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IIRE Journal of Maritime Research and Development

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Editorial

Maximizing Effectiveness and Engagement amid Pandemic

Dr (Capt) Suresh Bhardwaj

COVID 19 effect will be felt by every company differently, but the fact remains that the corporate landscape has changed vastly. The COVID led disruptions is nothing short of a tsunami – a devastating catastrophe. Volatility has become the state of dynamic instability that creates a risk of rapid change in opportunity for value-creation with the ambiguity of navigating in fog. Any lack of compelling vision, a basic structured approach and roadmap, and failure to address the unthinkable, will be nothing but wilful blindness. We cannot fail to adapt and cope with unprecedented social and economic upheavals. Major disruptions create new normal, and organizations need to see disruptions as opportunities and setbacks as mere temporary. Strong, passionate, and compassionate culture will help in this shifting work landscape. Putting people before profits will give dividend in the end. Public perception in what difference the company made to the society will count.

This will require an agile and resonant leadership with a multiple stakeholder and customer centric dynamic strategy. COVID 19 pandemic has been an unprecedented human tragedy, one of the worst health and financial emergency with far reaching repercussions. It has put breaks on the economic growth with RBI predicting a minus (-) 4.5% growth this financial year. This will certainly put India dreams of 5 trillion USD economy by 2024 a few years forward. The Pandemic has been unrelenting and threat to our health and the economy are real. COVID 19 has become the 'known – unknown'. And it is not going away any time soon.

We will need a digital recovery through upscaling with safe, contact-less engagement, strike an emotional connect - with our teams, with our circumstances and with technology on an ongoing basis to build a social capital and a culture of excellence. There is a need to understand and action teamwork, effective communication, and resilience to adapt with an open and flexible learning mind-set. We need to pause, assess, anticipate, and then act, displaying courage, consideration, calculation, and decisiveness.

While agility, innovation and collaboration point the way forward, the data-rich cloud technology platforms provide the extra edge. There is no window-dressing which will help us. Working remotely has become a new normal. Though remote working has not been a panacea, but old days are not likely to come back again. We will need to retain some positives of remote working and video conferencing and speedily focus on recovery of our business. Future of organization is intrinsically tied to future of work and workplace. Future of work is not only a management issue, but also interrelated to the matrix of the outcomes of the organization. Focus must be on action and understanding the immediate needs of the organization, use technology to monitor the pulse of changing environment and help empower current and future

talent. Addressing and bolstering the immediate needs for technology and connectivity and looking at new ways of interaction within the matrix of the organization will be the way to go.

We need to convert crisis into opportunity. Risk oversight, vision, mission, objectives, managing risk, risk appetite, culture, ERM, Cyber security all these become important in their own way. The strategy must be dynamic, digitally driven, with long-term view, life cycle planning and sustainability; keeping pace with technology that is creative, innovative and compliance oriented. Diversity and inclusiveness, both are required with human resources. While diversity is about counting the numbers, inclusiveness is about making the numbers count. Critical issues must be taken head-on, and right amount of tension needs to be maintained to not allow slipping into comfort zones. If we are too rigid, we cannot be shifting gears fast enough. We require a very supple change, with emphasis on transparency and disclosure. There is need to listen to diverse perspectives to help drive innovation while fostering an inclusive environment.

We will hence need to spot the key strategy drivers through the challenge of digitalization and technology and execute effective hedging strategy with risk appetite. The emphasis must change from monitoring and compliance to creativity and innovation.

Navigating in this way through the new normal will lead to improved market position and brand value. The success of this strategy will essentially determine the strategy of return to work in the future of work. We need to maintain a progressive and forward-looking agenda and stay focused on the long term. History demonstrates that the most significant shifts in sector's competitive ranking occur during moments of crisis and uncertainty, with winners differentiated by their ability to play both offence and defence and seizing the opportunity to better address stakeholder needs.

It is important to maintain momentum throughout the recovery period, like we are in right now. We should be committed to achieving worthwhile and transformational outcomes in all our respective capacities. The next few months are important for this and we must use this time optimally.

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ONLINE TRANSPORTATION AND LOGISTICS PROGRAM: A CASE STUDY

Dr. Amit J. Mokashi
Dr. EunSu Lee
Natalia De La Fuente
Anthony Picciano

Abstract

Transportation and its affiliated sister channels like warehousing, port/terminal operations, logistics, and supply chain provide exciting as well as lucrative career options for those with an awareness and aptitude for the rigors of these professions. Progressing in this field requires formal education, which has traditionally meant an interruption in the existing career. This paper gives an insight into the experiences of a university as it adopted the online delivery of its courses for this niche student body. The recent development brought about by the COVID-19 pandemic has increased the support and urgency for the adoption of online delivery. The narration and concluding analysis are presented in the form of a SWOT analysis. The threats and weaknesses faced by the institution were considerable, but the inherent strengths and the opportunities of online education create an overall positive outcome.

Key words: Workforce Development, Supply Chain, Transportation, Logistics, Online Program, SWOT

JEL Codes: L91, O18

1. INTRODUCTION:

Transportation and its sister channels, including warehousing, logistics, port/terminal operations, and supply chain, have seen a consistent demand for skilled operators and managers. Prospective candidates often come from within the industry because they have both the required skills as well as the necessary aptitude for working in this demanding profession. It is, however, challenging both for the candidates as well as the academics to bridge their availability and come on campus for the necessary rigor of formal academic education. This challenge is further increased by the fact that some of the skills and knowledge required to perform the essential tasks in their roles as either first-line supervisors or managers require both theoretical knowledge that can be imparted in a classroom as well as practical skills that need exposure to the work environment (O*NET, 2019). As shown in Figure 1, the projected employment for transportation, storage, and distribution managers (Code: 11-3071.00) is expected to grow from 2018 to 2028 by 13% in New Jersey, while the overall percentage change in the United States is 4-6%% (O*NET, 2019).

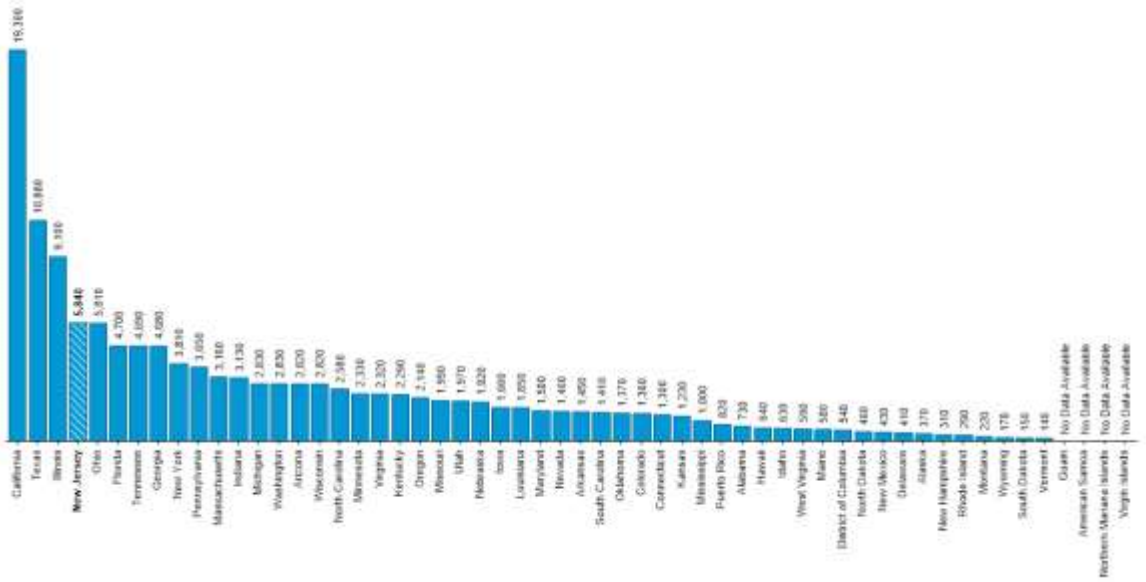


Figure 1: Projected Employment, Percent Change 2018-2028 for Transportation, Storage, and Distribution Managers in UNITED STATES (O*NET, 2019).

Thus, the projected employment of transportation, storage, and distribution managers is 5,840 in the year 2026 in New Jersey, resulting in the 4th rank in the United States (Figure 2).

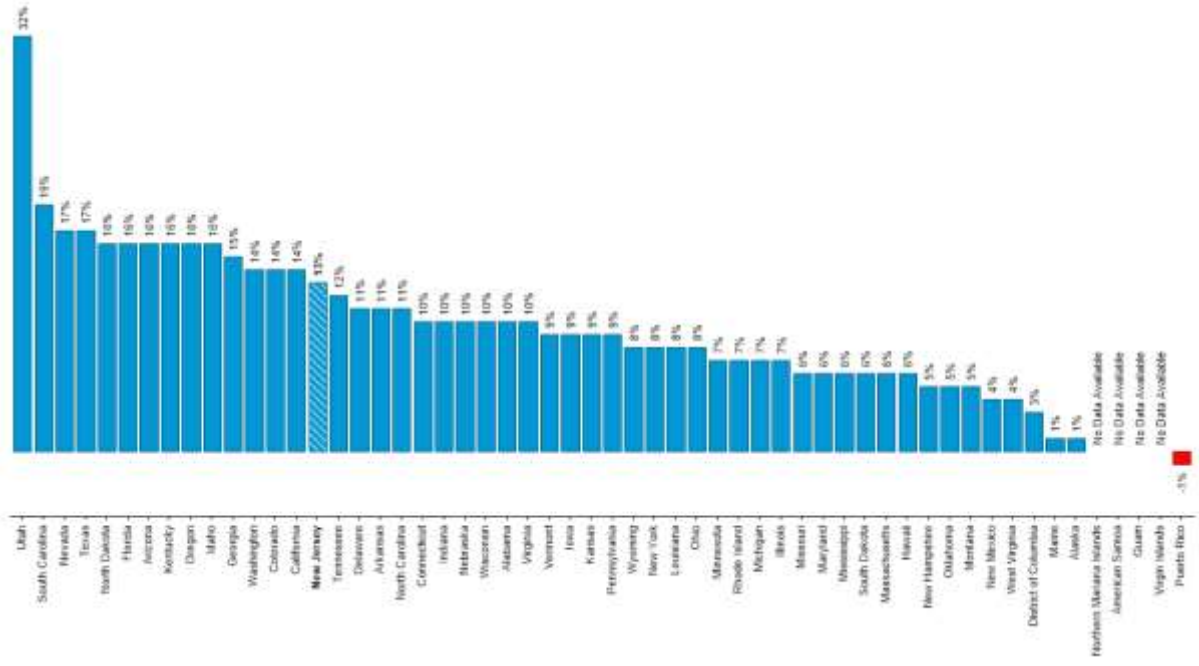
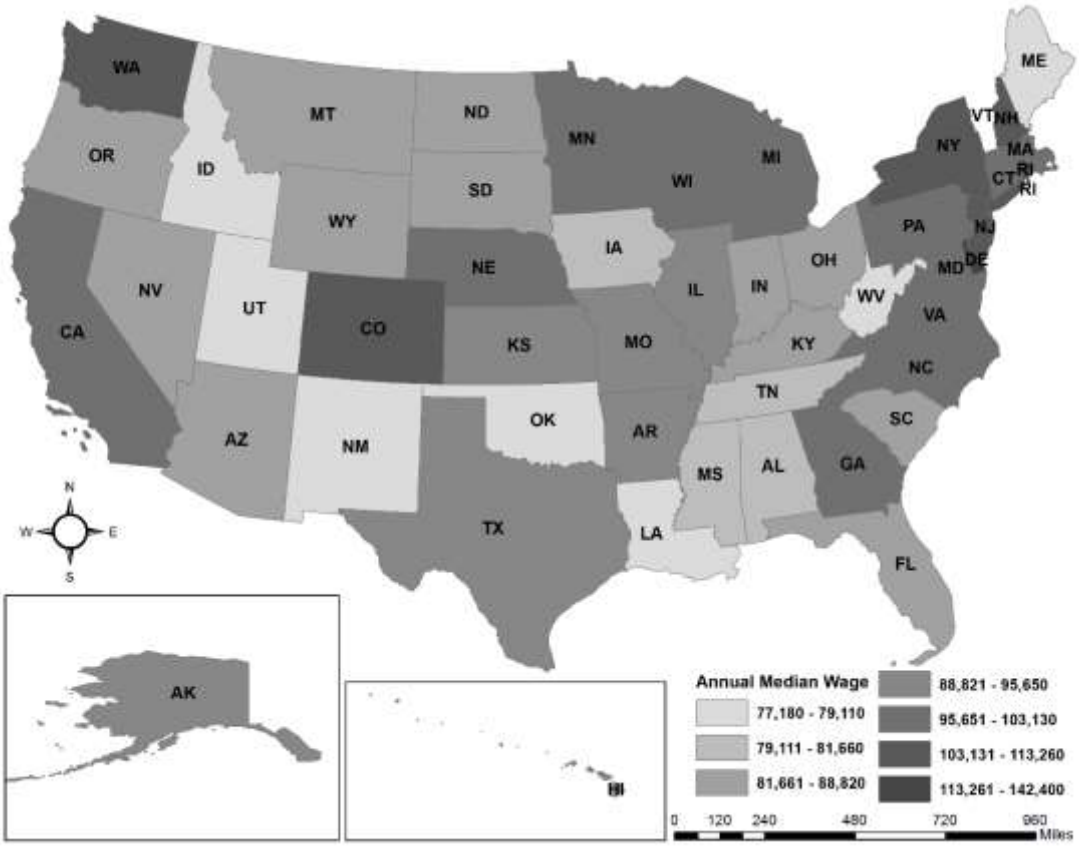


Figure 2: Projected 2026 Employment for Transportation, Storage, and Distribution Managers (O*NET, 2019)

The annual mean wage of the career was $113,260 in New Jersey and $94,560 in 2019 in the United States (Figure 3-a). The annual median wage of the logistics career is higher on the East

Coast than other regions in general (Figure 3-b). Regardless of the living cost, the wage seems to be strongly related to the market size and concentration of the industry.

(a) Comparison of US national mean wage to New Jersey's



(b) Choropleth map of national median wage by state

Figure 3: Annual mean and median wage of transportation and material moving occupations, May 2019 (O*NET, 2019).

Modern teaching tools have provided alternative means of imparting education without the need to attend classes on campus. The university's School of Business, within which the transportation program is held, surveyed its stakeholders (faculty and staff, students, alumni, and regional employers) to have a better understanding of itself and the perception held by others. Surprisingly the stakeholders ranked online programs as a dominant threat to the School of Business's future. Ironically, moving the newly developed program online was also the most viable solution to the conundrum of providing education to working individuals with varying hours as well as a constant need to travel. The program faculty, however, not only had to overcome the challenges involved with developing an online program but also had to face the systemic problem of doing so in an environment (culture in a traditional brick and mortar university) that was not naturally conducive to this mode of teaching. Figure 4 shows the distribution of the students who enrolled in undergraduate business online courses at the university. The School of Business is situated at Wallstreet West with the symbol of an academic cap along the Hudson River. The visual analysis tells us that a student's geographical distance from the class meeting location was not the only factor contributing to their decision to take online classes.

This paper shares the experiences of a regional public university as it launched a degree program aimed specifically at providing education for students desiring either entry as first-line supervisors or transitioning to managerial positions in transportation-related careers in a broad range of industries including ports, transportation, warehousing, wholesale trade, government, and manufacturing. Most students interested in the program were working professionals closely associated with the transportation industry.

A literature review conducted in Section 2 highlights the differences between traditional classes and online learning environments that were identified before undertaking the change. The research method is explained in Section 3. Section 4 discusses the online program migration experiences and SWOT analysis followed by impact analysis and instruction technologies being used for online learning. Key developments resulting from the recent COVID-19 (Coronavirus 2019) pandemic are discussed in Section 5. Section 6 concludes the study with the benefits and limitations of the study.

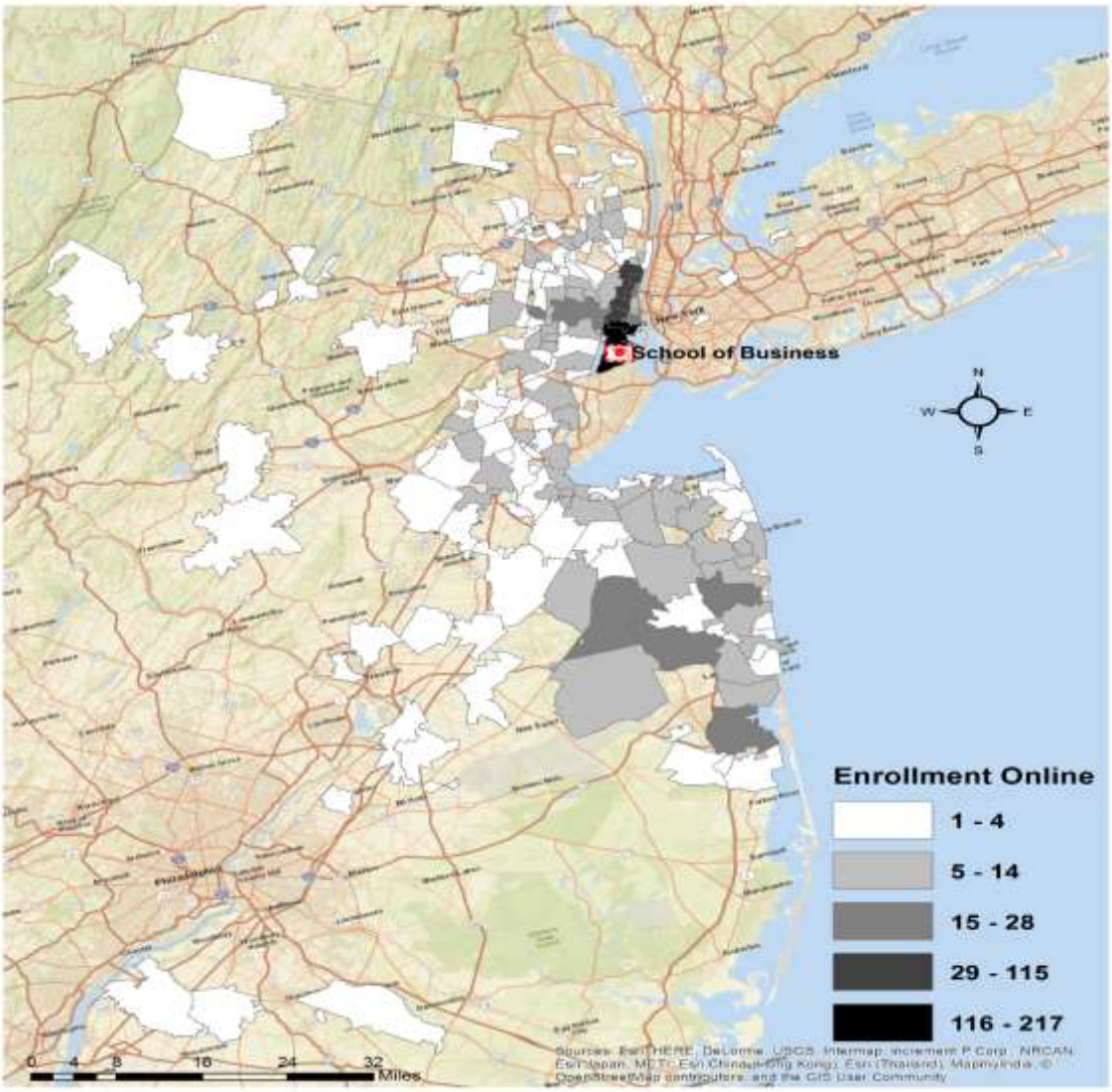


Figure 4: Enrollment Analytics - Online Student Geolocation by ZIP Codes.

2. LITERATURE REVIEW:

There is a considerable decrease in demand for traditional compared to online learning (Olatunji, 2013). Learners preferred the use of the internet and mobile devices due to their flexibility and convenience (Eaton, 2001). Online education makes career development a more accessible objective for instructors and students. Learners can attend classes at the places of their convenience, and instructors can issue assignments, communicate, and guide students at their convenience (Noble, 2017). Online education enables learners to access assignments, course materials, and lessons with flexible schedules. Instructors can easily track the progress of learners through the use of online tools such as the internet and emails (Dunlap and Lowenthal, 2018). The application of online learning has facilitated research among learners

by enabling a broader search for answers to challenging questions and personalizing instructor feedback. Students and instructors are also able to communicate with each other and exchange ideas globally without necessarily traveling or incurring huge expenses (Ortagus, 2017).

On the other hand, online education entails strong self-motivation and time management skills, which are not evident in today's learners (Allen and Seaman, 2013). The use of internet-based asynchronous learning does not provide the student with immediate feedback from the instructor. Since learning takes place online, there is minimal direct contact with instructors and especially classmates, and this may hinder the monitoring of learners. Online learning is subject to interruption with network connections, electronic devices, and browser compatibility (Harasim, 2017). Again, the practice results in less social interaction among learners and can impact their psychological development negatively. Learners, however, perceive online learning and teaching as a dynamic and exciting experience (Goodman *et al*., 2019). Instructors, on the other hand, believe that online learning and teaching is a challenging task that requires additional training, as many of them are not very comfortable with the extensive use of technology. A study conducted by Babson Survey Research Group has shown that the demand for distance education is consistently increasing though it is concentrated in a relatively small number of institutions. Another interesting finding of the same study that was also evidenced at the university that is the subject of this case study is that distance enrollments remain local, *i.e*., the majority of the students who took distance courses also took on-campus courses and resided in the same state as the institution (Seaman *et al*., 2018). Although there is considerable literature available on online learning, the specific field of transportation has not been the focus of many studies. The difference between our current research and the existing literature is that the existing literature mostly focuses on the analyses of online education in general, while this study focuses on the challenges of teaching transportation online. Therefore, the study fills the gap left by the existing literature when it comes to addressing online education in the transportation and logistics sector.

3. METHODOLOGY OF THE STUDY:

This study adopted a narrative inquiry research framework. Most of this work is based on an interpretation of the stakeholder interviews and group discussion. Stakeholders, including students, educators, administrators, and career development personnel, have participated in the discussion, and the narrative interpretation is based on their experiences and knowledge of

online education. In addition to the narrative approach, the study also reviewed relevant materials and previous studies to reflect on the stakeholders. With the aforementioned research method, the study will answer the following questions: what are the Strengths, Weaknesses, Opportunities, and Threats (SWOT) of offering a transportation program online and what are the benefits and challenges of the online program for workforce development in transportation and logistics operations and management?

4. THE ONLINE PROGRAM MIGRATION EXPERIENCE:

Online undergraduate supply chain, transportation, and logistics degree programs have had varied coverage of the skills required by the industry. Figure 5 shows the results of mapping between the curricula of the four-year university supply chain, transportation, and logistics online degree programs in the United States and the required skill sets and competencies recommended by the transport and goods moving industry. The study surveyed a total of nine schools with ten programs. The top four courses are transportation, distribution planning, material handling, and requirements planning; therefore, they are being offered by all the programs. Strategic planning and order processing can also recognize the importance of providing online in nine programs. In addition, data analysis, production planning, customer service, and information technology are also required by seven programs. Other competencies include warehousing, industrial packaging, purchasing, inventory management, demand forecasting, marketing, and sales. Interestingly, planning and forecasting, order processing and inventory management, data analysis and information technology, and sales and marketing groups are the main competency groups and skillsets.

This study utilized SWOT analysis to investigate internal strengths and weaknesses and external opportunities and threats for better understanding the online transportation courses. In addition to the SWOT analysis, the impact of the online programs is analyzed based on the enrollment for the online courses being offered.

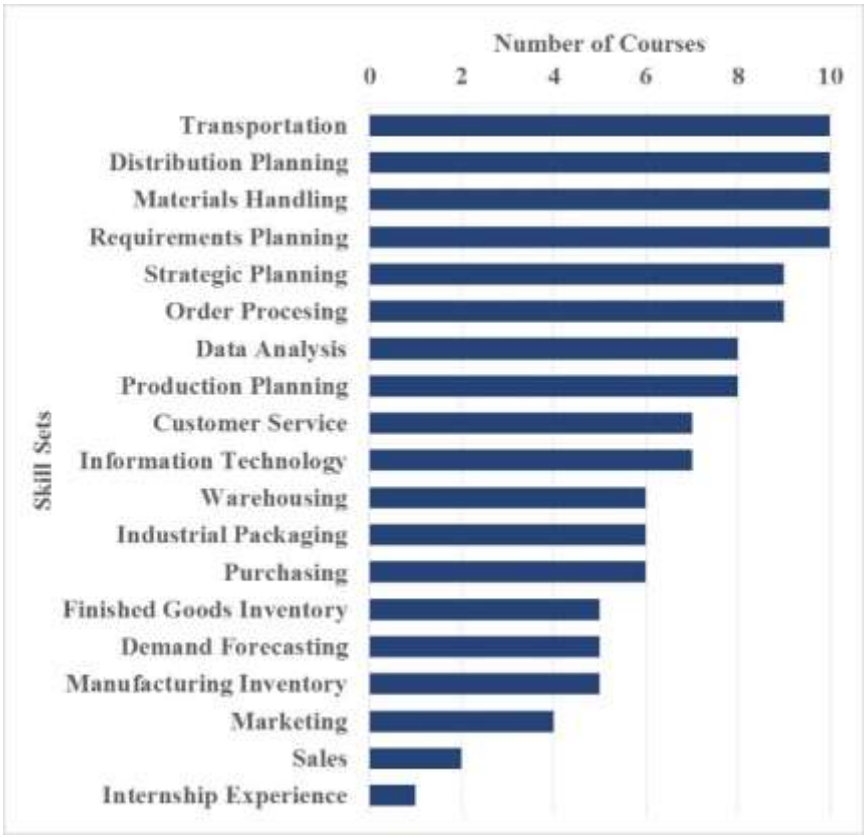


Figure 5: Skill sets in transportation and goods moving and the number of academic coverage of online programs.

4.1 SWOT Analysis:

The narration of this case is in the form of a SWOT analysis based on the faculty's experience with transitioning and running the program online. As could be expected, while this experience was overwhelmingly positive, it did have its share of challenges. The analysis below summarizes the experience.

4.1.1 Strengths Leveraged:

The School of Business is located in Downtown Jersey City, NJ; an area often referred to as the "Wall Street West" due to its high concentration of Wall Street companies (Timmons, 2001). This location helps the school deliver a unique business environment experience. However, along with that benefit comes the challenge of traveling into a city that is ranked amongst the top three longest commutes within the country (Anderson, 2019). Commuting is

known to adversely impact the students' wellbeing (Chatterjee *et al*., 2020; Hansson *et al*., 2011; Künn-Nelen, 2016) as well as academic performance (Contreras *et al*., 2018; Tigre *et al*., 2017) and retention (Butt *et al*., 2019). There is also a monetary cost associated with travel. Online mode of delivery eliminates these negative impacts. Another advantage of online education is the flexibility that it brings (Yang and Cornelius, 2005). Students may no longer be restricted to a particular schedule that may conflict with their work or family obligations. This flexibility is particularly critical in light of the reduction in traditional-age students and the resultant recruitment focus on mature adults. With the flexibility of online education also comes the ability to continue one's career and, by extension, earnings. This continuity in earnings is vital as while employers expect the employees to update their skills and knowledge, monetary support is not always forthcoming. Mature students have to balance their desire for education with commitments to their family and employers.

There are some pedagogical advantages, as well. The School of Business is part of a Hispanic Serving Institution (HSI) and is located in one of the most diverse cities in New Jersey, and the second most diverse in the country (Jersey City, 2020). With this diversity comes the challenge of assimilation in a one-size-fits-all classroom. It is here that race, gender, accent, self-image, *etc*. influence the students' ability to participate proactively in discussions. Online discussion forums are blind to these factors and promote participation (Commander *et al*., 2012).

Supply Chain Management is evolving into an exercise in optimization using data-crunching software (Singh, 2003). Increasingly this software tends to be web-enabled for convenient collaboration between supply chain partners (Adriana and Cristian, 2011; Chou *et al*., 2004). This easy access is equally suitable for students to learn of technologies that they would have to use in the workplace. It is now possible to teach transportation utilizing online tools such as transportation management systems (TMS), warehouse management system (WMS), enterprise resource planning (ERP), as well as other analytical tools such as Tableau, R, Python, and Excel Dashboard. This awareness has also led some of the SCM software vendors to offer free student access.

Faculty that teach in higher education (higher-ed) often come from the era of physical libraries and are used to search through journals and textbooks for information. Online resources are easily accessible; therefore, students prefer to have web-based instructional material. Videos also have the ability to better convey information (Adriana and Cristian, 2011; Snelson, 2008).

The video-sharing site, YouTube, not only has content that is pedagogically relevant but is also legally accessible. It is also possible for the faculty to easily add new content and share it with the students privately using tools such as Zoom and Panopto. These videos are an option that the faculty involved in the transportation program has often used.

4.1.2 Weakness Addressed:

Transportation is a physical activity, and for the students to be able to actually witness the movement of goods and people, no doubt helps. Field trips are known to increase learning performance amongst its students (Putz *et al*., 2018). Due to its social impacts, students involved in learning about transportation also benefit from undertaking community-engaged learning (CEL). However, the challenge in undertaking any sort of field activity is that of temporal and spatial coordination of the students in an online environment. By its very nature, online programs have a broader geographical market. To insist on having all the students together at the same time and place would have essentially negated the program's unique selling point, *i.e*., flexibility. An option explored was to involve the students in a project for the City of Jersey City. The project was completed in an asynchronous format by the online students. It was voluntary and did demonstrate the viability of such an approach. This is an approach consistent with Extreme E-service Learning (Waldner *et al*., 2010). Other alternatives being considered are transportation games and simulation (Zhu *et al*., 2011).

One of the limitations of an online course is the lack of face-to-face interaction. This greatly reduces the effectiveness of communication between the faculty and students. Live video interactions used either as a required part of the course or optional to simulate in-person meeting during office hours, greatly help reduce some of the communication limitations. The faculty involved have used Skype and other similar video conferencing tools with good results. The School of Business is further exploring the concept of a live studio, which would facilitate face-to-face interaction like a regular classroom (Aisner and Schmitt, 2015; HBS Online, 2020; Hearing, 2016). In the absence of face-to-face communication, the emphasis shifts to written communication, both for delivery as well as assessment. This "written" communication can be in the form of posts on the discussion forum or essays and reports. This could well be a strength as it encourages the development of writing skills, which is often cited as one of the weaknesses of current college students (White, 2013). The faculty needed to be innovative and collaborative in their approach. Often the challenges include perceptions of the administration

regarding effort required to design and conduct online courses. Lack of classroom time is interpreted as a lack of work. The effort behind the scenes in running an online course goes underappreciated. The immediate impact of this perception is the lack of support in terms of time and resources allocated for these courses. The faculty had to create resources, which in turn increased the workload.

4.1.3 Opportunities Capitalized:

The School of Business is reaching out to community colleges and other universities for the transfer and exchange of students. As of February 2020, the School of Business has signed articulation agreements with two community colleges and is in talks with another three. However, the scope of collaboration with the online mode of delivery goes beyond the national boundaries. There are plans for joint programs with universities in Asia and Europe. As mentioned above, online programs have made it possible for the university to reach out beyond the region and go global.

The transportation programs are closely allied with the military, which is often considered the origin of the field of logistics. These closely allied specializations of logistics and transportation support the transition of ex-servicemen from military to civilian life. The program has consistently attracted veterans who have been involved in activities that are complementary to a career in logistics and transportation during their service. As a professional course that addresses a field of general interest, there are many open educational resources available for use as instructional material. Initiatives such as Open Textbook Library provide supporting resources freely, which can take considerable financial stress off the students (Monaco, 2019; Petrides *et al*., 2011). There are also various other sources besides standardized textbooks that can cover the learning objectives, including reports by governments or NGOs.

4.1.4 Threats Mitigated:

One of the recent disruptors in higher-ed has been the arrival of massive open online courses, *i.e*., MOOCs (Mazoue, 2014; Schuwer *et al*., 2015). So far, MOOCs seem to concentrate on topics of general interest. They have proven to be a support resource rather than the competition due to the specific focus of the transportation program (Belleflamme and Jacqmin, 2015). There is also the possibility of integrating the MOOCs with the program for credit (Sandeen, 2013).

The general trend in universities is to focus on either the supply chain in business schools or transportation engineering in technical schools. The program that was developed deliberately focused on transportation and port operations and management to differentiate itself from the rest. With the strong business school background, it was also able to have an identity separate from the maritime academies. Again, being a niche program with a focus on transportation and port in a business context has reduced the incentive for other universities to emulate and compete. Both the School of Business, as well as the program, are relatively small and agile. The faculty involved, have therefore been able to keep up with changes in the operating environment by concurrent changes in the topics covered in the courses. The courses and the program have been designed to afford flexibility when it comes to the signature assignments and the capstone course. This flexibility permits the faculty to work with the students when they have specific interests that need to be accommodated, *e.g*., career objective, licensing, *etc*.

4.2 Impact of the online shift:

The very significant influence of migrating online was an increase in program enrollment along with retention. The online courses were quickly filled by students that had them as a requirement for their major along with those that didn't need to take them but thought they were a more suitable option. The mandatory written discussions used to compensate for the lack of in-class interaction helped develop the writing skills of the students (a constant concern in the current age).

4.2.1 Enrollment growth:

The program has shown a steady increase in enrollment. The enrollment figures for the years are 3 for 2017, 13 for 2018, and 24 for 2019. Per trend line, it is expected to increase the numbers to 35 for 2020 and 45 for 2021. Figure 6 illustrates the increase in student registration for transportation courses.

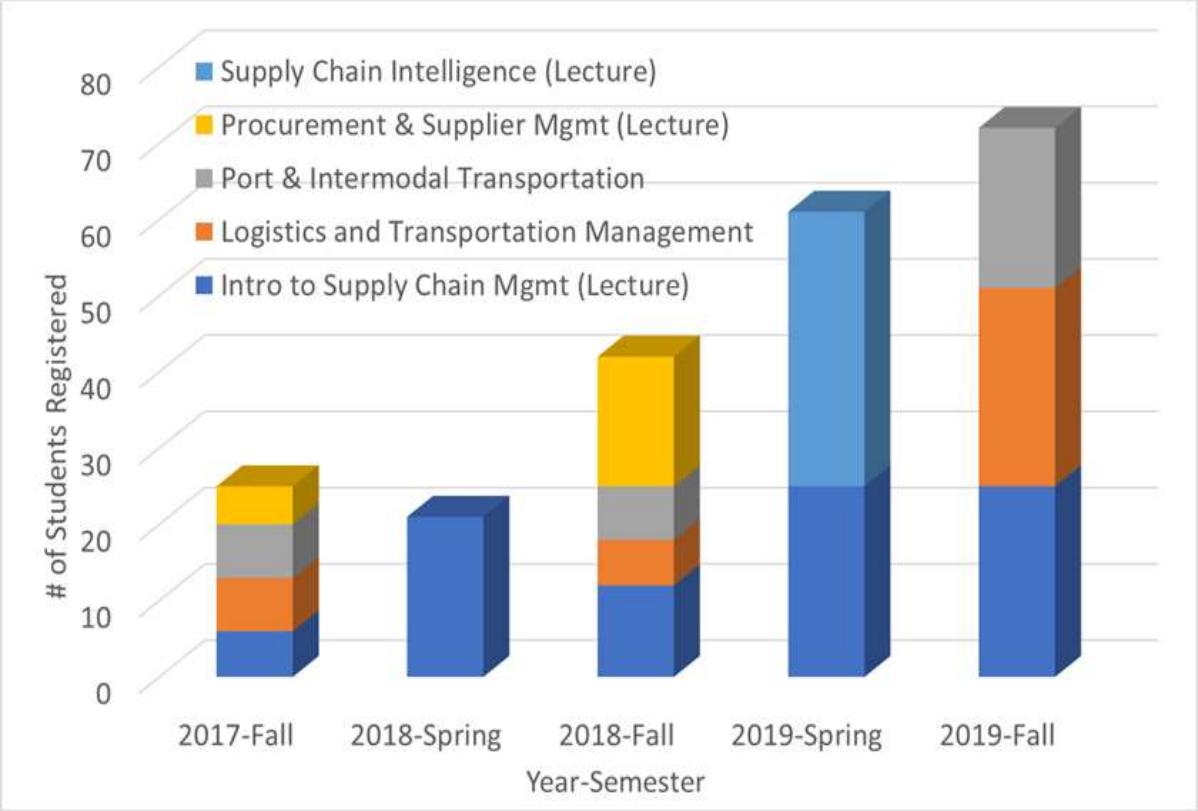


Figure 6: Impact Analytics Online Student Course Enrollment.

4.2.2 Public outreach:

The faculty also have gained recognition and were invited to act as external reviewers and research partners by other institutions. The faculty have reached out to experts in the industry and taken their recommendations for enhancing the program and the students' marketability for the current demands in the industry. These experts have also agreed to formally be part of the Management Department's Advisory Committee. There are plans to include an online community-engaged learning (e-CEL) course in the program. The success of the Bachelor's program has prompted the administration to support the development of a Master's program. To support further opportunities for the program and its students, the faculty have initiated online support with the School of Business career services.

5. IMPACT OF ONLINE DELIVERY DURING COVID-19:

Similar to the economies and lives of people, higher education is facing a drastic transformation due to the COVID-19 outbreak. Some campuses have closed, courses have been canceled, and in general, education from elementary to higher-ed is transitioning from on-campus to remote

learning (Altbach and De Wit, 2020). This has particularly been demanding for colleges and universities around the US because they represent such a wide variety of functions. They are educational establishments for local and foreign undergraduates; however, they also function as small cities, with police, power stations, sports facilities, and other public institutions. They are the largest local employers and significant producers of local and national economies (Illanes, *et al*., 2020). Therefore, the transition of education to a full remote instruction will not be exempt of complications.

Around February 17th, 2020, the first case of COVID-19 on campus was identified, the reaction from higher education across the US was to protect staff and student health, with several organizations broadcasting information on protection and preventative measures. By that time, many colleges had gone on spring break, leaving several campuses bare. The education sector did not start a major response online until March, with prominent institutions making announcements early in March, and many others joining by mid-March (Crawford, *et al*., 2020). Other universities moved spring break by a week, to allow online adaptation. As the outbreak rate rose significantly, Harvard University declared on March 10th, that it would switch to complete online instruction by March 23rd, as did Massachusetts Institute of Technology, Yale, Princeton, Stanford and the University of California, while Southern Oregon University declared on March 19th, it would provide all instructions remotely by the same day (Crawford, *et al*., 2020). The university that is the focus of this study declared a shift to online delivery on March 16th, 2020.

Though the strategy of migrating from traditional or combined learning to a fully online instructional mode offers a solution to the current pandemic, it has also brought many challenges. Most establishments did offer some level of online education; however, due to the pandemic, there was significant variation in how central online education was to strategic planning for an organization. It is thus no longer a matter of how online education can deliver on the pledge of excellent higher education, but rather of how universities can quickly and successfully support the mass reception of online learning (Liguori and Winkler, 2020).

The crisis management style of education that universities were forced to adopt as a result of the COVID-19 crisis, is called emergency remote teaching (ERT). ERT occurs when a course planned for traditional in-person instruction, is forced to transition to online instruction. Online instruction has been researched extensively, and many studies have determined that the level

of planning and consideration of an online course has a large impact on the quality of education received by students. Courses that use ERT are unlikely to deliver high-quality education because of their inability to plan for the change in delivery mode (Hodges, *et al*., 2020). The shortcomings of ERT courses as a result of COVID-19 have created a spike in demand for universities to adapt online education models that provide high-quality education. This situation has created a new market opportunity for both universities and commercial digital learning services (Teras, *et al*., 2020).

It is crucial to note that remote instruction is not only a resource of revenue but must be understood as the center of a college's strategy for systemic sustainability and academic integrity. With this understanding, colleges and universities can create a plan for better managing and funding online education (Kim, 2020). A fact of distress that can't be denied is that several universities and colleges depend on the fees paid by international students for their economic sustainability. The COVID-19 crisis shows that this financial bond is problematic. In principle, the institutions that rely on these capitals to survive will face multiple difficulties. In the case that US embassies and consulates are unable to reopen fairly quickly, that would negatively affect the handling of newly accepted international students and applications (DePrieto, 2020). Obstacles are likely to occur for those foreign undergraduates who are already in the US, in particular by the rescheduling of internal and associated external examinations. These measures might impact on their final evaluations (Sethi, 2020).

While online education provided a solution to this crisis, many students from underprivileged communities are in danger of not being able to continue their education process due to a lack of infrastructure and access to resources (Sethi, 2020). Remote learning is not just about transitioning to online instruction. Thus, universities should also utilize other influential platforms to establish a blend of resources to make material available to as many students as possible. Because in the end, the goal of all education systems should be to resolve the learning crisis and stay free from contagion (Sethi, 2020). Although the COVID-19 crisis has affected the educational system tremendously; jeopardizing the financial system of thousands of universities, limiting the future of many foreign students, and forcing institutions to take extreme measures to provide quality virtual education; there is no doubt that institutions can benefit from the opportunity to learn new methods to make online education much more effective, after all, it is very likely that online education will become a permanent feature of

higher education. This will allow institutions to make the most of providing and sustaining remote education in a safe and efficient manner.

6. CONCLUSION:

This study used SWOT analysis to understand the challenges and the benefits of adopting online delivery for a four-year undergraduate transportation and logistics degree program. Since workforce development through transportation and logistics online programs is a global phenomenon, the investigation done in this paper using SWOT analysis techniques will be valuable to a worldwide audience. It will help medium-sized public universities to develop online supply chain and maritime port management programs. The SWOT analysis shows that adapting online education has allowed students to maintain more control and flexibility in their schedules. The cost associated with travel is eliminated as a barrier for students. A variety of information technology tools help facilitate face to face experience in an online learning environment and enhance student engagement and increase the accessibility of education opportunities. The increased enrollment directly resulting from the shift to online delivery is the concluding testament of its efficacy.

These inferences drawn from the SWOT analysis in this paper are limited by the extrapolation of data from stakeholder surveys by the authors regarding the design process of the online curriculum. Both the interpretation and stakeholder opinions are subject to change in a different academic context. The limitation can be improved by conducting surveys of interested parties, including students in other regions.

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MARITIME AND INLAND TRADE IN INDIA: A PERSPECTIVE STUDY

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Suchitra M. Kumar

Abstract

India has a vast coastline with so many natural harbors and inland waterways. The country's exports and imports logistics revolves mostly around the ports. This study aims to highlight the various projects for development of ports, the progress so far and the various future plans. Government as well as private sector participation in this regard is discussed. Market size and the contribution of maritime trade in Indian economics are detailed. India's Sagarmala Project and the efforts to revive the inland water transport discussed in detail with their scope and advantages. Multimodal transport with the effective use of inland waterways included. Development of existing and future ports outlined. Various investments by different stake holders and the present port developments along with some hurdles experienced examined. Government's initiative of the same and the future prospects of Indian port developments discussed.

Key Words: Coastline and ports, Maritime Trade, History of Indian Maritime trade, Major and minor ports, Port Developments, Sagar Mala Project and Inland Waterways, Ganga Waterway, Present Scenario, Investments, Progress, Government Initiatives

JEL Codes: L9, L91, L92, L99

1. INTRODUCTION: INDIAN COAST LINE AND PORTS:

India being one of the biggest peninsulas, has very vast and vivid coastline with a stretch of about 7516.6 kilometers[#1], and is the sixteenth largest maritime country in the world. Indian coastline stands unique with its varying topography and nature. There are many natural, artificial and protected ports along the east and west coasts of India. Maritime trade plays a major role in India's economy. Hence the development of ports and other inland water ways of transport is vital in the country's progress. This study aims to highlight the history of Indian Maritime Trade and the present scenario of Indian Maritime Trade and port developments with emphasis to the advantages of inland water trade. It also tries to analyze the various measures for Indian port developments both through private and Government initiatives and the hurdles for Indian port developments.

2. BRIEF HISTORY[#2]:

India boasts of the first ever global trade through the maritime sector by the Mesopotamians trading with the Indus Valley people as early as the 3rd Millennium BC. The world's first ever dock was found at Lothal which dates back to 2400 BC. There was a sudden increase in trade

between India and the Roman Empire after the Roman invasion of Egypt in BC 25. India had developed a predominant trade relationship with South East Asian Empires of Arabia and Persia during the 8th Century. Excavations in the Odisha coast had yielded proof of Indo China Trade dating back to 2300 BC due to the presence of some artifacts which were common in Vietnam area. Chandra Gupta Maurya (322-298 BC) tried to make a naval force in India as per the writings of Megasthenes. The Mauryas had ventured out and achieved many ocean voyages for various reasons.

The Maritime Silk route (2nd Century BC to 15th Century AD) was the major maritime trade route connecting India, China, SE Asia and Arabia, Somalia, Egypt and Europe and goods even from South India found their way out to foreign nations. Kalinga (present Odisha) after its annexure to the Maurya Empire by Ashoka in 3rd Century BC, had established maritime trade with China, Java and Sumatera, *etc*.

Down South. from 200 to 1280 AD, the Chola Emperors had an upper hand in developing the maritime trade with China and Java as they had absolute control over the west and eastern side of Indian peninsula. Their empire the Srivijaya was the largest empire in SE maritime Asia. Even the Pandyas and Cheras also had developed ports like Kollam and engaged in maritime trade.

In 1497 AD, four merchant vessels set sail from Portugal under the leadership of Vasco De Gama as per the orders of the then Portugal ruler Manual 1. They rounded the Cape of Good Hope sailing towards India and finally made landfall in India in 1499 thus providing an alternate sea route between India and Europe paving way for a strong trade pact even though the chain of events that followed led to the colonization of India.

On April 05th1919, SS Loyalty, the first ship of the Scindia Steam Navigation Company sailed from India to the UK which was a milestone in India's Maritime history as the sea routes were all dominated then by the British.

3. INDIAN MARITIME TRADE AND PORTS: PRESENT SCENARIO:

Today, according to the Ministry of Shipping, around 95 per cent of India's trading by volume and 70 per cent by value is done through the sea. Hence the country's exports and imports

logistics revolves mostly around the ports and the trade through maritime sector plays a major and prominent role in Indian Economy.

India has 12 major and 205 notified minor and intermediate ports. Under the National Perspective Plan for Sagarmala, six new mega ports will be developed in the country in addition to some major private sector ports. The Indian ports and shipping industry plays a vital role in sustaining growth in the country's trade and commerce. The Indian Government plays an important role in supporting the ports sector. It has allowed Foreign Direct Investment (FDI) of up to 100 per cent under the automatic route for port and harbor construction and maintenance projects. It has also facilitated a 10-year tax holiday to enterprises that develop, maintain and operate ports, inland waterways and inland ports.[#3]

3.1. Market Size:

During FY18, cargo traffic at major ports in the country was reported at 679.36 million tonnes (MT). In the first quarter of the FY19P, the traffic increased by 2.79 per cent year-on-year to reach 633.87 million tonnes. Cargo traffic at non-major ports was estimated at 491.95 million tonnes FY18 and grew at 9.2 per cent CAGR between FY17-18. The major ports had a capacity of 1,452 million tonnes by FY18 end. The Maritime Agenda 2010-20 has a 2020 target of 3,130 MT of port capacity[#4]. The government has taken several measures to improve operational efficiency through mechanization, deepening the draft and speedy evacuations. Still there is a long way to go till we can utilize the boon of the vast coastline to the optimum. The reasons are many varying from financial issues to labor and trade union issues.[#4]

3.2. Multi Modal Transport Through Inland Waterways:[#5]

In India the domestic freight movement is generally as follows:
65% By Road
27 % by Rail

But only 0.5% is done through inland waterways even though the country has a vast network of rivers and inland waterways. India has yet to take advantage of its inland waters and develop this cheaper and greener mode of transportation. Goods still travel by the traffic stricken and congested road and rail networks, slowing the movement of cargo, adding to uncertainties, and

increasing the costs of trade. With such means of uneconomical transport, logistics costs in India are estimated to account for as much as 18 percent of the country's GDP. The Government of India is now reviving the Ganga watercourse – known as National Waterway 1 or NW1- to ferry cargo from the eastern seaport of Haldia to Varanasi, some 1,360 km inland. This inland waterway has the potential to evolve as the main way of inland transport for northern India. The waterway's stretch between Kolkata and Delhi passes through one of India's most densely populated areas. A major part of all India's traded goods either originate from this resource-rich region or are destined for its teeming markets. Even though this region is estimated to generate about 370 million tonnes of freight annually, only a minor part of it - about 5 million tonnes – is currently being transported by water.

Figure 1: Freight Movement Ratio by various means (Source: worldbank.org/ developing-India-first-modern-inland-waterway)

Currently, goods from the states of Bihar and Uttar Pradesh in the Gangetic Plain take much longer land routes to reach the sea ports of Mumbai in Maharashtra and Kandla in Gujarat for exports, rather than going to the much-closer port at Kolkata. The development of NW1 will help these states direct some of their indigenous goods to the Kolkata-Haldia belt, making the movement of freight more reliable and cheaper. The World Bank is financing the development of the Ganga waterway with a loan of $ 375 million. The Capacity Augmentation of National Waterway 1 Project will help put in place the infrastructure and services needed to ensure that NW1 emerges as an efficient transport way in this important economic region. Once

operational, the waterway will form part of the larger multi-modal transport network being planned along the river. It will connect with the Eastern Dedicated Rail Freight Corridor, as well as with the existing network of National Highways. This multimodal mode of water, road and rail transportation will help the region's industries and manufacturing units to utilize the different modes of transportation as they send their goods to markets in India and abroad. Small industries people and farmers in the area will also benefit, as the waterway opens up markets further away.

This is more ecofriendly and greener. This mode is also cheap as:1litre of fuel can move 24 tonnes by road, 85 tonnes by rail and 105 tonnes by water.
Cost to transport 1 ton through 1km: Rs.2.28 for Highways, Rs. 1.41 for Railways but only Rs. 1.19 for Inland Waterways.[#5]

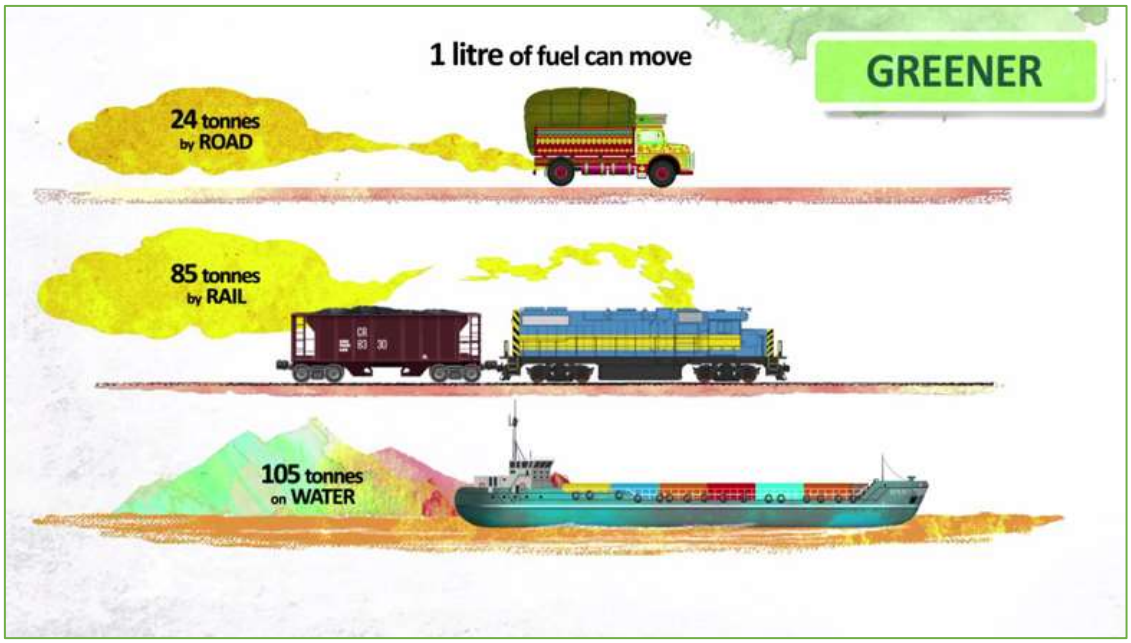

Figure 2: Freight Movement Cost Comparison (Source: worldbank.org/ developing-India-first-modern-inland-waterway)

3.3. Development of existing and new ports-Hurdles:

There is immense potential for modernization and growth of Indian ports both due to their geographical location and due to the connectivity. The main problem is that, due to pressure from trade unions, the government has not been able to modernize the major ports. As a result, Indian ports are highly over manned making a direct effect on efficiency. Political pressure,

lack of autonomy, absence of incentives, excessive bureaucracy, labor issues and hierarchical rigidities are contributors to the current state of the Indian ports. In some cases, there has been a vehement repulsion for private or external investments for the development of ports. These issues have caused an undue delay in completion of projects in time like the Vizhinjam port Project which is still lagging behind due to various issues.

Compared to the large international ports, India lags behind badly. For instance, the largest port in the world in Hong Kong, processes more than 20.01 million TEUs (20-foot equivalent units) in a year. The tenth largest port, Antwerp, processes about 5.4 million TEUs. In contrary, the Jawaharlal Nehru Port GNP)/ India's largest container port, handles only about 2 million TEUs.

There are also problem with average pre-berthing time, which is in the range of 11 hours, and the average turnaround time, which is around three days. In Singapore, for instance, the corresponding numbers are 3 hours and half a day respectively. These low performance indicators are primarily because of the poor road and rail container evacuation infrastructure from the port.

Unlike terminals at major public ports, privately-built independent ports are free from complicated bureaucratic controls associated with pricing and investment.[#6, #7]

4. INVESTMENTS/DEVELOPMENTS: [#8]

- Adani Ports and Logistics have developed/developing ports of Mundra, Dahej, Mormugao, Kattuppilli, Vizag, Tuna, Hazira, Ennore, Dhamra and Vizhinjam. Mundra Port is the largest private port of India located on the north shores of the Gulf of Kutch near Mundra, Kutch district, Gujarat. The deep draft, all weather port is a major economic gateway that caters to the northern hinterland of India with multimodal connectivity. [#9]
- Diversified business conglomerate Shapoorji Pallonji Group, which has a controlling stake in Gopalpur port off the coast of south Odisha, envisions that port capacity will be 55 million tonnes (mt) by 2025. After taking over the port in 2017, Shapoorji Pallonji Group had undertaken an expansion project entailing an investment of Rs 2,000 crore to enhance the capacity to 20 million tonne. [#10]
- . In November 2019, JSW Infrastructure commissioned a new iron ore terminal at the Paradip port in Odisha with a capacity to handle up to 18 million tonnes of cargo per annum.[#15]

- In November 2019, first ever movement of container cargo on Brahmaputra (National Waterway -2), focused on improving the connectivity to North Eastern Region (NER).
- In October 2019, Ease of Doing Business-Implementation of Radio Frequency Identification (RFID) based Port Access Control System (PACS) at Kolkata Dock System (KDS) was introduced. [#16]
- JSW Infrastructure enter into built, operate and transfer agreement with Paradip Port Trust investing Rs 750 crore (US$ 107.31 million) to operate Paradip port. [#15]
- In August 2019, India became the first country in the world to issue Biometric Seafarer Identity Document (BSID), capturing the facial bio-metric data of seafarers.
- Adani Port and Special Economic Zone (APSEZ) became the first Indian port operator to handle cargo movement of 200 million tonnes (MT) in 2018-19. [#9]
- Essar Ports will invest US$ 70 million in Hazira port by 2020. [#17]
- In 2019, the previous Indian Minister for Shipping, Road Transport and Highways, Mr. Nitin Gadkari had announced huge investment in India's ports and roads sector, which will boost the country's economy. The Indian government plans to develop 10 coastal economic regions as part of plans to revive the country's Sagarmala (string of ports) project.[#18]
- The zones would be converted into manufacturing hubs, supported by port infrastructural modernization projects, and could cover 300–500 km of the coastline. The government is also looking to develop the cheaper ways of transportation like the inland waterway sector as an alternative and hopes to attract private investment in the sector.
- Ports sector in India has received a cumulative FDI of US$ 1.64 billion between April 2000 and March 2019.[#19]
- Indian ports and shipping sector witnessed three MandA deals worth US$ 29 million in 2017. [#19]

5. GOVERNMENT INITIATIVES:

Indian Government has already realized and understood the importance of the Maritime trade and its role for shaping the destiny of the nation. Hence it has come up with lot many projects to develop ports and inland/maritime trade. National Waterways as mentioned earlier are being developed for the effective and economical transportation of the goods from interior areas to the ports for exports and vice versa. Also, the Sagar Mala Project is aimed for development of the ports along the peninsula.

In addition to the above, some of the major initiatives taken by the government to promote the ports sector in India are as follows: [#8]

- As of November 2019, many projects with a total project cost of Rs 13,308.41 crore (US$ 1.90 billion) have been awarded in the last three years on the development of the major ports.
- As of Union Budget 2019-20, the total allocation for the Ministry of Shipping is Rs 1,902.56 crore (US$272.22 million).
- Net profit at major ports has increased from Rs 1,150 crore (US$ 178.4 million) in FY13 to Rs 3,413 crore (US$ 529.6 million) in FY18 while operating margin increased from 23 per cent to 44 per cent.
- To boost up the container trade, in May 2018, Ministry of Shipping allowed transshipment of containers by foreign flagged ships
- In March 2018, a revised Model Concession Agreement (MCA) was approved to make port projects more investor-friendly and make investment climate in the sector more attractive.

6. INDIAN PORT DEVELOPMENT: LOOKING AHEAD

Shipping is one of the key beneficiaries in terms of percentage increase with their budgets increased by 18.2% increase over FY20 outlay. The expenditure on shipping and ports sector has increased marginally in absolute value terms compared to FY20. One major announcement in the Budget was regarding corporatizing at least one major port and listing on the stock market. Various Infra Structure Projects are announced in the Budget for development of port roads and facilities encouraging multimodal transport.

The capacity addition at ports is expected to grow at a CAGR of 5-6 per cent till 2022, thereby adding 275-325 MT of capacity.

Under the Sagarmala Program, the Government has envisioned a total of 189 projects for modernization of ports involving an investment of Rs 1.42 trillion (US$ 22 billion) by the year 2035. India’s cargo traffic handled by ports is expected to reach 1,695 million metric tonnes by 2021-22, according to a report of the National Transport Development Policy Committee.

Within the ports sector, projects worth an investment of US$ 10 billion have been identified and will be awarded over the coming five years.

As per the present Shipping Minister Mr. Mansukh Mandaviya the government will put in place a comprehensive 'Port Grid and Port Development' plan in six months for 204 minor ports in the country to boost coastal shipping and inland waterways, and bring a Bill in Parliament to provide a fillip to major ports.[#11]

With these projects by the Government as well as private sector investments, India can regain its historical glory of the major exporter/importer through the maritime sector. These collaborated efforts will bear fruit only if executed as planned and without any unforeseen issues. [#19]

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MARITIME EDUCATION IN INDIA- THE 'THEORY-PRACTICE' CONUNDRUM

Dr. Lekha K C Ravi

Abstract

Maritime education enjoys a unique status amongst traditional education and fields of study. The uniqueness is born out of two important factors; one is that the maritime courses are compulsorily built on global standards; the second is that it is still evolving in curricula as compared to conventional courses. This paper attempts to trace the origin of maritime education in India and take the reader through India's rich maritime heritage so as to comprehend the significance of this field in the broader perspective. The paper also touches upon how in earlier periods prior to independence the British literally led the maritime sector through her Royal Navy for over 250 years right up to early twentieth century. Fields of maritime study depended greatly on practical training and experience rather than formalised theoretical training. It was only in the post- independence era that training institutes started formal classroom teaching of maritime courses.

Shipping, considered as the core of maritime activity, operates on a worldwide canvas, in a multinational, multicultural, and multifunctional environment. To work competently in such an intricate setting, the seafarers must be trained bearing in mind all international standards and related regulations. They need a strong theoretical grounding evenly balanced by practical training sessions. The paper deliberates on the challenges faced by the maritime teaching fraternity in arriving at the right mix of theory and practice and imparting a curriculum laced with the strict discipline that is considered paramount for shipping careers.

Key words: Maritime courses, Maritime training, Theory vs Practice, Education, Shipping

1. INTRODUCTION:

Looking back over the centuries, it becomes apparent that the genesis of shipping or sailing never relied on equipment or a surfeit of theory, rather it banked almost entirely on the spirit of adventure and a zeal for risk. Over a period, sailing and navigation studies have changed from an art to a science. Initially voyages were planned based on positions of stars and moon indicating time and direction, which later gave way to equipment such as the sextant and chronometers. Ship building which involves intricate engineering was not even a big deal till the dawn of eighteenth century. The Industrial Revolution in the west also brought in sweeping changes when vessel engineering underwent complete transformation. Ship sizes increased radically and the 'simple rowing' was replaced by propellers and engine control. The steam power plant aboard ships were eventually replaced by diesel power plant and then to gas turbine plant. The Global Positioning System (GPS) or Differential Global Positioning System (DGPS) brought in further changes in navigation training.

Nature of cargo shipped across the continents changed too which brought about sweeping changes in how ships were manned, and ports were built. It was predominantly coal in the early nineteenth century which has given way to petroleum, largely Liquefied Natural Gas

(LNG) in this century. These advances demanded presence of comprehensive set of skills amongst seafarers. Imparting these skills called for a compulsory formal education system and this eventually led to the growth of maritime education industry globally.

India, though endowed with a rich maritime heritage, saw the start of formal maritime training only as late as 1910 when training ship 'TS Rahman' was set up in Mumbai. This was followed by the government initiative of installing TS Dufferin to train nautical students in 1927. Interestingly, prior to these training initiatives for nautical hands, Indian ships were known to be of sturdy and skillful origin and were manned by able bodied seamen. Back then the seafarers were trained entirely by on-hands apprenticeships and extraordinarily little theoretical impart. It is truly relevant to unveil a brief panorama of Indian maritime history and early seafarers before embarking on how the maritime courses came to be framed and how modern-day curriculum still holds on to certain conventional training methods.

2. INDIA'S RICH MARITIME HERITAGE:

History chronicles India's maritime traditions and trade links with far flung regions of the globe. India has been a seafaring nation for centuries. India's maritime past can be traced to the Indus Valley Civilisation which records dynamic trade with Mesopotamia and Egypt. Some of them show definite links to the Mohenjo-Daro and Harappa civilizations where native Indians exhibited remarkable maritime skills and enterprise. India can claim to have built the oldest port in the world in Lothal, on the estuary of the Sabarmati adjoining the Gulf of Cambay, in the State of Gujarat. It was built by the Harappans before 2300 BC. Explicit references to India's seafaring activities can be obtained from the art, sculpture, paintings epigraphy, monuments, and numismatic evidence of different periods. Adventurous merchants from India sought to navigate to far-flung lands in search of wealth and prosperity. Various periods in India's ancient history show trade links with the Phoenicians, Jews, Assyrians, Greeks, Egyptians, and the Romans in the pre-Mauryan and the Mauryan periods. Her unbridled reign over the sea and exclusive merchandise have been mentioned by various historians across the world. Traders from distant lands also moved toward India in search of fortune and settlements. These were all peaceful voyages virtuously embarked upon only for trade and had no military connotation till the European traders arrived on the scene. These traders completely changed the tenor and balance of this peaceful sea-borne vocation.

Amongst the Europeans who had come calling, the first was Vasco de Gama, the famous Portuguese navigator. He landed on the Indian shores on May 11,1498, when his ship *San Gabriel* landed on the west coast at the Port of Calicut, a flourishing port then. The Portuguese enjoyed a fairly long and prosperous run of maritime business along the Indian coast. The Dutch also entered India and were trading in some of the far eastern areas. By mid-16th century, they effectually wedged out the Portuguese from their powerful locus and took over control over their settlements; except for, three small territories on the west coast, viz., Goa, Daman and Diu. These places to this date bear the colonial imprint. The Dutch reign was however short-lived with the British entry into the Indian maritime sphere.

The formation of the East India Company saw an avid increase of trading activities with the British. India maintained her status as the world's leading industrial country right up to the beginning of the 19th century. The onset of Industrial revolution in the West in the 18th century had a severe impact on Indian rural enterprise and village-based artisans, which had been the very fabric of Indian trade, began to disintegrate. The 18th and the 19th century saw a sea change in the scenario of Indian sea-borne trade. Ships were fitted with steam boilers which turned the paddle and though initially complemented sails, eventually replaced the same. Coal burning ships with steam engines became the order of the day. Though it was the British who led to build such ships, India did not lag far. Maritime Records reveal that Indian ship building entered a fascinating era from mid eighteenth century. The art of shipbuilding was further perfected and large ships with sails and masts were built. Shipbuilding activities under government funding were initiated in Mumbai.

3. BRITISH SUPREMACY:

Being an island nation, the British soon set about gaining supremacy over the sea not only in self-defence, but also to establish its superiority over other European powers. The Royal Navy emerged as the most powerful force on the globe and reigned so for almost 250 years till the beginning of the 20th century. Though the French attempted to come close to establishing its own strength, the British defeated them at Trafalgar in 1805. With opposition practically non-existent, the British naval power reasserted its supremacy not only in the European waters but also in India and the East. In a few years, they began to acquire ships, initially by chartering and subsequently buy about 16,000 GT (gross tonnage) of shipping and employ roughly 2,500 seamen. The shift of economic and political power into the hands of Britain which had become

the maritime supremo driving the growth of modern trade and industry turned out to be a major watershed in shaping the economic development of the Indian nation for a long time to come.

4. EARLY MARITIME TRAINING INSTITUTES:

India got its first training maritime institute when it was set up by Ismail Yusuf, the then proprietor of Bombay Steam Navigation Company in 1910 at Worli, Mumbai, which latter got shifted to Nhava. It was incidentally the first marine training institute in South East Asia which came to be known as Training Ship Rahman in 1972. The first Government initiative came in 1927, when Royal Indian Marine's largest troop ship, after many fittings, was converted to mercantile marine training ship named 'Training Ship Dufferin'. TS Dufferin had trained about 2,656 cadets before being decommissioned by 1972. It was replaced by Training Ship Rajendra, which was built to train about 250 cadets at a time. Later, increased demand for seafarers led to the commissioning of a shore-based structure – Training Ship Chanakya, that was set up in Navi Mumbai and TS Rajendra was decommissioned. Amidst this, several attempts were made to bring the TS Rahman under the Government control. In 1973, the foundation had received notices from the Government for acquisition of its entire campus by ONGC (Oil and Natural Gas Corporation). However, the (late) Prime Minister Smt. Indira Gandhi held that it should continue to maintain its independent identity. It is often said that India's maritime training history runs parallel to the rise and fall of TS Rahman and TS Dufferin. Various new courses were introduced with passing of time, keeping up with training developments in Europe.

Most seafarers used to be drawn from the OECD (Organisation of Economic Co-operation and Development) nations as they were the nerve centres of shipping. After the Second World War ended, people of various nationalities jumped into the seafaring bandwagon. This period also saw the growth of maritime sector in East Asia and other developing nations. Very soon other developing sectors caused the shipping industry to lose its charm amongst the OECD countries due to mushrooming of plenty of alternative lucrative careers. Earlier, ratings (sailors) used to come from natives of coastal Gujarat and Tamil Nadu which were coastal states accustomed to sea and sailing. The deck and engine officers were usually from Northern and Eastern parts of India. Post-independence the trend continued. However, after liberalisation, other opportunities beckoned, and the ratings mainly began to upsurge from states like Orissa, Bihar and Uttar Pradesh. The *Gujaratis* who were the predominant maritime community, increasingly moved

away from shipping career as other industries and entrepreneurship offered better and lucrative alternatives.

5. EMERGENCE OF REGULATORY BODIES FOR MARITIME:

The growth of the sector threw up various governance issues like safety norms and legal compliances that would have an international application. Thus, bodies such as IMO and charters such as STCW emerged which brought upon the seafarers and the shipping sector in general an order and discipline.

Figure 1: The IMO (A constituent of the UN)

The IMO (International Maritime Organisation)**:** The IMO was established in Geneva in 1948 (the original name was the Inter-Governmental Maritime Consultative Organization, or IMCO, but the name was changed in 1982 to IMO) and came into force ten years later, meeting for the first time in 1959. Headquartered in London, United Kingdom, the IMO has 171 Member States and three Associate Members. The IMO's primary purpose is to develop and maintain a comprehensive regulatory framework for shipping and its remit today includes safety, environmental concerns, legal matters, technical co-operation, maritime security, and the efficiency of shipping.

At the time of inception of IMO, India did not have a voice. The scenario changed later with Indian seafarers gaining great demand and Indian training standards getting universally recognised. Dr. C.P. Srivastava, a maritime luminary who occupied the highest seat in IMO for four consecutive terms led to India acquiring a greater say in the affairs of IMO.

Figure 2: DG Shipping (India)

The highest body of shipping regulation in India, the Directorate General of Shipping (DG Shipping), governed by the Union Ministry of Shipping is housed in Mumbai and is responsible for the operational development of the maritime industry in India, and the maritime education sector too. India, being a signatory to International Maritime Organisation (IMO), implements all the guidelines through this body DG shipping. Continuous evaluation, persistent efforts and guidance of DG Shipping have played a significant role in moulding India into a major maritime nation.

STCW: The International Convention on Standards of Training, Certification and Watch keeping for Seafarers (or **STCW**), 1978 sets qualification standards for masters, officers, and watch personnel on seagoing merchant ships. Before STCW guidelines (amended in 1995), the government bodies undertook the task of maritime education and training. Very few players, viz. big shipping lines like Great Eastern and SCI (Shipping Corporation of India), were granted permission to set up captive training institutes. With IMO-STCW'95 guidelines, DG

Shipping liberalised their policy and invited interested private players to take up the responsibility. The first free market initiative in the maritime training and education sector came in 1997 when DG Shipping granted permission to private players to set up maritime training facilities on a commercial basis so as to meet the projected immense training demand.

6. EVOLUTION OF MARITIME COURSES:

Seafaring was, and perhaps still is, essentially an occupation where performance depended heavily on experience. In early seventies and eighties, whether intended for the crew or top command, gullible youths were recruited at about 15 years of age and were taught the tenets of sea faring by a dubious mix of commands and bullying and initiated into the work culture of the sea, progressively as and when each new experience or task arose. Those who could survive the ordeal of initiation slowly built up their layers of practical knowledge and progressed up the hierarchy. Mastery of practical skills ensured one's career growth especially in the coastal trades, even if one had truly little formal education. Commercial acumen avidly required of ships' masters could also be picked up through experience. Extraordinarily little distinction was prevalent between the training of future ABS (Able Bodied Seamen) and that of future Masters, though the latter might have the advantage of a general education.

The curriculum for vocational education and training depended largely on the need as perceived by those experienced industry veterans before the state education system evolved. Much of the curriculum was tutorial in nature and course content and duration was kept variable based on input from the shipmasters, merchants, and ship-owners. The introduction of compulsory licensing, of maritime institutes in Britain from 1851, standardised the syllabuses but generated a minimal approach to learning. For the next 100 years students preparing for their certificates of competency at sea needed only the minimum of instruction to pass the examination.

Eventually with the opening-up of navigation and the oceans, seafaring occupation began to demand a more formalised higher level of educational attainment. Hence to the informal shipboard training was added this new dimension of nautical education delivered through specialized schools charging a sizeable fee. Such schools might be attended following a general education before going to sea (pre-sea) or between voyages (in-service) as a step in the ladder to command. Until the nineteenth century vocational training in the practical work of ships, loosely grouped under the term "seamanship," remained experiential but from the middle of

that century, state-aided navigation schools, endowed nautical schools and private establishments began to provide formal training in aspects of seamanship. Nevertheless, structured practical training aboard a ship of variable quality, through officer apprenticeships or cadetships, continued to be considered as the principal route to officer status. This approach to maritime vocational education and training was continued into the twentieth century when nautical education came to be largely absorbed into the state tertiary education system.

Over the same period the educational content was enlarged as more detailed knowledge of a variety of subjects relevant to the safe operation of ships was required to qualify in professional examinations. It was also in the mid-nineteenth century that the idea of providing an industrial training in seamanship for youngsters, through shore establishments and static training ships, was developed. Further introduction of new technologies of power propulsion and radio communication, of new manning groups aboard ship, engineers, and radio operators, created related educational provision ashore. The marine engineering and radio schools followed a similar development to the navigation schools: mostly initially private establishments, then drawn into the state tertiary system in the twentieth century.

All the maritime sea faring courses were broadly of three categories, namely, the modular courses, competency courses and various familiarization courses. Competency courses require high degree of infrastructure whereas the rest relatively do not require as much. In 1997, the critical decision of DG Shipping to allow private sector into this field, opened an opportunity to many players. These entities were such with prior experience in sailing and had access to investment. This period witnessed a steep rise in demand for those courses and many such institutes began to offer several modular courses with minimum infrastructure charging exorbitant fees. This unsavoury situation led to mushrooming of several such establishments especially in the Mumbai region.

In India, two courses eventually became preferred at the entry level for the deck side officers', the first one being a three-year Bachelors in Nautical Science, a graduation course and the second one being a three to four months course sponsored by a Shipping line. The basic qualification for both is a 10+2 schooling with Physics, Chemistry, Mathematics configuration, and the entry is as a sea-cadet. But the former must have a one-year sea time whereas the latter will have to serve 3 years before they become eligible for higher ranking jobs. Experts have

debated if the two years extra sea time in the latter equal the three years theoretical training in the former. Do these two deserve differential treatment on-board?

7. THE THEORY-PRACTICAL CONUNDRUM:

7.1. On-board Training vs Onshore Training:

Onshore training is predominantly a theoretical training with various simulated classroom sessions and a few actual on-board conditions thrown in. On-board training is literally on-the-job training. Many experts opine that a perfect learning system for a seafarer would be the correct amalgamation of both. They feel that the ratio of on-board and onshore depends upon two factors: one the maturity of the shipping industry and secondly the shipper's management/operation strategy. In any industry typically, initial growth rate creates a disproportionate demand for qualified personnel which the market is unable to supply. Hence shippers agree to take seafarers on board after minimum formal education and resort to giving them on-board training while utilising the hands at the same time. They are also asked to take up the concerned job responsibilities immediately after learning them on hand. However, when the industry matures into the growth phase, the market system becomes well developed to supply the candidates with proper qualification and attributes by making them go through a well-designed course with enough class room training intermingled with practical sessions and simulation classes. Many experienced seafarers say it is the latter who will be more suitable mariners in the long run. When thoroughly equipped with a strong theoretical base he could pick up the practical aspects with ease when on-board. Presently (2019-20) it is perceived that global shipping industry worldwide is well into the next phase after growth which is the saturation phase.

7.2. Training still meant "On-the-job" in Maritime:

Another influencing factor in this maritime training challenge is the operation strategy of the shipping companies. Most businesses when they are through the cyclical industry pressure would adopt a cost strategy to survive in the market. Shipping companies' world over have been focusing on cost reduction techniques, more so in recent times of global recession. This leads to a shipper opting for a minimum manning requirement on-board. Obviously, he will want them to be technically knowledgeable, having a wide array of domain expertise, and one

who can substitute a dozen less knowledgeable personnel. They opine that it will not hurt their costing if such a person were to demand a high pay package as the benefits would emerge in the form of reduced cost per unit of employee. The industry prefers its personnel to be well educated in a formal system before they gain entry on-board. The result is just more onus on onshore training. Another influential parameter is the rate of change of technology employed. IT training is a definite must these days and ostensibly this requires extensive classroom training.

Although increasingly part of state tertiary education provision, nautical education and training remained separated from developments in other areas of vocational education. It was in the 1960s that this began to be corrected, and in recent decades serious attempts have been made to tie maritime education in with developments in state tertiary provision, leading to national qualifications at certificate, diploma, and degree levels. Though much of the evolution summarised above relates largely to Britain, it was the scenario in India too. Due to its world-wide domination of merchant shipping in the nineteenth century along with its extensive empire, British influence on maritime education, training and licensing was very much widespread.

Britain had a major influence at the International Maritime Organisation (IMO) since the 1970s in the development of IMO international standards for watch keeping and certification, and in the development of model courses, so that all countries with merchant fleets end up providing a vocational education and training to the same standard. Today, there are over 200 establishments in over 80 countries offering maritime education and training at levels from basic training in seamanship to the highest maritime licence standard that now carries degree level status.

8. CURRENT STATUS OF INDIAN MARITIME EDUCATION:

Global maritime education and training (MET) is currently subject to great change brought about by a dynamic shipping environment and the growing impact of technology. The biggest challenge was to analyse the extent that global MET institutions could enhance and enrich traditional practices of maritime training. New international legislation emerged and maritime institutions all over the globe tried to serve the growing demand. However fresh challenges were posed as they had to survive in an uncertain marketplace. Did access to new technology

and the use of innovative teaching and assessment methods fit into a sustainable and achievable framework. Assessment of these courses has also been a challenging task. According to a study published in the Asian Journal of Shipping and Logistics (June 2009); "Assessment should be a tool for educational improvement, providing information that allows educators to determine which practices result in desired outcomes and which do not. By focusing on outcomes rather than the processes by which they are achieved, teachers and schools are free to use whatever methods prove practical in achieving student academic progress"

Shipping is perhaps the most international of the entire world's great industries and one of the riskiest careers. Safety of seamen, the marine environment and majority of the world's trade depends almost solely on the competence of seafarers. It has been reported that over 80% of accidents and incidents are due to human error (IMO, 2005). A recent study shows that top 25% of the safest ships were involved in just 7% of all accidents. University of Technology and Science (NTNU) in Norway present a clear argument that by improving the quality of the world fleet to the same level as those in the safest 25% category, there might be an overall reduction of 72% in shipping accidents (Ziarati, 2006). It was opined that the good practices from the safer ships are to be transferred to those ships with a poorer record of safety.

Education and training are being recognised as vital to the development and success of today's knowledge society. The Indian Maritime grand strategy proposed by the government and stakeholders calls upon all policy makers and experts to work in collaboration and learn from each other. It urged the Indian maritime education and training (MET) policy to enhance that body of knowledge, encouraging newer and innovative pedagogy. MET is required to not only train mariners to service on-board ships but also to provide personnel for key onshore positions. Today, shipping business is no longer limited to transportation of cargo and its management but has metamorphosed into a mammoth industry which covers a variety of activity including maritime finance, port and shipping management, brokerage, warehousing, customs house clearing, logistics and supply chain, law and insurance.

Thus, MET extended itself horizontally too to meet the demands of shipping industry; in areas such as shipbuilding and maintenance, ship operation, maritime management, and services, as well as maritime teaching and research. The Directorate has introduced a Comprehensive Inspection Programme (CIP) that seeks to do away with the inspection processes a maritime training institute is required to undergo on a regular basis—scheduled inspections by academic

councils, quality certifications by certifying bodies and grading of the institutes by rating agencies. These mechanisms have not yielded the desired results because these agencies lack expertise in the maritime education field. A comprehensive grading process by established agencies in the maritime field will form the core of the new monitoring mechanism for training institutes. It was in the same perspective that the Indian government created a Central University, Indian Maritime University, in 2008. All the seven government-run legacy maritime institutes are now subsumed under this University. Besides, the Central Government of India managed institutions, there are many privately managed and run Institutions in India, numbering over 130. (For Officers and Ratings training)

9. CONCLUSION:

The total Indian shipping tonnage amounted to 12.7 million GT (Gross Tons) and the number of vessels was 1 419 in Sep 2019. 456 of these vessels ply on overseas routes. India is the 16th largest shipping nation globally based on merchant fleet size. The need for trained maritime personnel is unquestioned. Maritime education and training (MET) are currently subject to great change brought about by new international legislations, a dynamic shipping environment, the constantly changing technology, and the dawn of the digital era. The challenge of uncertainty that hangs over maritime institutions all the time is very real.

The Safety norms in the maritime industry requires standards to be set at an international level, and Maritime education and training institutes should play a key role in asserting the need for consistent, uniform education and safety awareness. On the above arguments it is suggested that India and indeed global maritime education can enhance pedagogy by harnessing technology to arrive at the right mix of traditional practical training with a sound theoretical framework to build a contemporary course curriculum that is both robust and futuristic.

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ROBO BOAT

Dr. R. Venkatesan

1. INTRODUCTION:

Remotely operable oceanic surface vehicles are widely used for survey and monitoring of conditions at sea and measurement of oceanographic parameters. The main objective of this platform is remote rapid data collection at sea. This platform has sleek design and capable of working in rough sea environments and climatic conditions with provision to mount oceanographic sensors. Low power and high endurance components are used for control and data acquisition. Sea Surface Robo-Boat is a mobile platform build with UV resistance low density polyethylene material (LLDPE) and electrically propelled with the maximum speed of 7.5 km/h. Robo boat gives us added advantage of improved range and data acquisition capabilities which helps us to validate the data collected from moored buoy systems after deployment. The control of the vehicle is done with the help of variety of telemetry system such as WiFi/4G. The Robo Boat can be equipped with a suite of sensors for measurement of ocean surface and upper ocean parameters.

2. OBJECTIVE BEHIND THE DEVELOPMENT/SCIENCE OF ROBO BOAT:

Ocean Observation Systems (OOS) group is engaged in deployment and maintenance of Met-Ocean and Tsunami buoy system at Bay of Bengal, Arabian Sea and Arctic Region. In order to ascertain the data soon after the deployment of buoy system, rapid data collection to be done at close vicinity of buoy system to record the initial values to study the performance of sensors and allowable drift in data. In order to suffice this technical requirement, OOS has designed a Robo boat which can be equipped with a suite of sensors and payload for real time rapid data collection.

The real time video streams from the Robo Boat provides clear details of underwater sensors. OOS maintains India's First Arctic Mooring (IndARC) at Kongsfjorden, Arctic. There has been always a requirement from the scientific community for data collection very close to the Ice bergs. But due to safety reasons the ship/boat are not allowed to approach the iceberg very closely. Robo Boat has solved the above problem as it is remotely operable and can collect data very close to the iceberg safely. Measurements made from ship/boat at these locations may

have disturbances due to the machineries/ acoustic instruments of the ship but data collected from such small platforms are free from most of the disturbances. The electrical propulsion system of the Robo Boat can be instantly controlled for noise free measurements.

3. FEATURES OF ROBO BOAT:

- Electrically propelled remote-controlled boat.
- GPS for Geo Tagging and Navigation.
- Rechargeable batteries.
- Real time underwater video stream.
- Real time day and night atmospheric camera.
- WiFi and 4G telemetry. Satellite telemetry possible.
- Surface oceanographic parameters such as conductivity, temperature, Photosynthetically Active Radiation (PAR), Fluorescence and Turbidity (FLNTUS), Dissolved Oxygen (DO) can be interfaced at discreet depths.
- Atmospheric sensors such as Humidity, temperature, Longwave radiation, shortwave radiation, pressure.
- ADCP for subsurface current measurement with algorithm for movement correction
- Echosounder for bathymetry survey
- Autonomous operation with dead reckoning and return to home feature- to be implemented.
- Controllable speed based of sensor measurement.
- Maximum speed of 4 knots.
- Surveillance at controlled areas such as ports.

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THE PPE PARADOX

Dr. Nippin Anand

Abstract

Why is it that something regarded as the least effective of all measures in managing safety is considered so important both from the policy and industry perspective?

In many high-risk industries (maritime, oil and gas being no exception), the desire to eliminate the risks associated with new technologies is far from practicable. This is eloquently captured in a quote by Henry Petroski, an internationally acclaimed American academic, specialising in history and civil engineering. According to Petroski, 'Many new technologies come with a promise to change the world, but the world refuses to cooperate'. Here, Petroski is referring to the designed-in protection offered by new technology that time and again proves insufficient in the work environment, due to unpredictable operating conditions, resource constraints, or the conflicting goals of safety and efficiency in getting the work done. It is the gap between the protection offered by the design and the reality of operating conditions that necessitates the use of PPE.

Key words: *PPE, Safety, Risk Control Hierarchy*

1. THE REALITY:

Sir', he said in a pale voice. 'It was 59 degrees in the engine room that afternoon and I took my helmet off. Not for too long, sir, just a few minutes. I was standing under the blower to cool my head. And then this safety officer comes to me and starts shouting. "Why are you not wearing your helmet? What if you get injured? Who will be responsible for your safety? Did I not tell you before? Why do you keep ignoring safety?" Even before I could explain myself, I was told to treat this as a verbal warning. Sir, one more warning and I lose my job, I go home. I have a family to support.' He ended with a sigh.

After a brief silence he looked into my eyes and went on, 'You see here, I'm working in this workshop. Nothing will drop on my head here. Why do I need to wear a helmet? When I go in the purifier room it is so hot, my eyes are sweating, why do I need to wear safety glasses? I cannot see anything, is that safe? When I go to the steering - at, there is no noise, why must I wear ear plugs? Why can't they leave this for me to decide? I am not ignoring safety, I know my safety, sir'.

2. PERSONAL PROTECTIVE EQUIPMENT:

Working in harsh, unpredictable, and unforgiving conditions often means adequate protection is required for front end workers. A wide and ever-increasing range of products is available to minimise the risk of personal injury. According to research body Global Market Insights, the market for personal protective equipment (PPE) is forecast to hit $67.6 billion by 2023, growing at a rate of 7.3% per annum between 2016 to 2023. Many countries have made it mandatory for employers to provide their workers with PPE. All this makes PPE 'serious business'.

On the other hand, regulatory agencies and industry bodies have consistently maintained that PPE is often the 'last line of defence' in managing operational risks. Safe Work Australia, the government body responsible for workers' health and safety (WHS), states that 'Using PPE is ranked as one of the least effective safety control measures; that is a level 3 control measure. Level 3 control measures do not control the hazard at the source. They rely on human behaviour and supervision and used on their own tend to be least effective in minimising risks. Workplaces must not rely on PPE to satisfy their hazard control requirements. PPE should only be used:

- as a last resort;
- as an interim measure;
- as a back-up.'

The UK's Health and Safety Executive takes the same view. Protection by design, maintenance scheduling and setting up operational limits are considered more reliable measures of safety and risk management.

Starting from this viewpoint, PPE is an essential compromise between eliminating the risks altogether and undertaking the activity while accepting a certain level of risk that is inherent in everyday work. For example, ideally, it would be best to fit the entire mooring deck with a non-skid plating, but anti-skid footwear offers a practical and cost-effective solution. Other examples may include PPE allowing:

- Heat resistant gloves allowing work on hot surfaces without adequate thermal insulation;

- High visibility vests allowing work as a signaler in the vicinity of suspended weight;
- The handling of heavy and wet ropes under tension;
- The use of portable lifesaving equipment for entry into enclosed spaces without adequate escape arrangements.

In such cases, PPE acts as a compensation for what designed-in protection cannot offer. It could be argued that the more unsuited the design is for the work that will take place in it, the greater the need for PPE, which is compensation for an incomplete design. One could even say that an increased emphasis on PPE is an indicator of poor technical design. By the same token, a reporting system that consistently shows that front line workers do not follow the company's 'PPE policy' could well mean that the design intent is flawed, or at best, unfit for the intended purpose of the system. That is how human factors and ergonomics experts would approach this problem.

3. MYTH MAKING:

But life is not that straightforward. The emphasis on the use of PPE can also extend beyond just ensuring the usability and safety of front-line workers. This is a deeper problem than it appears on the surface, and where the proper role of PPE is not understood, it could easily become the antithesis of safety.

Many companies are convinced that one of the most effective ways of managing safety lies in managing the behaviour of their workers. A number of behaviour-based safety programs are being initiated to address this issue. One of the most frequent examples of behavioural safety – or the lack of it – is workers not wearing proper PPE. In fact, it is a common assumption in many accident investigation reports that failure to use proper PPE was a contributing factor, and the number of times it comes up in accident investigations, on-site inspections and safety observation cards serves to reinforce this assumption. As we learn from Erik Hollnagel, before we realise it, an assumption turns into a myth and the myth can become an accepted belief. All this leads to a 'zero tolerance' message from top management about missing PPE – and for companies' conscious of their brand reputation, a significant investment in the best available PPE. I have known of instances where the first question asked in the wake of an accident is not

about the injured worker's well-being, but whether or not the worker was wearing 'proper' PPE at the time when the accident happened.

What lies behind this myth that PPE is the ultimate preventer of accidents? I have interviewed many safety officers to find out what a 'safe working environment' would mean to them. What do they look for during inspections and why? A common theme in their answers is the correct use of PPE by workers. When pressed to explain why, a common explanation is consistent reports of 'PPE violation' in the Safety Management System. This is a perfect example of the vicious circle whereby assumptions become myths and myths become deep-seated beliefs within the organisation.

4. CONTROLLING THE VULNERABLE:

Many companies set up performance indicators for monitoring safety but end up monitoring what is convenient rather than what is meaningful.

A safety officer who is less experienced in a specific activity runs the risk of not knowing enough about that activity when interacting with an experienced worker in that area. Faced with an uncomfortable situation that creates anxiety, it is not uncommon for the safety officer to fall back upon prior knowledge rather than engaging in a meaningful dialogue. Spotting someone not using the mandated PPE is a convenient option. It is easier to discipline a worker for not following the 'PPE policy' than to attempt to understand the design limitations of technology and the goal conflicts involved in everyday work.

Although the PPE policy applies to everyone irrespective of their position on a vessel, it is often the case that only ratings are targeted for violating it. There are not many instances where senior officers are reported for not using the right PPE (even making allowances for the fact that PPE is more likely to be needed by those in lower ranks). It makes me wonder if the issue is really one of risk and safety, or whether it is a question of power.

The impression that PPE is an instrument for controlling those in lower ranks is only reinforced when one talks to those working at this level. There have been instances where the crew is quite literally 'reprimanded' for not using the correct personal protective equipment. During a safety meeting the chief steward was given a warning by the third officer for entering

the vegetable room without winter gear for just a few minutes. In another instance, a rating was served a warning for not wearing the right type of gloves for the job. Workers are known to be served with warning notices for taking off their safety glasses or helmet even for a short break to escape scorching heat in machinery spaces. But it may be that the risk of someone collapsing from a heat stroke or getting knocked down due to impaired visibility is much higher than that from flying debris or dropped objects.

Evolving standards in the PPE industry create enormous opportunities for designing improved protective gear (such as working gloves and high-visibility garments) but innovations can sometimes also set up unrealistic expectations. From the management's perspective, more (PPE) should automatically lead to improved safety – and yet the evidence appears to be inconclusive. In many instances, avoiding certain PPE is a safer choice.

Protective gear, it appears, has become a means to instil fear and insecurity in front line workers. There are instances where crew members may even lose their jobs for not wearing proper PPE. But wearing PPE is not a binary choice between good and bad or between following and not following procedures. The choice to wear PPE or not is not the same as if a crew member had a choice between consuming alcohol or not prior to starting his watch. Much of what PPE qualifies as 'proper' is situational, and the final decision may be best left to the worker based on discussion with his supervisor before the start of work (commonly referred to as 'tool-box talk').

5. A SENSIBLE SOLUTION?:

Technology is 'unruly'; not in the colloquial sense that it is uncontrollable but in that it cannot always be regulated through a pre-determined set of regulations and procedures. This is partly due to the harsh and unpredictable work environment at the front line, where risks to the workers cannot always be foreseen and eliminated. In such instances, the use of PPE is aimed at managing the unexpected and protecting the workers.

Contrary to the popular belief that the problem always lies with the behaviour of workers, the use and abuse of PPE policy may provide some unique insights into human adaptability and resilience. Sometimes a sensible solution may be to install an affordable CCTV camera in the crane cabin to avoid someone standing near a suspended weight, rather

than focusing excessively on winning 'hearts and minds' on deck. We have a choice. We could either reprimand our crew for not wearing enough PPE, or we could pay attention to their choices and compromises, helping us to improve both safety and performance.

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ROBO COASTAL OBSERVER (RCO)

Dr. R. Venkatesan

1. INTRODUCTION:

A low-cost buoyant apparatus was developed for remote data collection in water bodies such as river, lake, pond and coast. The proposed equipment could be equipped with sensors for ocean data collection with camera .The equipment can be controlled by a radio controlled remote and the data collected are stored and can be transmitted using RF/GPRS/4G/Satellite telemetry. This equipment can also be used in Polar Regions for ocean data collection very close to the icebergs without risking life of persons.

Unlike a fixed mooring this equipment has a flexibility of rapid data collection over an area of interest. The data collected from various oceanographic sensors could help researchers by providing valuable data on coastal discharge, salinity variation, pollution monitoring. This equipment can also be used for coastal surveillance.

2. MAJOR COMPONENTS:

The Robo Coastal observer consists of following components

i. Life Buoy (SOLAS approved)
ii. Underwater enclosure for electronic components
iii. Microcontroller
iv. Electrical thrusters
v. 2.4GHz Remote control
vi. Rechargeable Battery packs.
vii. Coastal oceanographic sensors
viii. Camera for recording surface and underwater footage

3. OPERATION:

Robo Coastal Observer can be used for special data collection in coastal and deep waters within a range of 2 nautical miles from the source transmitter. It can also be programmed for autonomous data collection with the help of on-board GPS module.

4. FEATURES:

- SOLAS and IRS/equivalent approved Life Saving Appliance
- Easily operable using remote control, Life of sight: 2 Nautical Miles in fair weather
- Speed of 4 knots
- Rechargeable battery
- 5 hours of endurance
- Ease of visibility: fluorescent stickers attached
- Camera for visual surveillance
- Flashlight for low light condition
- GPS module for position indication
- Applied for Indian Patent
- Assistance for rescue of persons

5. END USERS:

RCO can be used for remote data collection in coastal waters by oceanographic institutions, universities, private industries involved in RandD. The advantage of aiding in rescue/assisting of swimmers in coastal waters will attract persons engaged in coastal fishing; coastal surveillance using the camera fitted with RCO. It can also be used in coastal patrolling covering a limited area and recreation purpose in Resorts/Hotels.

Figure 1: Robo Coastal Observer

Figure 2: Testing of Robo Coastal Observer at Sea

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