

THE USE OF BIG DATA AND ITS ROLE IN THE CAPACITY DEVELOPMENT OF SEAFARERS

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ABSTRACT : *Every day, hundreds of thousands of seafarers working on tens of thousands of vessels facilitate the smooth movement of global trade. Increasingly, companies are looking to technology in an effort to reduce costs, improve efficiencies and ensure safety for all those involved. As technology is being harnessed in an effort to eliminate much of the human element of the maritime sector, there are some distinct advantages in using certain technologies to enhance the human element. In turn, this will improve safety, efficiency and over the longer term, ensure stronger growth in the economies of developing nations. The ability to collect and analyse big data to develop the capacity of ships' crew will not only become of paramount importance in forecasting training needs, but will define the very roles of people involved in the safe and efficient operations of vessels globally.*

KEYWORDS – *Big Data, Capacity Development, Maritime, Shipping, Training*

1. INTRODUCTION

Big data is front and centre of every major corporation globally. It is used to make decisions, predict behaviours, and reveal patterns, trends and associations. It is becoming more accepted by those involved with training and human capacity development, as it allows for an accurate assessment of the skills required to work effectively during this time of the Fourth Industrial Revolution. The era of subjective training needs analysis, self-assessment during employee reviews, and regulated, stock training programmes following a prescribed capacity development path is fast becoming archaic. Jobs, and the skills necessary for those jobs, are rapidly evolving to keep pace with technological change. [1]

As the carriage of goods by sea continues to transform and embrace new technologies, so should those whose responsibility it is to transport those goods safely. Big data provides two results in seafarer development.

First, it allows for national maritime authorities to accurately forecast future seafaring needs and effectively plan national human development strategies to meet those needs. As the seafaring profession is global in nature and ships' crew can choose to work wherever and with whomever they want, national maritime authorities can remain confident that their ability to provide highly trained seafarers with relevant skills will be in high demand worldwide. Those nations who are on the forward side of the planning curve will be able to place more crew in higher value jobs. This in turn will develop their own economies and maritime capacity. [2]

Second, it allows for employers to anticipate the skills necessary for optimal, safe performance on board a ship. As technology used in the operations of vessels rapidly change, so should the skills of the seafarer. To predict skills needed for the future seafarer, data points can be collected from various digital sources including simulators, virtual reality training, gamified decision-making case based eLearning, and Internet of Things technology used on board ships. These data points, combined with subjective input from industry leaders, allow for the introduction of a new concept of combined skills for cadet training in the Merchant Navy called 'Cadet X', where more complex digital skills will be embedded into the syllabus. [3]

The carriage of goods by sea, even with autonomous ships, will always have a high dependency on the human element. Keeping trade safe and efficient will continue to be of utmost importance to the industry.

2. CURRENT REGULATIONS REGARDING THE TRAINING OF SEAFARERS

To envision the future of skills development for seafarers, it is important to understand the current regulations regarding the training of seafarers.

The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978 sets minimum qualification standards for masters, officers and watch personnel on seagoing merchant ships and large yachts. STCW was adopted in 1978 by conference at the International Maritime Organization (IMO) in London, and entered into force in 1984. [4]

The 1978 STCW Convention was the first to establish minimum basic requirements on training, certification and watchkeeping for seafarers on an international level. Previously the minimum standards of training, certification and watchkeeping of officers and ratings were established by individual governments, usually without reference to practices in other countries. As a result, minimum standards and procedures varied widely, even though shipping is international by nature. The Convention prescribes minimum standards relating to training, certification and watchkeeping for seafarers which countries are obliged to meet or exceed.

The Convention was significantly amended in 1995 when the IMO adopted a comprehensive revision of STCW. The most significant amendments concerned the enhancement of port state control (an inspection regime for countries to inspect foreign-registered ships in port other than those of the flag state and take action against ships that are not in compliance); communication of information to IMO to allow for mutual oversight and consistency in application of standards; and quality standards systems, oversight of training, assessment, and certification procedures. [5]

The IMO Convention on Standards of Training Certification and Watchkeeping of Seafarers adopted a new set of amendments in Manila in 2010 called "The Manila Amendments". These amendments were necessary to keep training standards in line with new technological and operational requirements that require new shipboard competencies. The most significant amendments include rest hours, new grades of certificates of competency, new training requirements, mandatory security training and additional medical standards. [6]

It should be noted that STCW courses are one of the basic necessities for any person to qualify as a mariner. A seafarer must be well trained in STCW courses before it can be deemed safe to be out on high waters. National training curriculum can vary in order to exceed these standards. In addition, officers on board ships receive far more advanced training than the basic STCW requirements. However, the important element of STCW is that it represents the bare minimum of qualifications.

STCW training equips a seafarer with various types of situations that can arise on a ship along with ways to deal with them. It ensures that every crew member aboard has the required level of training which will make them an asset in time of need, rather than a liability. All crew members are therefore aware of the same standard procedure of safety techniques making survival procedures more coordinated and chances of survival better.

The main aim of STCW training certification is to set an internationally accepted standard set of safety measures which can be implemented by seafarers all over the world and will make them capable of handling any situation, no matter what part of the world they are in.

The provision of a bare minimum set of standards in an industry that is quickly utilising advanced technologies gives rise to concern that the skills required to operate effectively in such an environment become outdated as soon as they are mandated. Individual member states of the IMO, employers and educational institutions can exceed the set of standards in whatever way they wish. The use of big data for the training of seafarers is the logical step forward, and is compatible to all ranks on board a ship.

3. FORECASTING NATIONAL SEAFARER DEVELOPMENT STRATEGIES

For many countries foreign currency remittance from seafarers form an integral part of their economy. The export of seafarers, for example, provides billions of dollars in remittances to the economy of the Philippines. These high value jobs allows for hundreds of thousands of Filipinos to find employment internationally every year. [7]

However, it is not just the export of seafarers and its corresponding inflow of foreign currency that is important to a national economy. Many countries have their own domestic maritime sector. These activities include coastal merchant vessels carrying cargo from one port to another in the same country; ferries carrying passengers within the same country; offshore oil and gas activities; and the various marine services performed within a sea port complex. Whether or not a seafarer is working internationally or domestically, the job is generally seen as high value and important in the creation of employment.

Some nations do not have the domestic capacity to meet the needs of their own maritime sector. As such, it is required that they hire foreign seafarers to meet the demands of their maritime sector. This action, of course, affects employment creation and the potential to train and develop seafarers who can work both domestically and internationally.

After thorough review by the Malaysian Marine Department in the early half of the 2010s, it was discovered that Malaysia had roughly 20,000 more registered seafarers than what is needed domestically. However the domestic Malaysian maritime sector employed roughly 10,000 non-Malaysian seafarers, primarily in the offshore oil and gas sector. It is very difficult to meet the human capacity needs domestically of all jobs in the offshore oil and gas sector as some jobs require high amounts of knowledge and specialisation which only a handful of seafarers in the world will have. [8]

As a result of their findings, the Malaysian Marine Department implemented a plan to create a national seafarer development strategy, with the aim being to replace foreign seafarers with qualified and well trained Malaysians. To achieve the desired result, the use of data was of utmost importance. Understanding that it is not enough to create legislation ordering the private sector to employ people, the Malaysian Marine Department set out to create an enabling environment that ensured high skilled workers were available and working in the Malaysian offshore oil and gas sector at all times.

3.1 WORKING FROM AN EXISTING CASE STUDY: MALAYSIAN PORT WORKERS

In 2010, the HuCap initiative began recruiting its first batch of students that would offer guaranteed employment to successful graduates. This ground breaking programme was spearhead by the Malaysian-based Plomo Group, who brought together private sector and government and used data and industry demand to create employment opportunities within the supply chain for those previously thought to be unemployable.

Recruiting youth from areas of extreme poverty, this programme used employment demand forecasts from ports across Malaysia to determine what jobs would be in highest demand.

Data points were collected and analysed in order for the Malaysian government to determine which jobs within logistics are in highest demand and of the highest value. Furthermore, private sector was consulted to offer an opinion on which jobs they are having most difficulty recruiting for. Armed with this information, the HuCap initiative was born and over the past decade thousands of youths have been recruited, trained and offered jobs around the country.

Using a similar formula, the Plomo Group and the Malaysian Marine Department began to brainstorm how the use of data and industry research would be able to fit together to ensure higher employment numbers of Malaysian seafarers in their domestic offshore oil and gas sector.

3.2 EduCOR AND THE DEVELOPMENT OF MALAYSIAN SEAFARERS

A statutory requirement for any foreign seafarer working in Malaysia is the completion of a Certificate of Recognition, issued by the Malaysian Marine Department. Prior to 2017, this training for this certificate was to be undertaken in a classroom environment. The data collected from foreign seafarers was minimal and poorly organised, while the classroom sessions were inefficient and expensive.

In 2017 the Malaysian Marine Department unveiled EduCOR which was an innovative use of technology to achieve training objectives and data collection in the efforts of formulating a national seafarer development strategy based on empirical evidence.

EduCOR is an online learning platform administered by MyDeck Talent Sdn Bhd (a wholly owned subsidiary of Plomo Group) whereby foreign seafarers undertake the required training to achieve a Malaysian Certificate of Recognition. Upon completion of the modules, the participants then take an online assessment which, once passed, allows them to gain their Certificate of Recognition and work in the Malaysian maritime industry.

Upon registering for EduCOR, the participant enters in key details of their employment and their qualifications. This includes data such as rank, work experience, education experience, employer, vessel and country of training. All of the data is collected electronically and tagged in a way that it reports trends and patterns. This data is then fed to Malaysia's Seafarer Management Centre which analyses it to develop a national seafarer development strategy.

In practice, Seafarer Management Centre analyses the data to discover which ranks are being filled by foreigners, and why those foreigners are being chosen for employment in Malaysia. This data is correlated to the existing Malaysian database of seafarers to determine where positions can be filled immediately and what positions need capacity development. Should a relevant Malaysian candidate fit the requirements of the industry, then an employment match is made. However, more often than not, a determination is made to develop specific ranks and it is then the duty of Seafarer Management Centre to ensure Malaysian seafarers are given the proper experience and education to become suitable crew. Links are made with employers to discover their motivations for employing foreign seafarers and as such, a tighter collaboration between government and private sector is made.

The end result is the effective use of data to chart a path forward to ensure more Malaysian seafarers are employed in Malaysia, while at the same time forecasting trends in terms of rank and experience to ensure that capacity is developed for the future needs of the industry. Moreover, the excess capacity that is developed for ranks of higher demand can be exported and as a result, Malaysian seafarers can continue to find employment in higher value jobs.

4. THE ADVENT OF NEW TRAINING TECHNOLOGIES AND THE COLLECTION OF DATA

If the data collected from a fairly simple eLearning platform like EduCOR can completely reshape the future of the Malaysian seafarer sector, then it must be considered what data from performance-based digital learning platforms can do.

Collecting performance data from simulators, virtual reality training systems and gamified eLearning programmes will allow employers to quantifiably understand what skills are needed and how people perform under certain circumstances. In addition, understanding data from on board devices connected to the Internet of Things allows for a much greater comprehension as to the skills required by seafarers.

Through amalgamation of all data sources, training and capacity development should be guided from big data.

The use of simulators in the training of seafarers has become ubiquitous so that seafarers can earn their hours and encounter countless scenarios in a safe environment. Virtual, mixed and augmented reality programmes, using gamification concepts, are being used to train thousands across the world. The primary benefit, of course, is that it is far more effective than any traditional or classroom based learning. This style of learning is essentially “learn by doing”, in a cost-effective and safe environment that can be anywhere in the world. In all of the aforementioned training media, the seafarer is placed into scenario case-based situations and asked to respond in real time.

On a large scale, the aforementioned learning technologies can collect millions of data points, which can then inform governing bodies (either national or international) to make effective decisions. For example, using mixed reality simulators, response times can be tracked among thousands of users worldwide. That can then be cross-referenced to age, gender, environment or any other factor. The use of this data is invaluable in creating future policy, strategy and training regimes.

We are currently in the midst of unprecedented technological change, termed the fourth industrial revolution. Following the industrial revolutions in mechanisation, mass production and computers, this revolution is linked to the fusion of cyber-physical systems through the Internet of Things (IoT) and enhanced by machine learning algorithms. The IoT is the extension of internet connectivity into physical devices and everyday objects. As vessels become more advanced, the IoT becomes more prevalent on board. One benefit of the IoT is the collection of data and the ability to understand how seafarers interact with controls on board a ship. This in turn creates a greater understanding of the training needs of the seafarer.

The collection of data through digital training programmes and ship board IoT will allow for the industry to have a much greater understanding of what skills are needed and will quantify how seafarers respond to situations and give direction as to what skills are needed to shape how they respond.

5. CADET ‘X’

The minimum qualification standards for seafarers was entered into force 35 years ago. At that time, colour TVs were a luxury, mobile phones were still attached by a cord, and the internet was not yet available for public use. Power windows on the automobile were rare, air travel was expensive and it took an operator to connect overseas calls. Since that time, the minimum qualifications standards have been amended twice, in 1995 and 2010. At this rate, the next amendments should be expected around 2025. Thinking back to how much technology has changed from 1984 to 1995 to 2010, was it even imaginable during any of those years how prevalent the internet would be by 2019?

Seafarers, as a matter of requirement, must keep up to the pace of change. The question, however, is how to define what skills are needed for future seafarers. A cadet in 2019 will need to completely transform her knowledge over the course of a 20 year career at sea and likewise, understanding what a cadet joining the industry in 2029 will need to know is itself a difficult exercise.

As such, a new concept of combined skills for cadet training in the Merchant Navy has been developed. It is called ‘Cadet X’, and accounts for future technologies and the skills needed by seafarers, so that more complex digital skills can be embedded into the syllabus.

Future changes in technology will change the way in which the maritime sector operates, with industry partners such as Rolls Royce already leading the development of autonomous ships

In order to allow the next generation of STEM (Science, Technology, Engineering and Mathematics) graduates to successfully navigate their way through this complex and interlinked, blended, web of data and technology, a new skills based curriculum is required.

5.1 KEY FUTURE SKILLS

To determine the key future skills of Cadet 'X', a methodology must be proposed and tested in order to map the key future skills demanded by the industry. This will then define and quantify both the technical and meta-skills required by the industry.

In maritime education, there is a tension between two growing needs. On the one hand there is the ever increasing body of technical knowledge that a professional seafarer must command and on the other the other hand, there is a growing recognition that seafarers must possess a wide variety of personal, interpersonal and system building knowledge and skills that will allow them to function in an industrial environment.

In order to resolve these seemingly irreconcilable needs, a new vision and concept for maritime education must be developed. In order to achieve this, a comprehensive understanding of the skills needed for industry must be developed through industry consultation. This will produce a requirements document for cadet training, which will draw on qualitative opinions of faculty, alumni, cadets and industry in a consensus building activity which arrives at a common understanding of the level of competence which should be achieved.

Quantitative understandings will be provided through the use of big data achieved through digital training media and on board IoT.

6. CONCLUSION

Big data has an important role to play in the development of seafarers. In fact, given the models in which big data can be applied to the formulation of a capacity development strategy, it can be argued that big data should be used in the development of any profession. The old adage, "you don't know what you don't know" is particularly useful when it comes to training and development. Self-reflection does not allow for an individual to request training on something that is unknown. Likewise, a training manager cannot make exact training need discoveries as those recommendations will always be subjective. Unfortunately, vast percentages of training budgets are wasted every year based on what people think they need, rather than what their job determines what they need.

Within the context of seafarers, big data can be used to find areas for skill development as well as areas for national human capacity building. The use of big data creates jobs, allows for long-term labour security, and ensures that seafarers are trained on what is needed. The alternative is being trained on what is thought is needed, which can lead to over training.

Over time, the role of the seafarer will change entirely. Even the minimum standards for a seafarer will be reflected as technology moves on. Certainly some elements will always remain the same, as they have for centuries. However, to embrace technology and big data for the goal of improving safety and efficiency will have numerous benefits for training regimes globally.

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