy, while industry 4.0’s impacts on economy are vast and

multifaceted, almost all people are concerned about employment. There are many concerns that Industry 4.0 and increased automation can lead to increased unemployment. However, the matter of labour market or employment does not solely depends on the technological feasibility but also affected by economic, legal, regulatory and socio-political factors (UN, 2017). Bughi, Manyika, and Woetzel (2017) shared the same ideas as illustrated in the Fig. 1

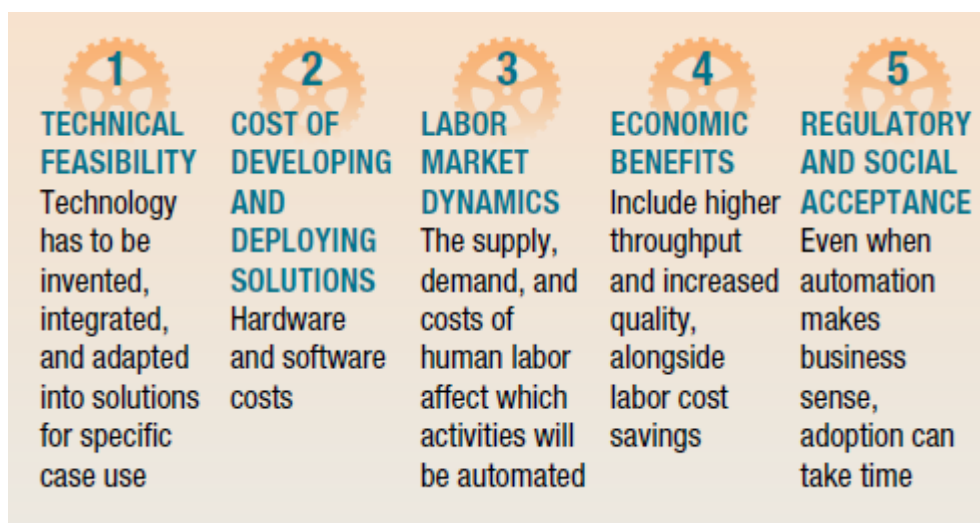


Figure 1. Five factors affecting pace and extent of automation adoption

Source: Bughi, Manyika, & Woetzel, 2017

Besides, the innovation will lead not only to the destruction, transformation, but also to the creation of jobs (UN, 2017; Bughi, Manyika, & Woetzel, 2017). Look back throughout the history, for example, when ATMs were introduced in the 1970s, the demand for bank tellers declined. However, by saving money, the banks opened more branches and created more jobs (Berlin, 2017). In the mechanization revolution, the demand for manual work in factories declined yet it created the labour demand for operating and maintaining the machines. Under the 4IR, a similar scenario is expected. According to the study of Frey and Osborne (2013), through the impact of technological innovation, employment will grow in high-income cognitive and creative jobs and low-income manual occupations, but it will greatly diminish for middle-income routine and repetitive jobs. WEF (2016, p.1) also forecasted that

disruptive changes could lead to “a total loss of 7.1 million jobs, two thirds of which are concentrated in routine white collar office functions... and a total gain of 2 million jobs, in Computer and Mathematical and Architecture and Engineering related fields” worldwide over the period 2015- 2020. Nevertheless, there is also an extreme scenario for the future labour market where even writing, one of the most creative professions, is threatened by the advent of automated narrative generation (Podolny, 2015).

To foster positive outcomes of the 4IR, it is the urgent need for all stakeholders to anticipate future employment trends and required knowledge and skills of the workforce (Schwab, 2016, p.44). One thing can be predetermined is that the future economy will require highly educated and well-trained people (Baygin et al., 2016).

Regarding business, Schwab (2016) mentions four main major effects of IR4 including changing on customer expectations; promoting data-enhanced products; forming new partnerships; and transforming in operating models.

For customer expectations, they are redefined into experiences. Buying an Apple product is not only because of its usage, but also because of its branding, packaging, customer services, etc. In the era of accessing and using data, more power is shifted to consumers when they can access to more data on supply chains and make peer-to-peer comparisons on the performance of products. Especially, they expect a “now world” regarding on the real time that companies respond to their demand.

For products, emerging technologies as smart sensors enable businesses to measure and monitor their asset performance over time through data and analytics. This not only helps businesses to maximize their utilization but also offers opportunities to make new price services. For example, long-distance haulers are interested in paying tire manufacturers by the 1,000 kilometres of road use rather than periodically buying new tires.

For collaboration, the 4IR forces companies to think about how offline and online worlds work together in practice. This leads to new collaborations between the established and young businesses or between traditional industry and innovative technology companies to find a good solution for enhancing value based on technologies.

For business models, we have seen the establishment and staggering development of companies with technology platform in the 21st century. Ribaudo (2016, p.5) provided the perception of “technology creators”, who use capital to develop and sell intellectual property and “Network Orchestrators”, who use digital networks of businesses or consumers to create, market, and sell goods, services, or information, with the company acting as organizer. He underlined that by creating a “digital divide”, those business can yield significantly different revenue multiplier results as demonstrated in the Fig. 2.

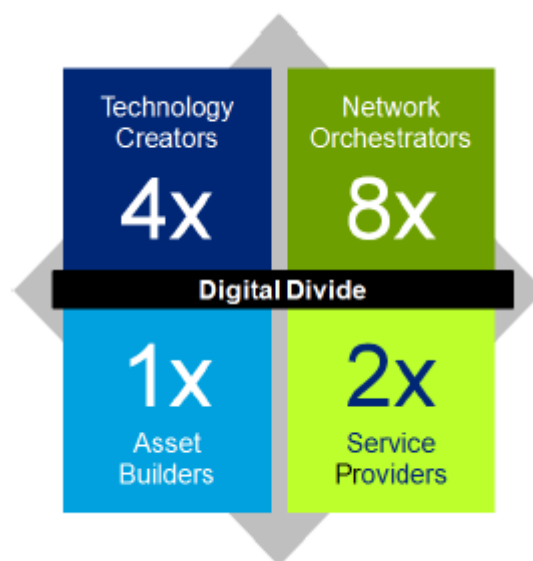


Figure 2. Revenue Multipliers above and beyond the digital divide

Source: Ribaudo (2016, p.6)

UNIDO (2017) also shared this idea when emphasizing that digital technologies initiate new business models and value-producing opportunities. Taking Uber for example, although this name was unknown some years ago, it has become one of the

popular providers for mobility services. In August 2018, Uber has 75 million riders with 3 million drivers despite of owning no cars (Craig, 2018). Facebook took only six years and Google just five years to reach revenue of \$1 billion a year. “There is no doubt that emerging technologies... are increasing the speed and scale of change for businesses” (Schwab, 2016, p.52). UNIDO (2017) believe that opportunities offered by Industry 4.0 are attainable for most developing countries. However, those countries that would like to take full advantages of the new wave must possess the required skills, energy infrastructure, broadband and transport networks (UN, 2017). In another aspect, emerging operating models underline the importance of cyber and data security to avoid direct disruption, according to Schwab (2016).

Regarding society, the two most important impact of IR4 are the potential for rising inequality and changing how communities form and relate to one another (Schwab, 2016, p.86). The discussion on implications of IR4 on economy and business above also allude to the potential for rising inequality between those who are able to participate fully in innovation-driven ecosystems by providing new ideas, business models, products and services, and those who can offer only low-skilled labour or ordinary capital. And rising inequality, according to Wilkinson and Pickett (2011) can lead to various issues for societies as security, health, welfare, and education to name some. Regarding community, “one of the greatest effects of digitization is the emergence of the “me-centred” society (Schwab, 2016, p.88) - a process of individuation and emergence of new forms of belonging and community, developed based on individual values and interests. New forms of digital media are affecting how a community is framed when people can connect each other in entirely new ways, across boundaries. Via social media, IR4 empower citizens when offering them opportunities to participate in civil debate or decision making yet it can also be used as new forms of surveillance and other means of control that run counter to healthy, open societies (Global Risks Report 2016, WEF). Besides, there is the fact that our political and civic decisions are shaped by what we read, share and see in the context of social media.

Regarding the individual, 4IR have manifold impacts on human, not only changing our behaviour and expectation as discussed in the impacts of 4IR on business and society. Nowadays, we are spending most of the time with technologies and the internet and there are growing concerns that it may negatively affect our social skills, cognitive skills, and ability to empathize (Konrath, O'Brien & Hsing, 2010; Carr, 2010; Kuper, 2015). The problem of privacy and losing control over personal data will also be intensified in the years ahead. And at the high phase of development of AI and biotechnology, 4IR is pushing to question what it means to be human when issues as life extension, designer babies, memory extraction and many more can be made via AI and biotechnologies if the principles of moral and ethics are not put at the heart of innovations (Schwab, 2016).

In brief, the implications of IR4 is profound in all aspects and unprecedented. However, “in an age of constant movement, nothing is so urgent as sitting still” (Iyer, 2014). When everything is still under our choices, it is necessary to think comprehensively how we would like to navigate this revolution.

2.3 Education in Industry 4.0

There are scenarios in which AI and machine learning replace human in the labor market. But in the majority of cases, technologies will serve to enhance human labour and cognition. In such world, there is a need to prepare workers skills that enable them to work alongside and engage more comprehensively with increasingly capable, connected and intelligent machines (Schwab, 2016; Bughi et al., 2017).

There is an increasing list of researches dealing with education in the 21st century, education in a technological society, education in the era of the 4IR. Those literatures provide us ideas about education in coming future.

First, it is the focus on building “intrinsically human capabilities that machines cannot yet match” (Bughi et al., 2017, p.18). These are creativity, as well as critical and systems thinking, logical thinking and problem solving, and so on. The importance of skills has been highlighted since the late of the 20th century (Pandya, & Basavaraj, 2018) but it has become even more important if one person wish to succeed in this century of increasing technological innovation. Going through literature in this field as the study of Brynjolfsson and McAfee (2014), Schwab (2016), the future of jobs report of WEF (2016), Bughi et al. (2017), Butler (2018), Short and Keller-Bell (2019) to name some, provides a list of essential skills need to be equipped in Industry 4.0 as illustrated in the Fig.3.



Figure 3. Word cloud showing necessary skills in Industry 4.0

However, the hard or technical skills still keep a certain role. “The key to success in the twenty-first century.. is to combine hard and soft skills into a comprehensive package tailored to specific needs” (Short and Keller-Bell, 2019, p.134). The future of jobs report (2016) of WEF also mentioned “In essence, technical skills will need to be supplemented with strong social and collaboration skills.” (p.3).

Nevertheless, “simply reforming current education systems to better equip today’s students to meet future skills requirements is not going to be enough to remain

competitive” (WEF, 2016b, p.8) because the future is uncertain with increasingly intelligent machines. Therefore, lifelong learning must be promoted (UN, 2017; WEF, 2016b, Gleason, 2018). Lifelong learning can be defined as “all learning activity undertaken throughout life, with the aim of improving knowledge, skills and competence, within a personal, civic, social and/or employment-related perspective” (European Commission, 2001, p. 9). And "learning how to learn" is one of the eight key skills identified by the European Union that all citizens should have for lifelong learning (EU, 2006).

Education has a crucial role in shaping societal transitions. It have to change, in collaboration with government and industry to respond to the 4IR. An important note here is the emphasis on “specific needs” or particular sectors. It is essential to understand “a country’s or industry’s skills base” (WEF, 2016b, p.7) or “to understand the industry and country-specific outcomes of the 4IR” (Schwab, 2016, p.44) because expected knowledge and skills will vary by industry and geography or region. This change should also be considered in a comprehensive context, including the implications of IR4 on individuals as mentioned above and emerging technologies that can be applied into educational activities (Gleason, 2018).

2.4 Summary

In section 2, fundamental understanding about industry 4.0 and its implications in various aspects as economy, business, society, individual, and education in particular, were presented. All industries are being pushed up a curve of transformation by 4IR yet not all industries are at the same point of disruption, according to Bughi et al. (2017). In section 3, the author will examine the impacts of Industry 4.0 on a specific sector of maritime.

3. Maritime and Industry 4.0

3.1 Introduction

The concept of Triple Helix of university-industry-government relations, which initiate a general framework for exploring and high-technology development in the knowledge-based society (Leydesdorff & Ftzowitz, 1996), can be applicable in the context of MET. For illustration, when there is a change in maritime industry, this change raises the need for reviewing, revising the maritime legal and administrative framework and giving certain influences on education and training. This interrelation can be seen in the Fig.4.

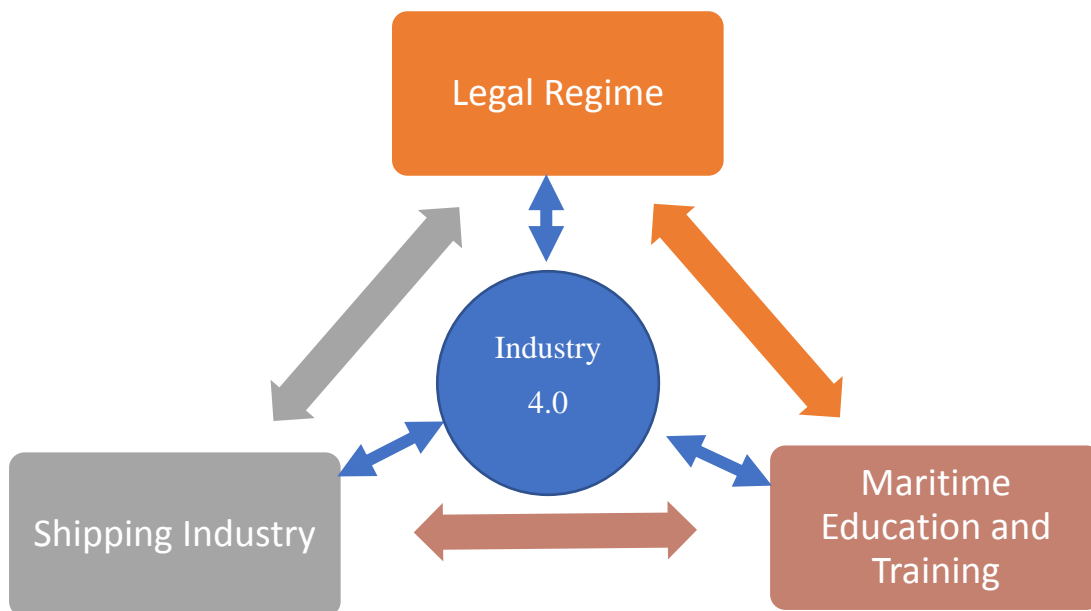


Figure 4. Maritime sector and Industry 4.0

The maritime industry is an inherently global industry with global legal frameworks, global industry (impacted by global technology development), and global competence requirements, yet MET is carried out under national legal framework and through national METIs. The author follow such approach to look at impacts of Industry 4.0 on maritime sector at international level first, then look at how different countries and METIs around the world dealing with Industry 4.0.

In this section, the author focuses on impacts of Industry 4.0 on maritime sector at international level, answering for the research question 2: “What are implications of Industry 4.0 on MET?”

3.2 Maritime Industry and the 4IR

Industry 4.0 with new technologies have brought the shipping industry to the new era of the IT platform, said Mr. Baba, Thuraya chief commercial. Some technologies have been deployed with success and some are still to be introduced to shipping (Baba, 2018).

Taking IoT for example, some shipping companies such as Maersk Line or Hyundai Merchant Marine use IoT technologies to monitor their reefer containers. They have also adopted blockchain technology in their operation to make data transfer safer and more transparent, reducing a tremendous amount of paperwork. By applying these technologies, they aim at enhancing their cost efficiency and service quality. More and more technologies are predicted to shake up the maritime industry, such as automation, deep learning, artificial intelligence, augmented reality, drones, robotics, cyborg crew, and so on (Baba, 2018).

Among emerging technologies, an intense debate is on autonomous or unmanned vessels¹. Despite the fact that nowadays almost of the ships are automated in some way, the shipping industry is coming to a revolution in alignment with Industry 4.0 with the emergence of autonomous ships which are operated by machinery and systems making decision (Cross et al., 2017). There are several rationales for investing on autonomous ships, namely increasing the safety of shipping by taking out the human element because 75–96% of marine casualties are caused at least in part by some form of human error (Rothblum, 2000); enhancing the efficiency when devoting

¹ While unmanned ships have no crew or human operator on-board, autonomous ships may be manned or unmanned (Kitada et al., 2018).

more spaces for cargo transportation; reducing the operational cost by cutting labor cost, saving fuel; contributing to ecological and social sustainability by reducing emissions; improving the family friendliness and social contact of navigating and engineering professions (Rødseth & Burmeister, 2012). The first remotely operated commercial vessel, Svitzer Hermod, was demonstrated in Copenhagen harbor, Denmark in June 2017 and the autonomous unmanned ocean-going ships are expected to launch in 2035, according to Rolls-Royce Plc (2016) (Fig.5).

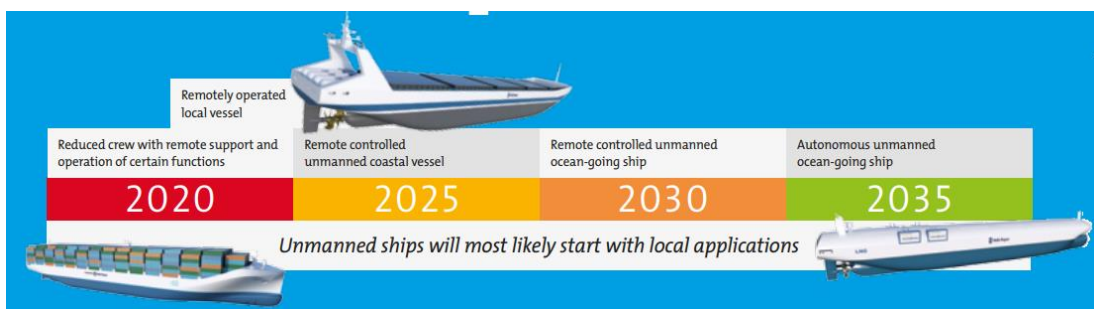


Figure 5. Forecasted timelines for autonomous ships

Source: Rolls-Royce, 2016

However, it is not a direct vector towards an ultimate autonomous system like unmanned vessels but rather a gradual shift towards the integration of maritime operations into digitalization from both ship and shore (Kitada et al. 2018). In this digitalization process, the interaction and dynamics between ship/land, ship/authority and ship/ship will be changed fundamentally. In recent years, some ships are evolving system-integrated transport platforms with a continuous digital connection to land, from where fuel consumption, routes, emissions, etc., can be monitored and controlled (The Danish Government, 2018, 2018).

In another aspect, 4IR promotes collaborations in business as we mentioned in section 2.2 and we can see this implication in maritime industry also. For instance, Alibaba has cooperated with several large shipping companies on its One-touch platform to facilitate e-commerce (Luo, 2017). In another example, A.P. Moller Maersk and American IBM are about to establish a digital platform through which the shipping industry can share data and thus provide more transparency and simplicity in the

movement of goods across borders and trading zones (Aitken, 2018). Shipping companies through these collaborations can not only improve their services but also target to more customers.

Nevertheless, together with advantages offered by technologies, nowadays the shipping industry is also exposed towards threats of cyber-attacks. The cyber-attack that hit A.P. Moller-Maersk in 2017 is one example that shows us how vulnerable an increasingly technology dependent and inter-connected industry is. These vulnerabilities can come from a variety of electronic devices and software systems used on ships as Global Navigation Satellite Signals (GNSS) of the global position system (GPS), Automatic Identification Systems (AIS), Electronic Chart Display and Information System (ECDIS), or from their interaction with other parts of the industry using internet or satellite communication (Garcia-Perez, Thurlbeck, & How, ca. 2017). Sharing global common trends (Fig.6), concerns of cyber security in the shipping industry has been increased recently and will be a continuously hot topic in the coming years when the shipping industry go further into automation and digitalization (Elly, 2018).

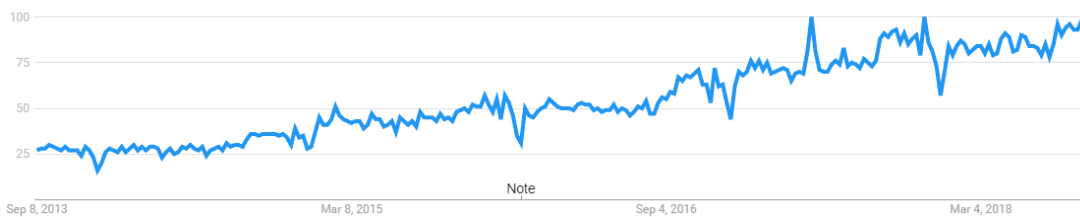


Figure 6. Interest on Cyber Security over the past 5 years

Source: Google trends, 2018

3.3 Maritime international legal framework and 4IR

International Maritime Organization (IMO)² as the global regulatory body for

² In 1948, the United Nations established the Inter-Governmental Maritime Consultative Organization (IMCO) to deal with the maritime affairs. In 1982, the name was changed to International Maritime Organization.

international shipping have had some actions responding to the industry's requirements in regard to industry 4.0.

In 2006, IMO initiated the concept of E-navigation, which is defined as “the harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means”. According to Kitada et al. (2018), the implementation of the e-Navigation concepts and the provision of a far enhanced information and communication infrastructure is providing a strong basis for autonomous ships and even unmanned ships respectively.

Regarding autonomous ships, IMO uses the term “Maritime Autonomous Surface Ships” (MASS) and during the IMO Maritime Safety Committee Session 99 held on 16-26 May 2018 in London, they endorsed a framework for a regulatory scoping exercise, with a target completion date of 2020. Via this exercise, they aim at examining how safe, secure and environmentally sound MASS operations may be addressed in IMO instruments (ie. SOLAS, COLREG, Load Lines, STCW, STCW-F, SAR, Tonnage Convention, SPACE STP, and STP³). (IMO, 2018)

Regarding cyber risk, IMO adopted the Resolution MSC.428(98) on Maritime cyber risk management in Safety Management Systems in 16 June 2017, and issued MSC-FAL.1/Circ.3 Guidelines on maritime cyber risk management in 5 July 2017, to support safe and secure shipping, which is operationally resilient to cyber risks. In this guideline, raising awareness of cyber risk at all levels of an organization is one of recommended actions (IMO, 2017b)

Although there is a human element with respect to the above actions, and IMO bear in mind that there will be continuous amendments of the International Convention on

³ IMO's instruments on safety (SOLAS); collision regulations (COLREG); loading and stability (Load Lines); training of seafarers and fishers (STCW, STCW-F); search and rescue (SAR); tonnage measurement (Tonnage Convention); and special trade passenger ship (SPACE STP, STP)

Standards of Training, Certification and Watchkeeping for Seafarers (STCW), there is, so far, no noticeable preparation on legal frameworks from IMO regarding maritime education and training towards Industry 4.0. At the IMO Human Element, Training and Watchkeeping Sub-Committee (HTW 5) held on 16-20 July 2018 in London, matters of using Massive Open Online Courses (MOOCs) and virtual reality based simulator in maritime education and training were put on the agenda yet there was no further actions on this field (Lloyd Register, 2018)

In summary, there has been preparation on legal framework for coming future but it is only at initial stage and not sufficient. This implicates a shift in the responsibility toward member states and METIs if they would like to proactively response to 4IR's requirements.

3.4 MET and 4IR

The impact on MET of Industry 4.0 is the analytical focus in this thesis.

In section 2, the shift of employment under industry 4.0 was discussed, which is profound yet not happen in a blink, and it is necessary to equip workers with required knowledge and skills. This idea is applicable in MET. Kitada et al. (2018) stated that it would be a gradual shift towards the integration of maritime operations into digitalization. While there is no or rare human intervention at full automation systems, there still exist the need of humans at partial automation or digitalized systems because their “cognitive skills and tacit knowledge are essential for safe operation of ships” (Kitada et al., 2018, p.346).

Facilitated by the nature of carriage of goods on the world market, the shipping industry has early become a globalized industry (Couper & Walsh, 2001). To govern such a global industry and promote a “safe, secure and efficient shipping on clean oceans”, a number of international maritime instruments have been elaborated, including the International Convention on Standards of Training, Certification and

Watchkeeping for Seafarers (STCW). STCW Convention was adopted on 7th July 1978, and until 22nd December 2015 was ratified by 160 countries, occupy 98.55% of world tonnage. It sets minimum standards for the education and training activities of hundreds of METIs around the world.

Recognizing the deficiency when focusing purely on knowledge, SCTW had a major amendment in 1995 when shifting to a focus on competencies (including knowledge, skills and attitudes). In addition to technical skills, we can note some required soft skills under the STCW as amended, including communication skill, teamwork skill, problem solving, decision-making, leadership skills, language skills, personnel management, and resource management (IMO, 2017a). Are those skills sufficient for a seafarer if he or she would like to be highly qualified under 4IR?

Being aware of increasing requirements on seafarers under a rapidly changing industry, as well as the importance to equip them necessary skills to be flexible in their career path, a survey of International Association of Maritime Universities (IAMU) named “A future Global Maritime Professional” were conducted in March 2018. The survey has 214 respondents from all regions of the world and diverse work areas of the maritime industry.

According to the IAMU survey (2018), while the importance of some competencies are kept similar in 20 years. There are some competencies that should be paid more attention, including environmental sustainability, ICT literacy, contemporary global issues and historical perspectives, quantitative reasoning and critical thinking, as demonstrated in the Fig.7.



Figure 7. Seafarer Competence – current and in 20 years

(Source: IAMU, 2018)

Exploring the result of IAMU survey, the author also found the competencies in Table 1 deemed to be of the most important competencies when they are always in top competencies in short or contemporary, medium of 5-10 years and long term of 20 years.

Table 1. Top 15 competencies of a future seafarer for different time periods

| No. | Competency | Short | Medium | Long |
|-----|------------------------------|-------|--------|------|
| 1 | Technical competencies | 1 | 2 | 2 |
| 2 | Technological awareness | 3 | 1 | 1 |
| 3 | Adaptability and flexibility | 7 | 4 | 4 |

| | | | | |
|----|--|----|----|----|
| 4 | Computing and informatics skills | 9 | 3 | 3 |
| 5 | Teamwork | 2 | 7 | 8 |
| 6 | Communication skills | 4 | 6 | 8 |
| 7 | Leadership | 6 | 5 | 7 |
| 8 | Discipline | 3 | 9 | 10 |
| 9 | Environmental/sustainability awareness/concern | 12 | 5 | 5 |
| 10 | Learning and self-development skills | 9 | 9 | 6 |
| 11 | Complexity and critical thinking | 8 | 7 | 11 |
| 12 | Language ability | 5 | 8 | 14 |
| 13 | Professionalism and ethical behaviour | 9 | 9 | 9 |
| 14 | Responsibility | 5 | 11 | 13 |
| 15 | Inter-personal and social skills | 14 | 9 | 10 |

(Source: IAMU, 2018)

Looking at Table 1, we can see that together with increasing concern on sustainable development, 4IR is another main driver for future MET. Put this finding in a comparison with current competencies regulated in STCW and essential skills in Industry 4.0 in Fig .., the following conclusions can be withdraw.

First, technical competencies still play the most important role in shipping industry in future. These are competencies relating to ship operation and mostly focusing on how to navigate the ships safely and securely as well as use effectively on board equipment. Most of these competencies are regulated in STCW, and will be updated in alignment with development of shipping industry and relevant international maritime regulations.

Other skills, which are currently mentioned in STCW, still play vital role, including communication skills, teamwork skill, leadership and language ability. In these skills, leadership and language ability is not well-noted in literature relating to 4IR. This may

partly result from the distinct nature of shipping industry, which is a global industry with international crew and require a high level of leadership.

Besides, there are emerging needs on technological awareness, computing and informatics skills, and environmental/sustainability awareness/concern. Indeed, there will be more technologies innovated and applicable to shipping industry. The shipping industry is also paying more and more attention on cyber security and sustainable development, including climate change and environment protection. It is not so difficult to understand why those knowledge are expected at future seafarers.

Regarding emerging skills, although creativity is highlighted in almost all literature relating to 4IR, it is not highly appreciated in shipping industry. Instead, more attention are draw on adaptability, flexibility, complexity and critical thinking, learning and self-development skill, and inter-personal and social skills. None of these skills are currently underlined in STCW.

Regarding attitudes, future seafarers are expected to be professional with ethical behaviour, discipline and responsibility. Again, discipline and responsibility is only highlighted in finding of IAMU survey and this could be from the nature of the industry when ships carry persons, a large number of good and can cause serious damage to environment.

In summary, 4IR leads to new requirements on MET outcomes. Although creativity may be not highly required, 4IR still require at seafarers a higher cognitive capacity of critical thinking and learning skills, etc. Seafarers also need more knowledge and skills on technologies, computing and informatics. Industry 4.0 results in more required competencies of a seafarer as illustrated in Table 2.

Table 2. Emerging competencies of a future seafarer under Industry 4.0

| No. | Competency |
|------------|-------------------|
|------------|-------------------|

| | |
|---|--|
| 1 | Technical competencies (for operation of new equipment, under new regulations, etc.) |
| 2 | Technological awareness |
| 3 | Adaptability and flexibility |
| 4 | Computing and informatics skills |
| 5 | Learning and self-development skills |
| 6 | Complexity and critical thinking |
| 7 | Inter-personal and social skills |

It is time for METIs to think about reforming their training and education activities beyond current STCW requirements if they wish their students are highly qualified seafarers in shipping 4.0.

3.5 Summary

In section 3, we have seen the penetration of Industry 4.0 into maritime sector and there exist the need to adjust the MET system. However, how and to what extent to adjust depends on the choice of member states and METIs as there is no regulations so far.

4. MET Practices toward Industry 4.0

4.1 Introduction

This section directly answer of research question 4 and 5 of this paper through providing a number of practices on how some around the world are working at the national level and at organizational or institutional level to prepare for the coming future MET.

4.2 Data collection and analysis

4.2.1. Data collection

To understand the practices at different countries and institutions, an online survey

(Appendix 2) have been developed, in which there are three main parts: institutional information, education and training, and national legal framework and supporting policies.

- At institutional information section, the author intended to get the idea on the operation model, education scale and facilities of the responding institution.
- At education and training section, current teaching, some HR activities, finance funding and policy practices at responding institution are investigated. Besides, the author asked for respondents' perspectives on prioritized fields that an institution should do now to proactively address the needs of the future education and training in respect to Industry 4.0.
- At legal framework and national supporting policy section, questions aim at collecting information on laws/ rules/ policies (even including which are under development) at responding countries to address requirements of Industry 4.0.

The online questionnaire have been sent directly to managerial positions of more than 70 institutions and officials of maritime administrations around. However, there were only 12 respondents, coming from 12 different institutions from the UK, the USA, Australia, Romania, Poland, Myanmar, Netherland, Ukraine, Poland and Korea. Nine of them are public universities/ colleges, and the others are private MET centers. Because the number of online respondents is small, the questionnaire's result is only used as an indicative instrument.

However, based on the online questionnaire's result, the author can identify some institutions that are confident in dealing with Industry 4.0's requirements and request for further interview towards these respondents are made. Two respondents are available for supporting via email.

Furthermore, the survey's result provided focus areas to address Industry 4.0's requirements. In combination with the literature study, a examination focusing on those areas was carried out through official web sites of maritime administrations,

educational institutions/ centers to get more practices around the world. Observations and discussions during the author's trips to the Philippines, Norway, the UK and the Netherland support further understanding of the issues at hand.

4.2.2. Data analysis

Information extracted from the survey data intends to answer how some around the world are working in MET at institutional level and national level in respect to the industry 4.0 and prioritized fields that an institution should do now to proactively address the requirements of Industry 4.0.

At institutional level:

- Among 12 METIs, 4 of them have installed Virtual Reality simulations. Besides tuition fees, to raise enough budget for installing, maintaining and upgrading training facilities, 5 of 9 answers (55.56%), the highest percentage, mentioned about providing courses (STCW courses, continuous professional development courses) to the industry. Other sources are from government, doing research, external funding (investors, NGO's funding).
- Most of public institutions (88.89%) receive subsidies from the government yet the percentage varies widely from 5 to 60% of their operation budget depending on national policies.
- 7 of 9 responding universities or colleges (77.78%) have integrated all desired soft skills in table 2 into the curriculum of their higher education programs.
- In short courses (STCW courses, tailor-made courses), only soft skills regulated in STCW (Teamwork, Communication skills, Leadership, Language ability) are well integrated at all centers. However, the other skills can also be achieved through short courses when 1 of 3 private centers believed that they have well delivered those skills through their programs. The author have made questions on transferring soft skills during her trips and being confirmed that soft skills could be transferred or not, mainly depending on the pedagogy of the instructors/ lecturers.
- For employing MET lecturers or MET instructors, most common criterion are

holding at least Master degree or above (83.33%), having seagoing experience (75%), and instructor certificate (66.67%). English Proficiency certificate is not highly emphasized when only 25% of respondents (3 of 12 institutions) considered it as employment criteria. Another mentioned criteria is holding assessor certificate, with 1 of 12 respondents, accounting for 8.33%.

- For continuous professional development (CPD) of teaching staff, the following activities are mentioned by respondents: scholarly activities, 5 days back to the industry/ study visits, internal training (facilitated open lectures, weekly staff meeting, etc), external courses, professional development funding for attending and presenting at conferences, sabbatical leave on six year cycles, frequently assess the teaching staff and practical training demands, yearly personal CPD plan, and knowledge management systems.
- The two biggest challenges in providing sufficient knowledge and skills to seafarers for the future shipping are lacking of qualified instructors/ lecturers (71.43% of respondents) and developing appropriate courses/ programs (42.86% of respondents). These are resulted from the knowledge intensive nature of the profession and difficulty in identifying the future needs in the industry and the skill sets needed, explained by two respondents.

To proactively address the needs of the future education and training in respect to Industry 4.0, an institution should prioritize the following actions:

- Refining strategic development plan. 91,67% of respondents considered this action as important or highly important, averagely ranking at 4.42 on scale of 5. This is the most recommended action.
- Developing human resources. 83.33% of respondents considered this as important and highly important, averagely ranking at 4.33 on scale of 5.
- Revising curriculum. 83.33% of respondents considered this as important and highly important, averagely ranking at 4.16 on scale of 5.
- Strengthening cooperation with industry. 66.67% of respondents considered this as important and highly important, averagely ranking at 4 on scale of 5.
- Developing appropriate infrastructure/ facilities. 83.33% of respondents

considered this as important and highly important, averagely ranking at 4 on scale of 5.

- Besides the 5 most prioritized actions mentioned above, the following actions are also mentioned as developing E-learning platform, strengthening institutional governance, improving quality assurance system, developing international cooperation, motivating students

At national level:

- In the UK, the Netherland, Romania to name some, 12-month-sea-time training is combined in MET bachelor programs and recognized by maritime administrations. Therefore, after graduation, students are eligible to take the examination for officer of watch certificate or can directly be awarded double certifications (bachelor degree/ engineer diploma and officer of watch certificate).
- In Netherland, simulation training can be applied for reducing sea-time at certain ratio.
- No respondent are aware of any national laws/ rules/ policies (including which are under development also) to address requirements of Industry 4.0 so far.

4.3 MET practices at national level

The data analysed in section 4.2 will be discussed more here, in a combination with a examination of official web sites of maritime administrations and government agencies, answering for the research question 3 of this paper “What are experiences of countries around the world on dealing with MET towards industry 4.0’s requirements?”

Looking at leading maritime countries in 4IR, the first thing can be noted is their clear, strong and explicit vision in the rapid changing maritime environment, followed by good implementation plans to have collaborative effort, aiming at capitalizing growth opportunities. Taking Denmark as an example, rooting from the Government’s vision towards 2025, which is making Denmark “a global maritime power hub”, they set up

Maritime strategy team in 2016 and developed Plan for growth in Blue Denmark 2018. In the plan, they clearly identified what the government will do together with all stakeholders to make Denmark as a power hub for digitization, a power hub with attractive framework conditions, a power hub of knowledge and know-how, and a power hub with a global outlook and attractiveness (The Danish Government, 2018).

The government can support the development of MET system in different aspects through various measures. Some following supports can be considered directly to facilitate METIs to response to 4IR's requirements:

- Identify the necessary education contents for future needs and technological developments. In reference to the practice of Denmark, this is done through initiating dialogue among relevant parties (The Danish Government, 2018).
- Recognize cadetship training and facilitate cadetship training/ apprenticeship at sea/ on-board training through different scheme/ agreement with industry, including using tax incentives. On-board training is not only required by SCTW, but also believed to essential to equip students with necessary skills and updated knowledge. Combination between education and practice is a hallmark of maritime education. In the UK, shipping companies can apply for UK Tonnage Tax scheme⁴ if they make minimum training commitment to recruit and train at least one trainee officer or equivalent each year for every 15 officer posts within its fleet (Department for Transport, 2015). In another initiative, the UK government run SmarT scheme. This idea is now being introduced to Denmark, the Danish government is working with the labour market parties to introduce the State Education Fund rather than paid shipping apprenticeships for maritime professional bachelor programmes. In return, the companies support for a certain number of apprenticeships at sea. An important notice from Denmark is that they will together with all stakeholders to make

⁴ Tonnage taxation is an alternative taxation where a company pays corporate income tax on a calculated standardized income based on the vessel's net tonnage, instead of based on the actual economic result (Swedish Shipowners' association, 2017). It is designed to be attractive to profitable shipping companies (Watson & Williams, 2018)

apprenticeships more flexible and must be modernised (The Danish Government, 2018).

- Provide finance funding for METIs. As mentioned in section 4.1, almost public institutions receive subsidies from the government although the percentage is varied by national policies. There are a variety of allocation models (Appendix.4) and among those, Higher Education Authority (2017) stated that there was growing focus on a performance-based funding mechanism. Discussed at the field study to University of South-Eastern Norway (USN), for each bachelor, master or doctoral student enrolled, the university will get certain funding from the government. Although it is not sufficient, it still support the university to set up training simulators.
- Promote research, knowledge-sharing and research collaborations between research units/ universities, industry and public authorities via forums and initiatives. Among highlighted themes are shipping and digitisation, new technological possibilities.
- Promote simulation training. In the Netherlands, simulation training can be applied for reducing seetime at different ratio 1:2, 1:3 or 1:4. For example, 40 hour simulation time (5 days) can be recognized as 10-day seetime (Cross, 2018).

It can be noted that those attempts mentioned above from the government will support METIs to actively involve in shipping industry's development and enhance quality of technical competencies training in alignment with technology developments.

In another aspect, the executive body in charge of governing maritime affairs (ie. Maritime Authority / Maritime Administration (MA)) of those countries are not restricted in administrative works but they work proactively to strengthen the nation's growth in maritime sector. Taking Denmark Maritime Authority for example, its mission is "to effectively strengthen Blue Denmark's conditions of growth and to promote safety and health on clean seas". This leads to their active participation in R&D, including technological developments. In addition to R&D unit directly under

control of Director General, Denmark Maritime Authority have established E-Navigation department to promote as well as to transform innovation potential into growth and jobs (Danish Maritime Authority, 2018). In another example of Norwegian Maritime Authority, they also established the Norwegian Forum for Autonomous Ships (NFAS) in early 2016 together with the Norwegian Coastal Administration, the Federation of Norwegian Industries and MARINTEK (now SINTEF Ocean) to consider all matters relating to autonomous ships.

In addition to changes in required knowledge, skills, and attitudes as mentioned in section 3.4, another consequence of 4IR in MET is changing in future jobs. By going advance together with the industry and innovations, those MAs can have deep insight what they can adjust in the future governance. At the official autonomous shipping test-bed opened by Kongsberg in December 2017, it was stated by Mr. Lasse Karlsen, technical director at Norwegian Maritime Authority, “We have to know what this technology could do... we have to follow the development very closed” (Kongsberg, 2017).

In summary, proactive responses of the government towards 4IR plays an important role to lead the development of the national maritime industry, including MET. 4IR forerunning countries do not basically ensure the implementation of the country toward ratified international conventions (including STCW). In contrast, these countries, in particular their executive systems, including MAs are proactive in the relation of university-industry-government to understand thoroughly what are happening and providing vision, leadership from government level. Applying John Maxwell leadership approach, they know the way, go the way and show the way to the others.

4.4 MET practices at institutional level

The data analysed in section 4.2 will be discussed more here, in a combination with

further interview via email, a survey accomplished through official web sites of METIs, and case studies during trips, answering for the research question 4 of this paper “What are experiences of MET institutions around the world on dealing with Industry 4.0’s requirements?”

Instead of a rapid and comprehensive transformation toward Industry 4.0’s requirements, what the author can observe in all case studies during her field study trips and thorough her research is that no institution reacts directly toward what is called “Industry 4.0”. However, what institutions do is continuously enhancing their teaching and learning quality. Necessary actions have been translated into their activities gradually, in alignment with their awareness of all internal and external factors, including technological developments and industry’s needs. As a result, they have embedded requirements of Industry 4.0 into their practices at different levels in different fields.

As mentioned in 4.2, to address the needs of the future MET in respect to Industry 4.0, five activities in Fig.8 should be prioritized.

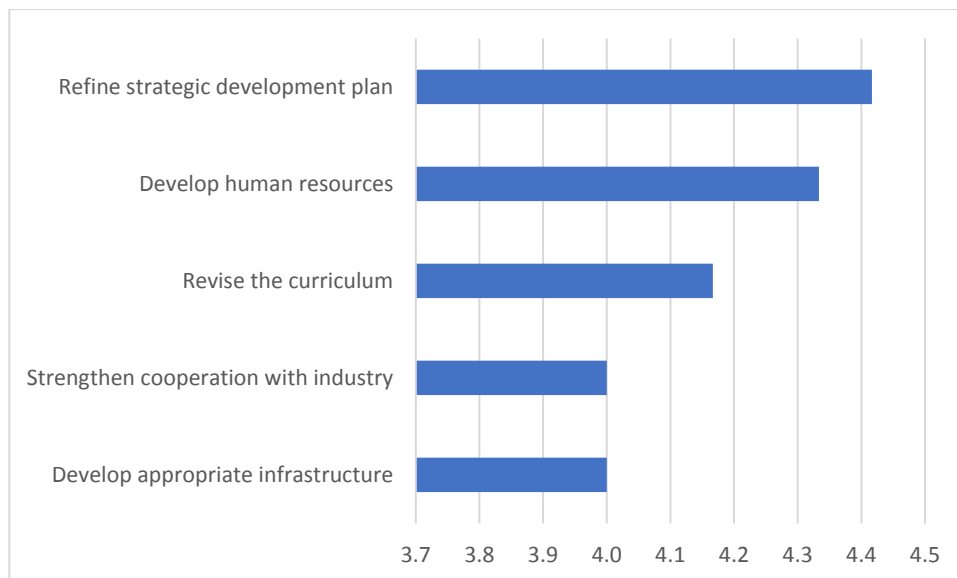


Figure 8. Prioritized activities to address future MET

Collected practices will be presented, focusing on these five activities, including:

refine strategic development plan, develop human resources, revise curriculum, strengthen cooperation with industry, and develop appropriate infrastructure.

4.4.1 Strategy

Visionary leaders and strategies are essential to ensure that an organization can achieve a comparative advantage in the changing environment (Jabbar & Hussein, 2017). In addition to internal factors, there are many external factors that an institution must analyse when developing its strategic development plan. METIs will not only be affected by 4IR but also by many other trends as sustainable development, globalization, etc. METIs' leaders must have an insight of all matters to be able to chalk out a good strategy for their institutions.

Regarding 4IR, it is not basically a technological factor because it has wide implications on all other factors as political, economic, social, environmental, ethics, legal, and even individual. However, it is very closed for METIs to think some of the following things of 4IR when looking back their strategies, in reference to previous discussions at section 2.2, 2.3, 3.4 and the practice of the STC-Group Strategic plan (STC, 2016):

- Automation and digitalization will influence society at the most in the coming years. It is certain that the sector and the company for which your students will later work will operate differently than it does now.
- A world which is changing fast and is uncertain, requires flexible and agile future employees.
- Special knowledge/ technical competencies will remain indispensable, but need to be supplemented with a broad range of other types of knowledge, skills and attitudes as mentioned in section 3.4.
- Although the robot teacher may not replace human teacher, teaching process need to respond quickly to digitisation developments and trends. Technical innovations can lead to innovative educational methods.
- Under “me-centre” society, the specific learning needs of individual students

should be facilitated, which link to the idea of customized education. Lecturers should act as coaches, who enable students to own their own learning process.

- There exist the needs for re-training, upskilling courses. Learnings how to learn and life-long learning must be promoted at everyone.
- Effective cooperation (ie. among lecturers, lecturers and students, the university and the business community, etc.) is a requisite factor for development in a continuously changing work environment.

However, a sound strategy are of limited value if they are not properly implemented (Neilson et al., 2008) and human resources is an important factor affecting strategy implementation.

4.4.2 Human resources development (HRD)

Lecturers or instructors are precious assets deciding the successfulness of an institution. Nowadays, more METIs have installed simulation yet it offers limited advantages if they do not have appropriately qualified instructors. As mentioned in data analysis, two third of survey respondents stated that the one of the biggest challenges in providing sufficient knowledge and skills to seafarers for the future shipping is lacking of qualified instructors, therefore playing attention on developing HR is essential.

Under industry 4.0, in addition to technical competences, seafarers must be good at a variety of soft skills. These skills cannot be achieved through separate subjects but gradually developed via learning process, with the elaboration of the lecturers. Therefore, the role of lecturers or instructors is very essential. Lecturers should be good at both specialist knowledge and teaching pedagogy. They need to respond quickly to digitisation developments and trends, applying flexibly teaching methods to get the best out of students. Also emphasized by one respondent, “need to balance between theoretical knowledge and practical experience of teachers”.

To develop human resources, there are various activities can be employed as mentioned in section 4.2. However, HRD activities will have greater achievements if

HRD is seen as a key factor for success because under such view, an organisation will have a comprehensive approach on HRD, taking Blackpool and the Flyde College (B&FC), the UK as a case study. This case is investigated through the field study to Fleetwood Nautical Campus of this college.

First, HRD activities at B&FC are planned in the harmony of individuals' needs and organizational objectives. Every year each member or staff will develop a continuous professional development (CPD) plan with his line manager to target both college strategic objectives and personal needs and interests. An important note is that CPD plans are distinguished with performance targets at B&FC. CPD plans have SMART⁵ targets, yet it is a bit flexible. The focus of CPD is on developing individual capability, appropriate to the role he/she is undertaking. If one point is not achieved, they will discuss the reasons and if those are valid, they will just transfer that for the next year. Attract good teaching staff is difficult but attaining them maybe even more challenging. By applying such good system among lecturers and line managers, young teaching staff have a clear career path. This not only provoke their motivation but also help to increase their engagement toward the organisation.

Moreover, HRD at B&FC is based on the value of cooperation and empowerment. A manager has a responsibility to ensure that individuals have the opportunity, at regular intervals, to discuss their professional development needs and attend relevant CPD activities where appropriate. Nevertheless, it is the responsibility of the individuals to identify their own learning and development requirements. The manager is there to facilitate any relevant needs. B&FC also offers several teams to standardise the support available. This includes human resource team, quality team, curriculum area specific senior tutors for teaching and learning, support and guidance and HE.

Lastly, B&FC has developed a knowledge management ⁶ system to promote and utilize

⁵ SMART: Specific, Measurable, Attainable, Realistic, Time-bound

⁶ Knowledge management can be defined as the systematic management of an organization's knowledge assets and inter alia will consist systems that sustain and enhance the storage, assessment,

HRD activities. For illustration, B&FC encourage teachers and managers to speak at symposiums and congresses, or to participate in national and international think tanks. Tacit and explicit knowledge obtained via those participation then is transmitted to all colleagues via different models as weekly staff meeting, short presentation, internal seminars, distribution of materials gained, etc. Taking advantages of technology, they also developed a software to enable recording and sharing of scholarly activity (Appendix 5). STC Group shared the similar practice when they offer user-friendly knowledge management systems which are available 24/7 and are stocked with the most updated information (STC, 2016)

4.4.3. Curriculum

To have highly educated and well-trained people with new skills, curricula in schools and universities should be adapted (UN, 2017). There are many practices around the world on revising MET curriculum. For example, in Norway, one of the Norwegian METIs has already introduced commercial subjects in the curriculum for future seafarers as they supposed when boundaries between ship and shore become blurred, onboard personnel should be equipped with commercial education to take over some of business tasks from shore-based managers (Kitada et al., 2018). However, in this paper, practices of revising curriculum will focus on desired knowledge, skills, and attitudes at future seafarers which mentioned in table 2.

Among those desired knowledge, skills, and attitudes, the following knowledge/ skills in respect to Industry 4.0 can be integrated into the written curriculum: technical competencies, technological awareness, and computing and informatics skills. The other skills can be transferred through teaching and learning process.

Regarding technical competencies, they have closed link to technologies used on board, regulations and requirements of shipping companies, which constantly change.

sharing, refinement, and creation of knowledge (Frost, 2014). And successful management of knowledge resources can improve organizational productivity, service quality, promoting organizational innovation and uniqueness (Nonaka, 1994)

Consequently, it is not easy to say what specific emerging technical competencies should be added in the curriculum. The content of delivery is updated through CPD of lecturers, module specifications are amended, curriculum are validated periodically (2-5 years) or when necessary with the participation of industry's representatives are noted practices.

Nevertheless, there is certain that on-board training (or equivalent training methods which could arise and are accepted in the future) is essential and should be integrated into the curriculum to equip graduated necessary skills in alignment with industry requirements. In such cases, students will not only satisfy bachelor program's requirements but also satisfy STCW's requirements during their study. Therefore, they can have double certificates after graduation, including a Bachelor degree and a STCW deck and/ or engine operational level certificate. It is common now to see such a double program in MET Bachelor degree, taking the case of Maritime Institute Willem Barentsz, Netherlands as one example.

Moreover, there are practices where curriculum of relevant specializations (ie. Navigation and Marine Engineering) merge each other. In the Netherlands, since 1985 when realizing the trend of reducing crew size for ship operations, maritime universities have developed dual education with semi-integrated programs and fully-integrated programs since 1999, as illustrated in Fig.9. By attending dual programs, graduates can be flexible in operating vessels as dual operations (combining both navigation and engineering functions) or mono operations (performing either navigation or engineering function).

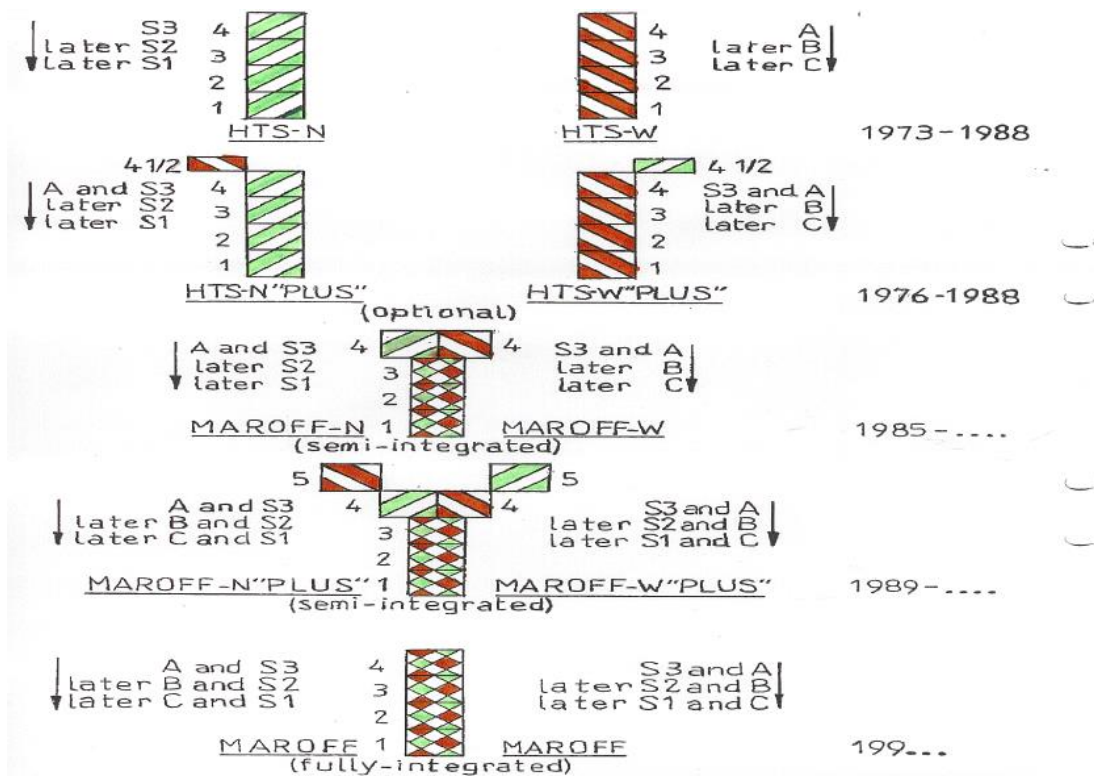


Figure 9. Dual program models in the Netherlands

Source: Cross, 2018

The case study of Netherlands on developing semi-integrated programs or fully-integrated programs in some way is a good practice toward challenging of Industry 4.0 when the crew size will be continue reduced because of automation. Denmark is also applying this approach when there is no traditional deck training path (Frazer-Nash Consultancy Ltd, 2017).

Regarding computing and informatics skills, they are not new anymore as they have been introduced since the late of 20th century together with the emergence of computers. Most of students nowadays already know how to use basic software as Microsoft office word or excel for their work. Instead, in the era of 4IR, a new world that is always connected and in which people work, interact and live using digital contents and tools, there are more demands for digital literacy skills. Glister (1997) defined digital literacy is the ability of the individual to use digital resources in a context totally immersed in technology. "A person who is digitally literate goes

beyond just being a digital information consumer to seeing themselves as someone engaged in the activity of digital information creation." (Meyers et al, 2013, p.362).

At B&FC, they have already integrated Academic and Digital literacy module in their Foundation degree of nautical science. On successful completion of this module, the students should be able to adopt and use digital devices, applications and services effectively; find, interpret, evaluate, manipulate, share, present and record information professionally and ethically. More information on learning outcomes, assessment of this module are presented at Appendix 6. Although the issue of cyber security is not mentioned explicitly in those outcomes at B&FC, fundamental knowledge and skills on cyber security should be integrated. Learning and self-development skills can be also be improved via learning this module.

Regarding technological awareness, there was no respondents in the survey thought that it should be integrated into the written curriculum as a separate module. Instead, to raise students' technological awareness, lecturers provide relevant skills and information through other modules. Otherwise, progressive topics can be introduced into the class discussion, stated by one respondent.

4.4.4. Cooperation with industry

Having good cooperation with industry, as a basic level, facilitate universities to understand industry's needs. Therefore, they can have timely and appropriate adjust in their programs, leading to higher employment opportunities for their graduates. In the long term, this support for the sustainable development of the universities as they can enhance reputation, increase enrolment, etc.

However, tightening cooperation with industry at a higher level offers universities additional opportunities to have investments from the industry on facilities and/ or their direct involvement in the education and training process through providing on-board training. In such cases, METIs act like hubs of supplying seafarer. For illustration, all students at Maritime Academy of Asia and Pacific (MAAP) are sponsored by shipping companies and will work for those companies after graduation. Therefore, to ensure the teaching and learning quality, those companies have invested simulators at MAAP. At present in 2018, MAAP has 62 simulators totally. In another example, all students following the Foundation Degree in Nautical Science, B&FC, the UK are required to have sponsorship from a shipping company or cadet training provider due to the work-based learning modules, which should be completed on board ships. To foster for this collaboration, there exist the needs for supporting policies from the government as mentioned in section 4.3. Under the rapid change of technologies used on board as Industry 4.0's implications, it is hard if universities wish to keep their training facilities updated. Strengthening collaboration with industry is a good solution.

Also, at a high level of cooperation, there is cooperation in research field. Universities and industry have joint R&D projects for innovation or practical applications, knowledge-transfer, and so on. Cooperation between University of Southeast Norway (USN) and Kongsberg in the R&D project "Innovating Maritime Training Simulators Using Virtual and Augmented Reality" is an example. USN also cooperate with Kongsberg in another project relating to autonomous ships. Via such projects,

universities have more opportunities to catch up with technologies, developing their human resources and integrating relevant knowledge into their program. In another view, via joint projects, universities can have certain investments from the industry for research, like investing in research labs. In USN campus, they have a modern simulator training under the collaboration with PGS and Kongsberg for Ramform Titan class ship simulation. To get this state, the universities like USN need to ensure a high quality of cross-disciplinary research staff.

In general, strengthening cooperation with industry become more and more vital for the development of METIs under the era of 4IR. It will not only help METIs update their programs, but also help to develop facilities and human resources.

4.4.5. Infrastructure/ facility

Besides lecturers/ instructors, facility plays an important role in enhancing teaching and learning quality. In addition to traditional facilities for MET (training ships, labs, workshops, classrooms), Virtual Reality (VR)/ Augmented Reality (AR) simulation and e-learning platform/ tools are terms that are mentioned recently and can be linked to Industry 4.0.

Virtual Reality (VR)/ Augmented Reality (AR) Simulation

In addition to special-task, limited-task, multi-task, and full-mission simulations, to prepare students even better for their future profession, creating a 3D environment that practically simulates working practices with as many senses as possible leads to the introduction of Virtual Reality (VR) and Augmented Reality (AR) simulations.

The term VR basically means ‘near-reality’. In technical explanation, VR is used to describe a three-dimensional, computer generated environment which can be explored and interacted with by a person. (Virtual Reality Society, 2017). Different to VR system whose surrounding environment is virtual, the surrounding environment in AR is real. AR system will have the following properties: (1) combines real and virtual

objects in a real environment; (2) runs interactively, and in real time; and (3) registers (aligns) real and virtual objects with each other. (Azuma, et al, 2001)

As mentioned in data analysis, 4 of 12 responding institutions now have already installed Virtual Reality simulation at their campuses. To have budget for installing, maintaining and upgrading facilities, besides tuition fees, other mentioned sources are providing courses to the industry, subsidies from government, doing research, and external funding from investors, and NGOs, in which, the highest percentage (55.56%) mentioned about providing courses (STCW courses, continuous professional development courses) to the industry.

Another solution for simulation training taking advantage of information and communication technology is using remote simulators. Australia Maritime College, now merged into Tasmania University, Australia has utilized the National Broadband Network to offer simulation to remote communities (Dunham & Lloyd, 2015).

E-learning platform is another facility which can be considered as Industry 4.0's achievement. However, it is also a tool to integrate requirements of Industry 4.0 into education, including MET. Indeed, to equip seafarers with all desired knowledge and skills as mentioned in Table 1, standard classroom with face-to-face methods still keep an important role yet should be supplemented with technology-enhanced methods. For example, to promote complexity and critical thinking, learning and self-development skills, communication skills, teamwork skills, flipping classroom is one of employed practices at STC Group (STC Group, 2016). Here, video and other forms of online instruction replace traditional knowledge transfer. Students will spend more time for self-study at home and more time available during school hours for question and answer, teamwork and discussion. E-learning platform should be established to support online interaction between lecturers and students, as well as to manage knowledge more effectively and efficiently. In some universities, take World maritime University for example, they even invested on e-learning lab and software for making

e-lessons.

4.5 Summary

In section 4, we have seen how different nations adjust their policies, strategies to respond to Industry 4.0. We have also seen how different institutions are working to adapt to the new environment of technology advancement. These practices are reference to think about solutions for integrating requirements of Industry 4.0 into case study of Vietnam MET.

5. Current situation of Vietnam and Vietnam MET

5.1 Introduction

Industry 4.0 has different implications toward different sectors and different nations. Therefore, in this section, the author first look at general situation of Vietnam under industry 4.0. Then, the current situation of Vietnam MET is examined.

The data in this section are obtained through literature study, a survey accomplished through official web sites of Ministry of Transport, Vietnam Maritime Administration, and Vietnam METIs and short interviews to staff or managers of METIs, providing answer for the research question 5: “What is the current situation of Vietnam and Vietnam MET?”

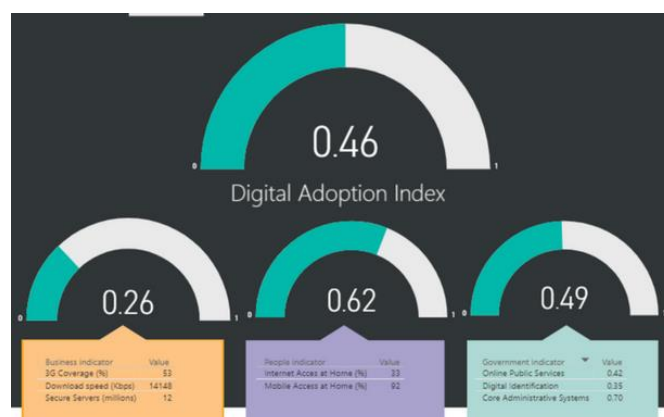
5.2 Vietnam and Industry 4.0

“In the past two decades, Vietnam has successfully inserted itself into select global value chains while achieving a remarkable reduction in poverty. However, in coming years, disruptive technologies will present both challenges and opportunities for remaining on this successful trajectory”, stated by Mr. Dione (2018), Country Director of World Bank Vietnam, at the Industry 4.0 Summit.

In one hand, disruptive technologies offer opportunities for Vietnam to foster development in different dimensions. For example, the innovation of using smart phones, paired with an automated sensor in the field to monitor the level of water has implications for agricultural productivity, water conservation, Green House Gas reduction and rural development in Vietnam. In another example, blockchain can be used for tax collection, boosting efficiency and data privacy. Also, the government can strengthen government to government, government to business, and government to citizens relationships, optimize government investments and enhance productivity by developing an interoperability infrastructure as E-government, enabling states services being done online. There are still many benefits that Vietnam can harness from these disruptions.

In the other hand, disruptive technologies present challenges to Vietnam. Large numbers of low-skilled workers who depend on brand supply chains for jobs are at risk of losing their livelihoods. The ILO forecasts that 56 percent of workers in Cambodia, Indonesia, the Philippines, Thailand and Vietnam is at high risk of being replaced with technology by 2040. (Verisk Maplecroft, 2018).

In terms of digital adoption, Vietnam shows strengths and challenges. The World Bank’s Development Report 2016 on Digital Dividends ranks Vietnam’s Digital Adoption Index at 0.46 out of 1-point scale. While higher than the average of global lower middle-income countries, it is lower than the regional average. (Dione, 2018).



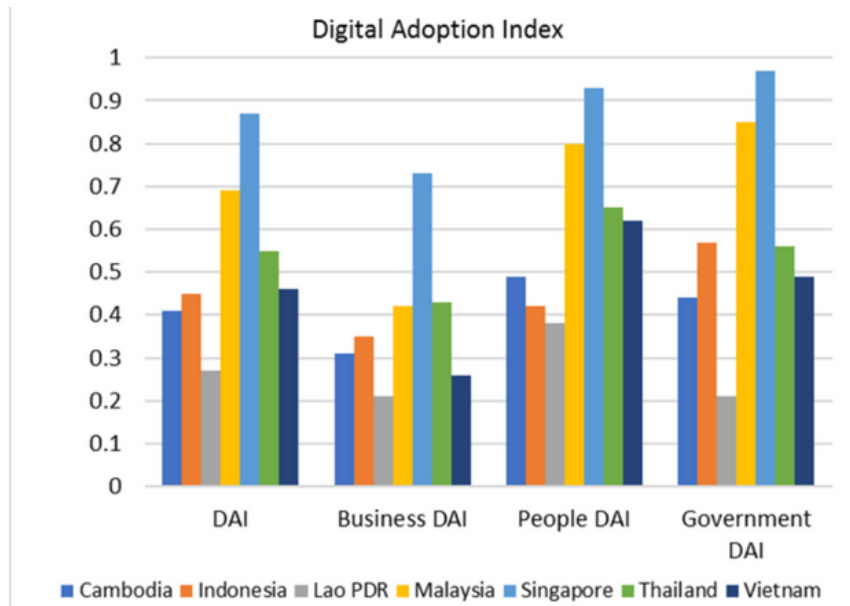


Figure 10. Digital Adoption Index of Vietnam

(Source: Dione, 2018)

Internet penetration is 54 percent, and 40 percent of Vietnam’s population are social media users. While those numbers are impressive, according to a survey of Alphabet in 2017, Vietnam fares lowest in the region in other digital measurements.

| ALPHABETA DIGITAL NATION SCORECARD | | | | | |
|------------------------------------|-----------------|-------------------|------------------|---------------|-------------------|
| RANK | OVERALL RANKING | FINANCIAL CAPITAL | DIGITAL PRODUCTS | HUMAN CAPITAL | DIGITAL COMMUNITY |
| 1 | Singapore | Australia | South Korea | Singapore | Japan |
| 2 | Australia | Singapore | Japan | Malaysia | Singapore |
| 3 | South Korea | Japan | Taiwan | New Zealand | Australia |
| 4 | Japan | Taiwan | Australia | India | India |
| 5 | New Zealand | Malaysia | New Zealand | Taiwan | South Korea |
| 6 | Taiwan | New Zealand | Singapore | Australia | New Zealand |
| 7 | Malaysia | India | Malaysia | South Korea | Taiwan |
| 8 | India | Indonesia | Viet Nam | Indonesia | Indonesia |
| 9 | Indonesia | Thailand | India | Japan | Malaysia |
| 10 | Thailand | South Korea | Indonesia | Thailand | Thailand |
| 11 | Viet Nam | Viet Nam | Thailand | Viet Nam | Viet Nam |

Figure 11. Alphabet Digital National Scorecard

(Source; Asia-Pacific Economic Cooperation, 2017)

To forge ahead, or even leapfrog, Dione (2018) emphasized that Vietnam need to leverage technologies to capitalize on innovations, put in place fundamental institutions, and invest in the people of today and the future.

Indeed, although the total number of labour in Vietnam in 2016 is 54 million peoples (General Statistics Office of Vietnam, 2016), as illustrated in Fig.12, 41 percent of the labor force are low-skilled and only 10 percent are high-skilled (WEF, 2016a). This number is insufficient to make the leap into Industry 4.0.

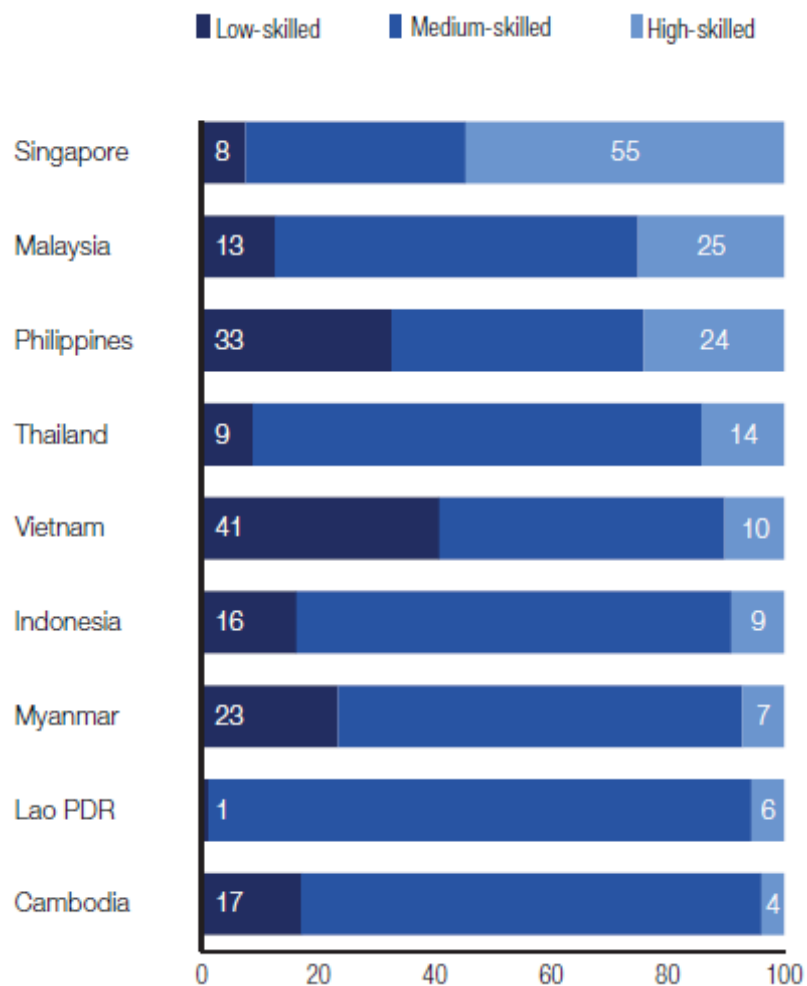


Figure 12. Employment share in Vietnam.

(Source: WEF, 2016a)

Being aware of opportunities and challenges of the 4IR, recently the Vietnamese

government have had some efforts to achieve its development aspirations.

For example, the government issued the Law on citizen identification, which came into effect since 1 January 2016, to accelerate the national ID reform implementation. This is the basement for Vietnam to foster developing its digital Citizen Identification Card system and E-government.

In another attempt, to promote innovations and taking advantages of technologies for development, Vietnamese government also established a number of funds, programs at State and provincial/city level to support startups (eg. Vietnam – Finland Innovation Partnership Programme, National Technology Innovation Fund, etc.) In 2016, the Prime Minister approved the Project 844 on “Supporting National Innovative Start-up Ecosystem to 2025”. In March 2018, Decree 38/ND-CP of the government also came into effect, focusing on innovative start-up investments (Shira, 2018).

Directly relating to Industry 4.0, in May 2017, the Vietnamese Prime Minister has issued the Directive 16/CT-TTg on strengthening the capacity to tackle challenges posed by the Industry 4.0 as well as to harness this revolution for development. Six measurements were mentioned (The Prime Minister, 2017), briefly including:

- i. Promote development, making a real breakthrough in infrastructure, application and human resources for information technology and communication technology;
- ii. Continue improve the competitive business environment;
- iii. Review strategies and action plans, propose and formulate targeted plans and tasks so that they are implemented in accordance with the development trend of the 4IR;
- iv. Promote national innovative startup ecosystem;
- v. Change policies, contents and methods of education and vocational training in order to generate human resources which are able to follow new technological production trends;

- vi. Raise the awareness of leaders of regulatory authorities, local governments, enterprises and society about the 4IR.

Another noticeable measurement of Vietnam recently is the adoption of Law on cyber security by the National Assembly of Vietnam on 12 June 2018, taking effect on 1 January 2019. This law provides principles, measures, and activities to ensure the implementation of cybersecurity tasks; the responsibilities of relevant agencies, organisations, and individuals in managing, providing services in cyberspace, and using cyberspace (Updates to draft cybersecurity Law, 2018).

In summary, Vietnamese Government has got certain efforts towards seizing opportunities and minimizing negative impacts of Industry 4.0. However, Vietnam can really harness this disruption for development or not depends on the efforts of all sectors and each individuals.

5.3 Vietnam MET and Industry 4.0

5.3.1. MET System in Vietnam

Vietnamese seafarers are mostly educated and trained at two universities: Vietnam Maritime University (VMU) and Ho Chi Minh City University of Transport (UT-HCMC). Both universities are governed by Ministry of Education and Training (MOET) and MOT. Besides the two mentioned universities, there are other four MET colleges. These colleges are placed under the MOT and Ministry of Labour, Invalids and Social Affairs (MOLISA). The system of METIs in Vietnam is demonstrated in Fig 13.

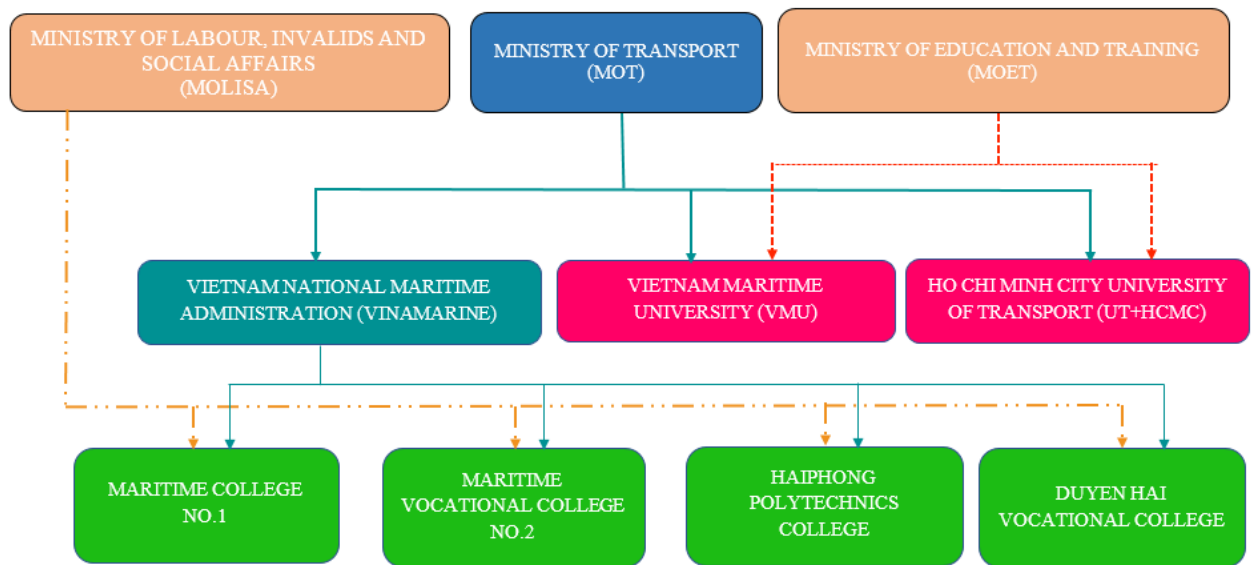


Figure 13. The system of MET institutions in Vietnam

(Adapted from VMU, 2016)

It is noted that the MET system in Vietnam at present is still much centralized. Ministries have a high level of control over the system. When MOET/ MOLISA focus on the institutional enrollment (ie. enrollment exams, quota of enrollment), tuition fee, and teaching and learning under the National Academic Accreditation, MOT will control METIs in terms of organization, structure, promotion, top personnel appointment, state budget, and training programs in compliance with the STCW Convention. All MET training courses shall be approved by Vietnam Maritime Administration (VINAMARINE) and for degreed programs, it is required to have additional approval from MOET/ MOLISA.

5.3.2. Current situation of Vietnam MET at national level

Responding to Directive 16/CT-TTg mentioned in section 5.1, in November 2017, MoT had the meeting of all subordinate organizations to review the strategic plan on human resources development in the transport sector in 2011-2020, with orientation to 2030 in respect to Industry 4.0's requirements (Ministry of Transport, 2017). The revised plan, however, is still under development. Nevertheless, the original strategic

plan⁷ still provide guiding for activities relating to education and training of all relating parties in transportation, including METIs, VINAMARINE, and shipping companies under MoT.

Under the strategic plan for human resources development, following activities have been being offered directly by the government to support for MET (Ministry of Transport, 2016):

- Organize conferences/ dialogue between employers and METIs to foster understanding about the needs for education and training.
- Through the mentioned conferences, MoT also encourage collaboration among METIs and shipping companies. Some memorandum of understanding, agreements for scholarships, internships were signed based on voluntariness and mutual benefits.
- Provide a number of programs for human resources development. Under these programs, a number of lecturers, managers at METIs are funded to follow CPD programs.
- Provide finance funding to METIs. At present, MoT still set ceiling for tuition fees and support partly for regular operational expenditures at public METIs. However, latest by 2020 all METIs will be autonomy on finance. Nevertheless, although the government have encouraged METIs to call for investment from society to invest on infrastructure, facilities, etc., the solution is not successful because the return on investment rate in education is not high. National budget is still the main source for developing facilities at METIs.
- Decentralize some activities to institutions. For example, presidents of METIs can make decisions to delegate persons for studying, training or doing research abroad, adjusting curriculum of one existing disciplinary.
- Promote research via national budget.

So, in general, Vietnamese government have similar measurements as other countries

⁷ Strategic plan for human resources development in transport sector, period 2011-2020, issued under the Decision 1576/QĐ-BGTVT on 19 July 2011 of Minister of Transport.

to support MET. However, while the tighten relationship between industry and METIs is essential for encountering Industry 4.0's requirements, Vietnamese government so far has no policy to engage industry into MET. The collaboration between METIs and industry is based on agreements among them.

Regarding maritime administration, VINAMARINE at present places most attention on management. It assists the government to govern all maritime affairs and shipping related matters, including implementing effectively international instruments of IMO that the government has ratified and legislated into national laws. Indeed, VINAMARINE has performed well its duty in this aspect. For example, regarding education and training, Vietnam has been in the white list of IMO in term of implementing STCW 1978, as amended since 2000 and always retain in this list. However, VINAMARINE seems not so dynamic in term of R&D or involving technology developments. Although there is the department of Science and Technology, Environment in VINAMARINE (VINAMARINE, 2018), there is no highlighted activities of this department toward recent technology developments. Regulations, guidance from VINAMARINE are basement for unifying activities in maritime sectors, including MET. Therefore, if Vietnam wish to harness this disruption for a leapfrog, it is necessary to have proactive reaction of VINAMARINE toward Industry 4.0

In summary, Vietnamese government has certain efforts to support for MET, yet these supports are not sufficient to transform MET system toward Industry 4.0's requirements. Also, the leadership role of government has not been strongly demonstrated so far. There exist the need for a comprehensive strategy and more supports, policies from the government for a fundamental and comprehensive transform in Vietnam MET.

5.3.3. Current situation of Vietnam MET at institutional level

This section discuss the current situation of METIs at five areas: strategy, human resources, curriculum, cooperation with the industry and infrastructure.

5.3.3.1. Strategy

In 04th November 2013, MoT approved the Action Program No. 302-CTr/BCSD on implementing Resolution No. 29-NQ/TW of Central Steering Committee on fundamental and comprehensive educational reform. This measurement of the government and MoT directly affects strategic development plans of all METIs. Indeed, the current strategic development plans of METIs have been revised or developed based on this resolution and action program.

Although the elements of Industry 4.0 have not been considered in the Resolution No. 29-NQ/TW, with the aims of providing high quality human resources to serve industrialization and modernization in a socialist-oriented market economy during international integration, some following viewpoints have been highlighted, which can be linked to Industry 4.0's requirements (Central Steering Committee, 2013):

- Associate education development with socio-economic development,... science and technology advances (Article B.I.4).
- Keep radically changing the teaching and learning methods towards modernism; encourage the learners' independence, creativity, and application of knowledge; Focus of teaching learning and thinking methods, encourage and enable the learners to update knowledge themselves, improve their intellect, skills, and capacity. Diversify the methods of learning,... Intensify application of information technology and telecommunication to teaching and learning (Article B.III.2).
- Focus on analytical ability, creativity, self-learning ability, professional ethics, research and application of science and technology, technical skills, organization ability and adaptability with working environments (Article B.III.3).

- Complete the national education system towards openness, lifelong learning, and building a learning society (Article B.III.4).
- Enable employers to participate in the developing, adjusting, running training programs, and assessing learners' ability (Article B.III.4).
- Keep modernizing the facilities, especially ones for information technology (Article B.III.7).

As a result, strategies at METIs have been quite updated and basically sufficient toward Industry 4.0's requirements. The most important shortcoming in these strategies in respect to Industry 4.0 is lacking of the vision of an uncertain future and a rapid changing environment, which will require proactive, visionary leadership and flexible, agile future employees. These elements are underestimated in current strategies.

5.3.3.2. Human resources

Being aware that lecturers/ instructors play an important role in ensuring teaching and learning quality, Vietnam METIs have employed various activities for having highly qualified teaching staff. For example, UT-HCMC set up employment criteria for lecturers in Navigation, in which lecturers must satisfy the following criteria: having Master degree or above for bachelor degree programme, having seetime experience, having English proficiency certificate (IETLS 6.0 or equivalent), having IT certificate at least at intermediate level, and certificate of pedagogical competence. Certificate of pedagogical competence is compulsory at all higher education (HE) lecturers (MOET & MIA, 2014). Also, they have policies to encourage lecturers to participate in CPD activities. For example, UT-HCMC have incentives to promote lecturers to report at conferences, attend further education or training programs, participate in research projects, and so on (UT-HCMC, 2017a). In another attempt to enhance teaching and learning quality, as well as developing human resources, UT-HCMC and VMU delivered online survey for each delivered module.

However, there are still some following drawbacks in human resources development at Vietnam METIs.

First, there is little consideration to develop pedagogy at lecturers. In a project aiming at developing teaching methods of lecturers at UT-HCMC in 2017, Nguyen (2017) has mentioned several reasons preventing lecturers from applying active teaching methods and technology in their lectures and highlighted the need to develop a team of academic developers to support lecturers in teaching and learning. However, so far, there is no such team established at UT-HCMC. Other Vietnam METIs share the same situation.

Second, there is a lack of a consistent and effective knowledge management system at Vietnam METIs. For example, under the mentioned project, a tailor made CPD program was delivered in UT-HCMC and 36 lecturers were trained to be the trainer Nguyen (2017) yet there is no system to store as well as continuously disseminate the outcomes of this project to other new lecturers. All staff trainings at Vietnam METIs are delivered case by case and there is no institutional knowledge management system be noticed during this research.

Last but not least, the concepts of values and CPD plan are not popular at present at Vietnam METIs. Indeed, there is no statement on core values can be found on websites or documents of Vietnam METIs. This can partly lead to weak intrinsic motivation of employees in continuous development. Also, they often misunderstand between CPD plan and performance targets. While this one is not a problem toward active lecturers, it can be a barrier preventing passive lecturers from continuous professional development as they only try to satisfy the minimum requirement of the institution.

5.3.3.3. Curriculum

At present, METIs in Vietnam still provide separate education and training programs in maritime including navigation, marine engineering, and marine electrical

engineering. The curriculum of those programs will be updated every 2 to 5 years or when necessary, depending on the institution. However, there are following things can be found in the curriculum development and curriculum delivery at Vietnam METIs.

First, although there is seetime mentioned in these curricula, Dean of Navigation from VMU and UT-HCMC replied that their institutions can not arrange sufficient onboard training for their students. Instead of going onboard, students will be arranged to have internship at shipping companies, shipyards or workshops to obtain some basic relevant knowledge. This leads to the fact that after 4-year study at Bachelor programs, students are not eligible for taking the officer of watch examination.

Second, there are soft skills modules integrated into the current curriculum of VMU and UT-HCMC (UT-HCMC, 2017b, VMU, 2017). In those modules, students will be taught and practiced to cultivate necessary soft skills as S.W.O.T⁸ analysis skills, presentation skills, goal setting skills, creative thinking skills, teamwork skills, communication skills, skills for preparing job application, and job interview skills. They are also taught how to develop CPD Plan, and personal development plan (UT-HCMC, 2014). This is an effort from METIs to increase the employability and personal capacity of students. Yet, this could be a mistake if METIs do not pay attention to transfer some of those soft skills during the learning of other modules.

Lastly, there is also module of computing and informatics in the current curriculum of VMU and UT-HCMC (UT-HCMC, 2017b, VMU, 2017). After successful completion of this module, students can use properly basic applications for office works. This module is totally different with the idea of Digital Literacy mentioned in this paper.

⁸ SWOT: Strengths, Weaknesses, Opportunities, Threats

5.3.3.4. Cooperation with the industry

The collaborations between Vietnam METIs and industry are basically good. Shipping companies play the role of employers and contribute to curriculum development when being invited by institutions. They employ qualified students educated by METIs and provide feedbacks of these seafarers' performance when being consulted. For some shipping companies, they provide scholarships to students with good study performance or of disadvantages.

However, it is not common in Vietnam to find cases where shipping companies sign agreements for employment in advance and METIs play the role as hubs for seafarer supplying. Nevertheless, there are such collaborations. For example, every year UT-STC provides approximately 15 UT-HCMC students to the fleet of Wagenborg. To foster this type of collaboration, it is not purely the problem of quality of education. It requires a comprehensive framework for collaboration between METIs and companies to ensure the benefits of all relating parties, including the companies, the institutions, the seafarers/ students. In some cases, there exist the need for intervention of labour union or government body in charge of governing labour.

It is also difficult to find in Vietnam cases where shipping companies are willing to support METIs in arranging onboard training. This is only provided based on the favour of shipping companies because there is no incentives for this collaboration.

5.3.3.5. Infrastructure/ facilities

It is the fact that most of facilities in Vietnam METIs are invested by the government. Therefore, with a limited national budget, it cannot be sufficient for installing modern facilities. Besides some models and workshops, there are 3 training ships yet those ships are not always ready for cadet training. Furthermore, there is a few of simulations installed at VMU and UT-HCMC under joint venture programs, grant projects or national investment. There is no VR or AR so far at Vietnam METIs. During the interview, Dean of Navigation at both VMU and UT-HCMC insisted that what they

really need now are ships for cadet training. This is essential for improving practical knowledge and skills of students.

A noticeable effort of Vietnam METIs recently responding towards the technology advancement is the establishment of E-library, learning management system, and E-learning platform. However, e-learning is still new to most of lecturers of maritime affairs and they are not active in applying this into teaching and learning. Nevertheless, there is faculty of information technology at UT-HCMC and VMU and these IT lecturers have already well applied this technology into their lectures. For illustration, lectures on AI and expert systems, information safety and security have been uploaded on the VMU e-learning.

5.4 Summary

In section 5, we have looked at the current situation of Vietnam and Vietnam MET toward Industry 4.0. It can be seen that Vietnamese government and Vietnam METIs are just at the beginning of their journey to response to Industry 4.0's requirements. To prepare well for coming future, it is necessary for Vietnam to look at other practices around the world and make necessary adaption.

6. Suggestions to integrate requirements of Industry 4.0 into Vietnam MET

“What lessons/ experiences can be adapted for Vietnam MET? and how to adapt?” is the focus point in this thesis. This question will be answered at two level of action: government and institution.

From analysis of current situation of Vietnam in section 5, in reference to practices presented in section 4, the following solutions is suggested to integrate requirements of Industry 4.0 into Vietnam MET.

At national level, the government need to consider the following activities to foster the development of MET under Industry 4.0:

- Revising strategic plan with respect to Industry 4.0, in which the collaboration among government – industry – universities must be highlighted and promoted by specific measurements from all relevant parties.
- Developing appropriate policies, regulations like SmarT scheme or tonnage tax of the UK to encourage shipping companies to participate in cadet training. By this way, students have more opportunities to access to modern ships. The practice drawn out from different countries is that shipping companies only participate if they have economic benefits. This action from the government need to be done in short term as it is not only for encountering Industry 4.0’s challenges but also for solving the current shortcoming of Vietnam MET system that is lacking of onboard training.
- Promoting step by step the leadership role of VINAMARINE in maritime affairs, starting from re-considering the vision, mission of VINAMARINE. How would the government like VINAMARINE to lead the maritime sector?
- Developing strong, comprehensive and sustainable policies and legal frameworks to support for international cooperations and investments.

At institutional level, METIs need to consider the following activities to be able to educate highly qualified seafarers under Industry 4.0:

- Revising strategic plan in consideration of all emerging trends, including

Industry 4.0 with its multi-faced implications. The involvement of industry into education and training must be highlighted.

- Regarding development human resources:
 - Develop a comprehensive and strategic approach towards human resource development with a harmonization between individuals' interests and organization's objectives, starting from building core values and provoking demands for CPD of each individual.
 - Pay more attention on supporting lecturers in enhancing their pedagogy; establish support team in teaching and learning.
 - Elaborate an effective knowledge management system to accumulate and utilize benefits from separate CPD programs.
 - Taking advantages of multidisciplinary institutions, Vietnam METIs need to promote cross-disciplinary working group, research group between faculty of maritime affairs and faculty of information technology to have quality personnel with sufficient knowledge and skills for both research and teaching
- Regarding curriculum development:
 - In short term, integrate Digital Literacy module into the curriculum of all maritime affairs, with sufficient attention placed into ethical and professional behaviour, cyber security, and also privacy. Also, organize seminars, conferences to raise awareness of all faculties and students on technological achievements.
 - In medium term, try to obtain the double degree for bachelor program, by ensuring onboard training.
 - In long term, review the current programs with cross-disciplinary approaches to investigate the possibility for a dual program.
- Regarding industry cooperation: tighten collaboration with industry is the solution for continuous improvement of teaching and learning, as well as solving matters of infrastructure investment, training facilities.
- Regarding infrastructure:

- Provide consultant to the government to have an appropriate policy for training ships. If necessary, a research should be done to present the return value to the national investment. For example, under the SmarT scheme, for every £1 the government spend on SMarT1, there is a £4.8 return to UK GDP (Frazer-Nash Consultancy, 2017).
- Calling for investment from the society in infrastructure is a good option yet we need to think thoroughly as if it is efficient or not under the rapid changing environment. Also, other solutions can be considered taking advantages of technology. Using remote simulation at Tasmania University is an example.
- Continue developing e-learning supporting tools in combination with cultivating pedagogy of lecturers as the education 4.0 must be a customized education, be owned and decided by own students.
- Strategic thinking about industry and mutual benefits for long term investment.

7. Conclusion

This paper is the author's effort to understand systematically Industry 4.0 and its implications on MET, then find out solutions for Vietnam MET to response to its requirements in reference to the practices of other countries and METIs. Based on data finding, discussions in this paper mainly focus on such five areas as strategy, human resource development, curriculum, cooperation with industry, and infrastructure. Throughout discussions, the most prominent factor deciding the development of MET under industry 4.0 is the tighten cooperation among government, industry, and university.

Besides discussed matters, Industry 4.0 still have many other impacts on MET. For example, it can also affect the gap of gender equality/ equity in MET. This could be another direction for further study./.

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APPENDICES

Appendix 1: Consent form



RESEARCH ETHICS: CONSENT FORM

Project Title: Integrating requirements of Industry 4.0 into maritime education and training: case study of Vietnam

Researcher:

Name: Tran Thi Nguyet Minh

Student, MSc Maritime Affairs

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1. I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.

2. I consent to my personal data, as outlined in the accompanying information sheet, being used for this study and other research. I understand that all personal data relating to volunteers is held and processed in the strictest confidence and that should a need arise for the inclusion of any personal details in the research, express consent for such inclusion will be obtained from me in advance.

3. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.

4. I agree to take part in the above study.

Tick the statements if appropriate

5. I agree to the interview / consultation being audio recorded

6. I agree to the interview / consultation being video recorded.

7. All data collected will be deleted upon completion of the research as stated in the research guidelines

Name of participant:

Date

Appendix 2: Online questionnaire

Maritime Education and Training - Industry 4.0

Industry 4.0 is about to take place at present. Technologies or components that are commonly mentioned as part of Industry 4.0 include smart factories, cyber-physical systems, industrial internet of things, internet of services, and so on. Industry 4.0 is gradually implemented, often with digitalization as the first important step. One thing can be predetermined is that this innovation will demand new skills from workers. The future economy, including the maritime sector, requires highly educated and well-trained people.

This is a brief survey to collect views to support the master dissertation about integrating requirements of Industry 4.0 into maritime education and training (MET). Your contribution to this survey is very important and highly appreciated.

The questionnaire is anonymous and all information will be analysed and presented in aggregate. I thank you very much for your interest and for your response.

Minh Tran

Maritime Education and Training - Industry 4.0

* Required

PERSONAL INFORMATION

What is your age? *

Your answer

What is your gender? *

Female

Male

What is your nationality? *

Your answer

In which area of the maritime industry do you work? *

Maritime education and training institution/ center

Maritime administration

Other:

INSTITUTIONAL/ INFORMATION

DEPARTMENTAL

GENERAL

What is the name of your institution? *

Your answer

How many students totally are there in maritime affairs*? *

* Navigation, marine engineering, and marine electrical, electronic & control engineering

Your answer

How many lecturers/ instructors/ teaching staff totally are there in maritime affairs? *

Your answer

What programs are offered at your institution? Please tick all boxes applied. *

Bachelor degrees in Maritime affairs

Master and/ or doctor degrees in Maritime Affairs

STCW courses

Other:

Is there simulation at your institution? *

If YES, please continue with the two consequent questions. If NO, please pass these questions.

Yes

No

How many simulations are there at your institution?

Your answer

What types of simulations are installed?

Limited simulation

Multi-task simulation

Full mission

Virtual Reality

Other:

Do your institution receive any subsidy from the Government? *

If YES, please continue with the 2 consequent questions. If NO, please pass these questions

Yes

No

How many percent of your budget are government subsidy approximately?

Your answer

What are criteria for the Government to allocate the budget to your institution?

Your answer

BACK

NEXT

EDUCATION AND TRAINING

Which of the following skills/ attitudes have been integrated into the curriculum at your institution? Please tick all boxes applied *

Adaptability and flexibility

Computing and informatics skills

Teamwork

Communication skills

Leadership

Discipline

Environmental/sustainability awareness/concern

Learning and self-development skills

Complexity and critical thinking

Language ability

Professionalism and ethical behavior

Responsibility

Inter-personal and social skills

None of the above

Other:

What, in your opinion, are the biggest challenges in providing sufficient knowledge and skills to seafarers for the future shipping *

Your answer

In your opinion, is it necessary for students in maritime* to know about new technological trends (digitalization, internet of things, 3D

printing, etc.) which have potential impacts on maritime? *

* navigation, marine engineering, marine electrical, electronic & control engineering

Yes

No

If "YES ", what can an institution do to raise students' technological awareness? Could you share any experience of your institution (if applicable)?

Your answer

What are criteria for employing MET lecturers or MET instructors in your institutions? Please tick all boxes applied. *

Seagoing experience

Master degree and above

Instructor certificate

English Proficiency certificate

Other:

What programs or policies are being applied at your institutions for the continuous professional development of the teaching staff?

Your answer

Are you aware of any practices or policies does your organization do/ implement to prepare human resources for future education? If yes, please specify.

Your answer

How does your institution raise enough budget for installing, maintaining and upgrading training facilities?

Your answer

On a scale of 1 to 5 (1 being of relatively low importance and 5 indicating high importance), please indicate how you view the following as they relate to prioritized fields that an institution should do now to proactively address the needs of the future education and training in respect to Industry 4.0. *

- 1
- 2
- 3
- 4
- 5

- Refine strategic development plan
- Revise the curriculum
- Develop human resources
- Improve quality assurance system
- Strengthen cooperation with industry
- Develop appropriate infrastructure
- Strengthen institutional governance

In addition to the activities mentioned above, in your opinion, what activities should an institution consider to proactively address the needs of the future education and training?

LEGAL FRAMEWORKS AND SUPPORTING POLICIES

Are you aware of any your national laws/ rules/ policies (including which are under development also) to address requirements of Industry 4.0? *

If YES, please specify or send the relevant file to w1701866@wmu.se for reference.

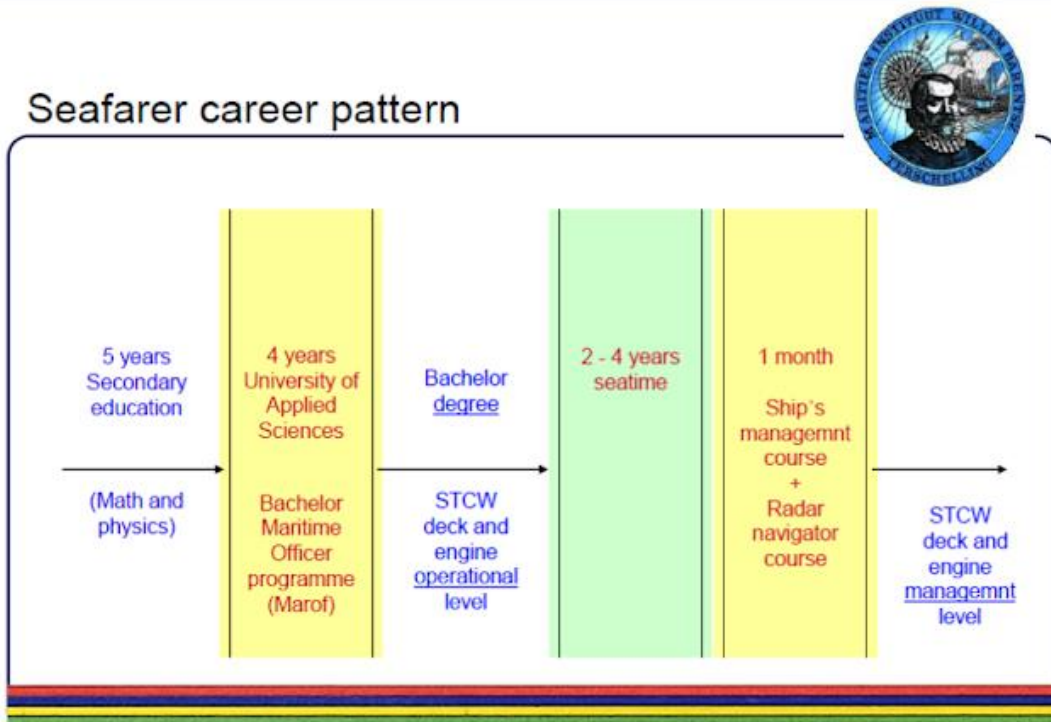
Your answer

Could you please describe briefly the maritime education and training system* in your country? .

*See the below of the Netherland for reference. You can also send relevant diagrams to the researcher via email W1701866@wmu.se

Your answer

Netherlands MET Structure



Further cooperation

Would you wish to receive the analysis of my research?

Yes

No

Your email *

Your answer

Are you willing to participate in my interview later on to discuss further the above issues? *

Yes

No

Maybe

BACK

NEXT

Thank you very much for your response and cooperation. Wish you all best wishes!

Ms. Minh Tran
Maritime Education and Training
World Maritime University
Cell: +46 762 509 786

BACK

SUBMIT

Appendix 3: Brief explanation of some industry 4.0's technologies

Artificial intelligence (AI)

Artificial intelligence (AI) is an area of computer science that emphasizes the creation of intelligent machines that work and react like humans. Some of the activities computers with artificial intelligence are designed for include: Speech recognition, Learning, Planning, Problem solving (Dictionary, 2018).

Augmented Reality (AR)

Augmented reality (AR) is a type of interactive, reality-based display environment that takes the capabilities of computer generated display, sound, text and effects to enhance the user's real-world experience. Augmented reality combines real and computer-based scenes and images to deliver a unified but enhanced view of the world (Dictionary, 2018)..

Big data

Big data refers to a process that is used when traditional data mining and handling techniques cannot uncover the insights and meaning of the underlying data. Data that is unstructured or time sensitive or simply very large cannot be processed by relational database engines. This type of data requires a different processing approach called big data, which uses massive parallelism on readily-available hardware (Dictionary, 2018).

Blockchain

Blockchain is a critical part of the bitcoin peer-to-peer payment system. The bitcoin system works using a blockchain ledger to record transactions. Bitcoin is a global cryptocurrency that can be used as a medium of exchange. However, while many parties have started to accept bitcoin as a currency, it is still controversial and poses risks in terms of security and stability (Dictionary, 2018).

Cloud computing

Cloud computing is the use of various services, such as software development platforms, servers, storage and software, over the internet, often referred to as the "cloud" (Dictionary, 2018).

Cyber-Physical system (CPS)

CPSs are systems that link the physical world (e.g., through sensors or actuators) with the virtual world of information processing. They are composed from diverse constituent parts that collaborate together to create some global behaviour. These constituents will include software systems, communications technology, and sensors/actuators that interact with the real world, often including embedded technologies (Cyber-Physicals Systems, n.d).

Cyber-security

Cyber security comprises technologies, processes and controls that are designed to protect systems, networks and data from cyber attacks. Effective cyber security reduces the risk of cyber attacks, and protects organisations and individuals from the unauthorised exploitation of systems, networks and technologies (What is cyber security, n.d).

Digital twins

Digital twins are virtual replicas of physical devices that data scientists and IT pros can use to run simulations before actual devices are built and deployed. They are also changing how technologies such as IoT, AI and analytics are optimized (Shaw, 2018).

Internet of services (IoS)

Under the **Internet of Services (IoS)** everything that is needed to use software applications is available as a service on the Internet, including the software itself, the tools to develop the software, and the platform (servers, storage and communication) to run the software (Internet of Services, n.d).

Internet of Things (IoT)

The internet of things (IoT) is a computing concept that describes the idea of everyday physical objects being connected to the internet and being able to identify themselves to other devices (Dictionary, 2018).

Robotics

Robotics is the industry related to the engineering, construction and operation of robots – a broad and diverse field related to many commercial industries and consumer uses. The field of robotics generally involves looking at how any physical constructed technology system can perform a task or play a role in any interface or new technology (Dictionary, 2018).

Smart sensors

A smart sensor is a device that takes input from the physical environment and uses built-in compute resources to perform predefined functions upon detection of specific input and then process data before passing it on (Rouse, n.d).

Virtual Reality (VR)

Virtual reality refers to computer-generated environments or realities that are designed to simulate a person's physical presence in a specific environment that is designed to feel real. The purpose of VR is to allow a person to experience and manipulate the environment as if it were the real world. The best virtual realities are able to immerse the user completely. Virtual reality should not be confused with simple 3-D environments like those found in computer games, where you get to experience and manipulate the environment through an avatar, rather than personally becoming part of the virtual world (Dictionary, n.d).

Appendix 4: Some core components of higher education funding systems

| Country | Block Grant and HEI autonomy | Primarily Student Nos Driven | Weighted by Discipline | Performance-Funding Agreement | Research & Access Funding within Core | Allocation model includes student fees |
|--------------------|------------------------------|------------------------------|------------------------|-------------------------------|---|--|
| Ireland | Yes | Yes | Yes | Yes | Yes | No |
| Australia | Yes | Yes | Yes | Yes | Research only | Yes |
| Norway | Yes | Not directly | Not directly | Yes | No, research within performance component | N/a |
| Netherlands | Yes | Yes, but by graduates | Yes | Yes | Yes | Yes |
| Wales | Yes | Yes | Yes | No | Yes | No |
| England | Yes | Yes | Yes | No | Yes | Yes |
| Scotland | Yes | Yes | Yes | Yes | Yes | N/a |
| Denmark | Yes | Yes, but credit based | Yes | No | Yes, within weightings | N/a |

Source: Higher Education Authority, 2017.

Appendix 5: B&FC Human resources web page

|  | | | | | | | | |
|---|--|------------------|-------------------------------|-------------------------------------|-------------------|------------------|--------------------------|--------------------------|
| Internal Courses | | | | | | | | |
| | Title | Start Date | End Date | Location/Room | Trainer | Available Spaces | Total Spaces | Book Now |
| Human Resources Home Information HR Documents Employee Information Staff Development Staff Development Home About Us Induction Internal Courses Teacher Development Extended Study | Fire evacuation training | 28/06/2018 09:30 | 28/06/2018 11:00 | UC Campus - 58151 | Joanne Shepherd | 6 | 15 | Book Now |
| | Moodle gradbook and logs | 28/06/2018 12:00 | 28/06/2018 12:30 | T8C, Biphom Campus | Julia Kirk | 20 | 20 | Book Now |
| | Principal's end of year staff address | 03/07/2018 09:00 | 03/07/2018 09:50 | Sports Hall, Biphom Campus | Bev Robinson | 90 | 300 | Book Now |
| | Customer insights-managing customer centric expectations | 03/07/2018 09:00 | 03/07/2018 10:00 | T103, Biphom Campus | Kate Coughlan | 13 | 20 | Book Now |
| | Safer Communities | 03/07/2018 09:00 | 03/07/2018 12:00 | LTC (T110b/c), Biphom Campus | Sue Crosbie | 9 | 20 | Book Now |
| | Tutor development session - substance misuse | 03/07/2018 09:00 | 03/07/2018 10:00 | E002b, Biphom Campus | Sue Crosbie | 14 | 20 | Book Now |
| | Outdoor skills workshop | 03/07/2018 09:15 | 03/07/2018 12:00 | Biphom Woodland (meet at reception) | Pam Reynolds | 1 | 10 | Book Now |
| | Enhancing learning and teaching through the LRCs | 03/07/2018 09:30 | 03/07/2018 10:30 | C301, Biphom Campus | Julia Kirk | 16 | 20 | Book Now |
| | Influence and communicating with impact | 03/07/2018 09:30 | 03/07/2018 12:30 | P004, Biphom Campus | Catie Hurst | 0 | 16 | Book Now |
| | Coaching skills for leaders | 03/07/2018 09:30 | 03/07/2018 12:30 | C101, Biphom Campus | Catie Hurst | 6 | 16 | Book Now |
| | Hate Crime | 03/07/2018 10:15 | 03/07/2018 10:45 | T213, Biphom Campus | Fenny Hindle | 11 | 20 | Book Now |
| | Supported storyboard workshop | 03/07/2018 10:30 | 03/07/2018 12:30 | C301, Biphom Campus | Simon Bailey | 15 | 20 | Book Now |
| | Now to education-inspection guidelines | 03/07/2018 10:30 | 03/07/2018 11:30 | T103, Biphom Campus | Kate Coughlan | 16 | 20 | Book Now |
| | Tutor development session - substance misuse | 03/07/2018 10:30 | 03/07/2018 11:30 | E002b, Biphom Campus | Sue Crosbie | 3 | 20 | Book Now |
| | Strategies for dealing with pressure points | 03/07/2018 11:00 | 03/07/2018 12:00 | T212, Biphom Campus | Catie Hurst | 8 | 20 | Book Now |
| | Educational, Health and Care Plans | 03/07/2018 11:00 | 03/07/2018 12:00 | C503, Biphom Campus | Kath Chamberlain | 16 | 20 | Book Now |
| | Yoga | 03/07/2018 12:00 | 03/07/2018 12:30 | T8C Biphom Campus | Lindsay Brannay | 0 | 8 | Book Now |
| | Scholarship Symposium | 03/07/2018 12:00 | 03/07/2018 14:00 | ATC Upper Floor, Biphom Campus | Debra Swift | 94 | 150 | Book Now |
| | Who can I talk to? | 03/07/2018 12:30 | 03/07/2018 13:15 | T212, Biphom Campus | Catie Hurst | 4 | 20 | Book Now |
| | Safer Communities | 03/07/2018 13:00 | 03/07/2018 16:00 | LTC (T110b/c), Biphom Campus | Sue Crosbie | 16 | 20 | Book Now |
| | Looked after children personal education plan (PEP) meeting expectations | 03/07/2018 13:00 | 03/07/2018 13:30 | C503, Biphom Campus | Sue Crosbie | 11 | 20 | Book Now |
| | Risk Assessment awareness | 03/07/2018 13:00 | 03/07/2018 14:00 | T019, Biphom Campus | Joanne Shepherd | 9 | 20 | Book Now |
| | Influence and communicating with impact | 03/07/2018 13:15 | 03/07/2018 16:15 | P004, Biphom Campus | Catie Hurst | 6 | 16 | Book Now |
| | Coaching Skills for leaders | 03/07/2018 13:15 | 03/07/2018 16:15 | C101, Biphom Campus | Catie Hurst | 8 | 16 | Book Now |
| | Funding | 03/07/2018 13:30 | 03/07/2018 14:30 | E007, Biphom Campus | Linda Smith | 14 | 20 | Book Now |
| | LAUNCH Online making for English | 03/07/2018 13:30 | 03/07/2018 14:30 | H103, Biphom Campus | Mandy Belg | 12 | 20 | Book Now |
| | Process mapping for continuous improvement | 03/07/2018 13:30 | 03/07/2018 16:30 | C412, Biphom Campus | Paul Dewhurst | 21 | 30 | Book Now |
| | Yoga | 03/07/2018 14:00 | 03/07/2018 14:30 | T8C, Biphom Campus | Lindsay Brannay | 3 | 8 | Book Now |
| | Maytas for work placements | 03/07/2018 14:00 | 03/07/2018 15:00 | C303, Biphom Campus | Michael Davenport | 14 | 20 | Book Now |
| | LGPS - Pension Seminar | 03/07/2018 14:00 | 03/07/2018 15:00 | B101, Biphom Campus | Catie Hurst | 12 | 20 | Book Now |
| | Enhance your Excel skills | 03/07/2018 14:00 | 03/07/2018 15:00 | C301, Biphom Campus | Nail James | 0 | 20 | Book Now |
| | How to generate high performing teams | 03/07/2018 14:00 | 03/07/2018 15:30 | T213, Biphom Campus | Catie Hurst | 5 | 20 | Book Now |
| | Looked after children personal education plan (PEP) meeting expectations | 03/07/2018 14:00 | 03/07/2018 14:30 | C503, Biphom Campus | Sue Crosbie | 20 | 20 | Book Now |
| | Young carers awareness | 03/07/2018 14:00 | 03/07/2018 15:00 | C505, Biphom Campus | Sue Crosbie | 23 | 24 | Book Now |
| | Principal's end of year staff address | 03/07/2018 14:15 | 03/07/2018 15:05 | Sports Hall, Biphom Campus | Bev Robinson | 232 | 300 | Book Now |
| ABC for Learning - Questioning techniques | 03/07/2018 14:15 | 03/07/2018 15:15 | C108, Biphom Campus | Jonathan Hill | 13 | 20 | Book Now | |
| Signs and risk indicators - child sexual exploitation (CSE) | 03/07/2018 14:15 | 03/07/2018 15:15 | E002b, Biphom Campus | Sue Crosbie | 10 | 20 | Book Now | |
| Fire Evacuation procedures | 03/07/2018 14:30 | 03/07/2018 16:00 | T019, Biphom Campus | Joanne Shepherd | 0 | 12 | Book Now | |
| LAUNCH Online making for English | 03/07/2018 15:00 | 03/07/2018 16:00 | H103, Biphom Campus | Mandy Belg | 20 | 20 | Book Now | |
| Enhance workplace wellbeing through meditation | 03/07/2018 15:00 | 03/07/2018 15:45 | Wellbeing room, Biphom Campus | Pam Reynolds | 9 | 10 | Book Now | |
| Maytas for work placements | 03/07/2018 15:15 | 03/07/2018 16:15 | C303, Biphom Campus | Michael Davenport | 20 | 20 | Book Now | |
| The new General Data Protection Regulation (GDPR). How it applies to your role | 03/07/2018 15:15 | 03/07/2018 16:45 | E007, Biphom Campus | Linda Smith | 16 | 30 | Book Now | |
| Delivering effective feedback and managing challenging conversations | 03/07/2018 15:15 | 03/07/2018 16:00 | T212, Biphom Campus | Sam Bailey | 11 | 20 | Book Now | |
| ABC or Learning - Developing activities that promote challenge | 03/07/2018 15:30 | 03/07/2018 16:30 | C108, Biphom Campus | Jonathan Hill | 4 | 20 | Book Now | |
| LGPS Pension Seminar | 03/07/2018 15:30 | 03/07/2018 16:30 | B101, Biphom Campus | Catie Hurst | 18 | 20 | Book Now | |
| Circuit Training | 03/07/2018 15:30 | 03/07/2018 16:30 | Biphom Campus | Lindsay Brannay | 15 | 15 | Book Now | |
| Enhance your Excel skills | 03/07/2018 15:30 | 03/07/2018 16:30 | C301, Biphom Campus | Nail James | 9 | 20 | Book Now | |
| Customer insights-managing customer centric expectations | 03/07/2018 15:30 | 03/07/2018 16:30 | T103, Biphom Campus | Kate Coughlan | 19 | 20 | Book Now | |
| Young carers awareness | 03/07/2018 15:30 | 03/07/2018 16:30 | C505, Biphom Campus | Sue Crosbie | 22 | 24 | Book Now | |
| Manual handling | 03/07/2018 15:30 | 03/07/2018 16:30 | T019, Biphom Campus | Margaret Horton | 11 | 15 | Book Now | |

Source: Blackpool and the Fylde College, 2018a.

Appendix 6: Syllabus of academic and digital literacy module (brief)

Learning outcomes:

1. Adopt and use digital devices, applications and services
2. Find, interpret, evaluate, manipulate, share, present and record information professionally and ethically
3. Read critically and create output in a range of media
4. Communicate and collaborate to support research and learning through the use of digital and other networks
5. Produce academic evidence in formal and informal; traditional and technology-rich, environments
6. Use digital tools and media in making informed decisions and professional development planning
7. Reflect on own skill levels and identify further learning needs to support future studies and enhance transferable skills for employment.

Assessment:

The module is assessed as portfolio with using some IT platforms and also students need to write an essay on critical review of one of the articles provided.

(Source: Blackpool and the Flyde College, 2018b)