User Aspiration and Design of Functional Architecture in Seafarer’s Certification Management

S Nugroho¹, A T Putro¹
¹Institute Teknologi Sepuluh Nopember, Kampus ITS, Sukolilo, Surabaya
Department of Marine Transportation Engineering, FTK - ITS
snugroho@seatrans.its.ac.id

Abstract. Maritime (kepelautan) is matters related to manning, education, certification, authority, rights and seafarer’s obligations. In marine transportation activities, there are several main instruments that must be in place, namely transportation facilities (ships), transportation facilities providers (shipping companies / government), ship operator service providers (seafarer), certified seafarers / producers of seafarers (training institutions) and infrastructure, such as ports, channels, warehouses, and so on. The relationship between seafarers and seafarer certification (education and training institutions / government) and shipping companies is a concern in this study, especially in relation to the impact of many falsification of seafarer certificates, despite the implementation of an online database certification system that is centralized in Directorate General of Sea Transportation (DJPL). There are 3 (three) major problems that are still popular at this time, for instance unoriginal of seafarer certificates, unpaid seafarers or late receiving wages for more than 1 (one) wage period, and seafarers have a difficult time to find jobs on board. One of the available instruments to solve this problem is the intelligent transport system (ITS) architecture which is liable to be adopted in mapping the aspirations of marine transportation stakeholders, blockchain technology, such as decentralizing (one of the pillars / characteristics of blockchain technology) seafarer certificate database. A cost benefit analysis will be used in this study to obtain how much does it cost to improve the system and to see the benefit of the product.

1. Introduction

| Years | Supply of Seafarer Officer | Rating | Total | Demand of Seafarer Officer | Rating | Total | Balance (Supply-Demand) Officer |
|-------|---------------------------|--------|-------|----------------------------|--------|-------|--------------------------------|
| 2005  | 466,000                   | 721,000| 1,187,000 | 476,000                   | 586,000| 1,062,000 | -10,000 | 135,000 | 125,000 |
| 2010  | 624,000                   | 747,000| 1,371,000 | 637,000                   | 747,000| 1,384,000 | -13,000 | 0 | -13,000 |
| 2015  | 774,000                   | 873,000| 1,647,000 | 790,500                   | 754,500| 1,545,000 | -16,500 | 118,500 | 102,000 |
| 2020  | 789,500                   | 789,500| 881,500 | 881,500                   | 92,000 | 0 | -92,000 |
| 2025  | 805,000                   | 805,000| 952,500 | 952,500                   | 147,500| 0 | -147,500 |

Source : BIMCO Manpower report 2015 [3]

Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.
As in the Table 1 and Figure 1, it can be seen that in 2015 the world had a shortage of 16,500 officers and in 2020 it is estimated that the world has a shortage of 92,000 officers, until 2025 it is estimated that the shortage of marine officers is 147,500 officers [3]. According to the Baltic and International Maritime Council (BIMCO) report [3], the shortage of seafarers and the high population growth which increase job competition becomes more selective and competitive, furthermore it can be seen as an opportunity by individuals who want to take advantage of it by looking for shortcuts to make seafarers' certificates that can be traded and owned without a process of education and training [9]. Due to the high demanding, the person sells the illegal certificates with a price range approximately Rp. 700,000 to Rp. 20,000,000 depending on the level of the certificate, it doesn't stop there, the illegal certificate seller also hacked the Indonesian seafarer's website to enter the certificate data they sold so that it gave a genuine impression, and currently there are more than 5041 illegal seafarers certificates that have entered the Indonesian seafarers' database [9], in detail we can see in the following table:

| Certificate Level                        | Price Per Certificate |
|------------------------------------------|-----------------------|
| Sertifikat keterampilan pelaut            | Rp 700,000            |
| Electrical Technical Officer (ETO)       | Rp 1,500,000          |
| Competency Certificate Class IV          | Rp 7,000,000          |
| Competency Certificate Class III          | Rp 10,000,000         |
| Competency Certificate Class II           | Rp 15,000,000         |
| Competency Certificate Class I            | Rp 20,000,000         |

Source: Tribunnews.com 2020 [9]

those cases seriously threatens the existence of Indonesian seafarers on international shipping, where currently there are 300,000 Indonesian seafarers working on foreign ships [19] and if it becomes a serious problem in international law then the worst consequence is that all Indonesian seafarers' certificates will be banned and unable to sail in international seas.

The next problem is related to unpaid seafarers by the company that employs them or the company that employs them is late providing wages for more than 1 (one) period of wages [11]. the reports are quite
often received by the International Transport Workers' Federation (ITF). Every year, more than 1500 ships crew reported that they are not paid and on the other hand, the company is not able to pay [11]. The third problem is a contradiction report by BIMCO that Seafarers have a hard time finding jobs on board. When the world comes up short of seafarers, however it is difficult for seafarers to get a job. It can be concluded that the third problem is job vacancies are not conveyed to seafarers, or it could be that Indonesian seafarers are just looking for and applying for jobs at local companies [12].

2. Literature Review

The International Convention on the Standards of Training, Certification and Watchkeeping for Seafarers (or STCW), 1978 establishes the standard qualifications for captains, officers and guards on board merchant ships sailing. STCW was born in 1978 from the International Maritime Organization (IMO) conference in London [6].

1. A certificate of competence for both deck and engine seafarers;
2. Latest training, updated requirements;
3. Assignment of responsibility to members, including those relating to licensing, and flags of states employing foreign countries, to ensure seafarers meet the standard requirements of competence.

International Labor Organization (ILO), IMO does not have the capacity to make a comprehensive legal instrument on the protection of seafarers, so it is appropriate if the ILO makes the maritime labor convention (MLC) 2006 as an international legal instrument [5]. The MLC provides a legal basis relating to the fulfillment of several rights of seafarers [7], [8], namely:

1. A safe and secure workplace according to proper safety standards;
2. Fair terms of employment;
3. Work and workplace conditions on board are decent; and
4. Work protection, health care, welfare and other forms of social protection (Health protection, medical care, welfare measures and other forms of social protection).

Intelligent transport system (ITS) architecture, there are several basic things that are needed [1], [2], [4] [18], namely:

1. Change Stakeholder Aspirations into formal User Needs, whose functions can be expanded;
2. Divide functionality into components that can be produced;
3. Make an outline specification of these components;
4. Submit these specifications to the review team;
5. Compare 'where you are' with 'where you want to be';
6. Develop a placement plan.

3. Methodology

3.1 Research Location

This study was conducted in several places in Surabaya - Politeknik Pelayaran Surabaya and Port of Tanjung Perak, Surabaya. This study was also conducted in Jakarta - Directorate General of Sea Transportation (DJPL) Jakarta.

3.2 Data Collection Methods

Data were collected by using 2 (two) methods:

1. Field observations to find out how much does it costs and how long does it takes for seafarers to take education and training until they get a seafarer certificate and work on a ship.
2. Interviews with seafarers to find the information towards the duration in finding a job on board and how they apply for it.

All data will be analysed by using the cost benefit analysis.

3.3 Case Study

Various problems that arise when falsification of seafarers' certificates continues, are:

1. Indonesian seafarers are no longer trusted in the world shipping company, therefore, it is increasingly difficult to work in international companies;
2. If it is found out that the seafarers working on their ships are using illegal certificates, the company will suffer material losses because the ship is not allowed to sail until there is a replacement seafarer and makes another work contract with the replacement sailor and pays additional mooring fees at the port;
3. All seafarers’ certificates issued by the government in Indonesia are doubted in the world shipping company, so that seafarers cannot work, reducing foreign exchange and increasing unemployment.

4. Result and Discussion

4.1 Observation

In the observation on falsification of seafarers’ certificates, it is found that 5041 illegal certificates were successfully sold and the data entered into the database of Indonesian seafarers [9]. Some data obtained from observations, they are:
1. training rates at the politeknik pelayaran surabaya
2. costs and time spent on education and training seafarers
3. the supply data of the number of seafarer each year from the politeknik pelayaran surabaya
4. Minimum standards of wages for seafarers

Data obtained from observation can be seen as follows Table 3

| No | Types of Training Programs | Average Fare          |
|----|-----------------------------|-----------------------|
| 1  | Basic education and training program | Rp. 54,060,167/person |
| 2  | Upgrading training program   | Rp. 16,130,000/person/grade |
| 3  | Updating training program   | Rp. 1,083,125/certificate |
| 4  | Proficiency training program | Rp. 1,550,815/certificate |
| 5  | Revalidation of certificate proficiency | Rp. 490,000/certificate |

(Source: Poltekpel Surabaya 2020, author)

The tariff description from the table above is the average cost for education and training at politeknik pelayaran Surabaya. Furthermore, it is shown the amount of money needed for seafarers and the time consumed to obtain a seafarer certificate at the highest level.

| Seafarer Education and Training Certification | Cost       | Other expenses (living cost and transport) | Time                  |
|------------------------------------------------|------------|--------------------------------------------|-----------------------|
| Diklat pembentukan keahlian (Certificate Of Competance/COC) | Rp 54,060,167 | Rp 98,550,000 | 3 years               |
| Diklat peningkatan keahlian (Certificate Of Competance/COC) | Rp 48,390,000 | Rp 40,500,000 | 7 years 3 month       |
| Diklat Keterampilan (certificate of proficiency) | Rp 26,121,407 | Rp 540,000 | 6 day per certificate |
| Buku Pelaut                                  | Rp 100,000  | Rp 450,000 | 5 day                |
| Total                                        | Rp 128,671,574 | Rp 140,040,000 | 10.5 years          |

(Source: Poltekpel Surabaya 2020, author)
The table 4, shows that in order to obtain seafarer certification up to the highest level it requires training fees of Rp. 128,671,574,- and other costs Rp. 140,041,000,- in the fastest period of 10.5 years.

![Realization of Training Participants](image)

Figure 2 the number of seafarers’ graduates per year at Poltekpel Surabaya.

Follow the Figure 2, the number of training participants is varied and tends not to be maintained in annual numbers.

from the Tabel 5, it can be seen the data related to the minimum wage standard for seafarers :

| Position Level       | Dry Ship (GT 3000 - 20000) USD | Ship (Oil/Cemical/Gas Etc) GT 3000 - 20000 USD | Deck cadet | Engineer cadet | Able Deck | Able Engine | Bosun | Electrician | Radio officer | chief. Cook | third engineer | third officer | second engineer | second officer | first engineer | chief officer | Captain |
|----------------------|--------------------------------|-----------------------------------------------|------------|---------------|-----------|-------------|------|-------------|---------------|-------------|---------------|-------------|---------------|--------------|---------------|-------------|----------|
|                      |                                 |                                               |            |               |           |             |      |             |               |             |               |             |               |              |            |           |          |
| Engineer cadet       |                                 |                                               |            |               |           |             |      |             |               |             |               |             |               |              |            |           |          |
| Deck cadet           | 100                             | 200                                           | 1,487,800  | 2,975,600     |           |             |      |             |               |             |               |             |               |              |            |           |          |
| Able Deck            | 400                             | 500                                           | 5,951,200  | 7,439,000     |           |             |      |             |               |             |               |             |               |              |            |           |          |
| Able Engine          | 500                             | 600                                           | 7,439,000  | 8,926,800     |           |             |      |             |               |             |               |             |               |              |            |           |          |
| Bosun                | 800                             | 1,000                                         | 11,902,400 | 14,878,000    |           |             |      |             |               |             |               |             |               |              |            |           |          |
| Electrician          | 1,200                           | 1,500                                         | 17,853,600 | 22,317,000    |           |             |      |             |               |             |               |             |               |              |            |           |          |
| Radio officer        | 1,600                           | 1,900                                         | 23,804,800 | 28,268,200    |           |             |      |             |               |             |               |             |               |              |            |           |          |
| chief. Cook          | 2,000                           | 2,200                                         | 29,756,000 | 32,731,600    |           |             |      |             |               |             |               |             |               |              |            |           |          |
| third engineer       | 2,500                           | 2,800                                         | 37,195,000 | 41,658,400    |           |             |      |             |               |             |               |             |               |              |            |           |          |

(Source: ITF ILO Minimum Wage 2020, author)
The minimum wage in the Tabel 5 is the international standard recommended by the ITF ILO minimum wage scale [5].

4.2 Interview
Interview was conducted to obtain information from seafarers:
1. How do Indonesian seafarers apply for work?
2. How is the process for Indonesian seafarers to obtain the job vacancy information?
3. How do Indonesian seafarers choose the targeted job?
From those questions, the following business process diagram is obtained:

![Business process diagram for seafarers to work on board]

Following Figure 3 there are 14 steps that a sailor must take to be able to work on the ship, each stage in Figure 3 will be explained in table 6.

| No. | Description of activities                                                                 | Time      |
|-----|-------------------------------------------------------------------------------------------|-----------|
| 1   | Seafarers are looking for and applying for jobs by entering a curriculum vitae (CV) to companies that they know both digitally and manually and of course seafarers are already in a city where many shipping companies are domiciled so that seafarers also live temporarily in that city. | 3 month   |
| 2   | Shipping companies receive application files from seamen and when shipping companies need seafarers then | 10 minutes|
| 3   | The company contacted seafarers & offer jobs and requirements that must be met             |           |
| 4   | The shipping company calls the sailor to come to the company office by telephone           | 10 minutes|
| 5   | Seafarers come to the shipping company office and bring the required maritime documents     | 2 day     |
| 7   | Shipping companies verify seafarers' documents and when the documents match the company sets a schedule for interviews regarding time and place | 30 minutes|

Figure 3 General processes for seafarers to work on board
9. Face to face interview & Seafarers come to the specified interview location
10. Conducting interviews
11. Seafarers come to the shipping company office and sign the sea work agreement & (PKL) and submit maritime documents
12.
13. Seafarer go to the location where the ship is berth
   a. Transportation to the airport
   b. Air Transport
   c. Transportation to the inn
   d. Lodging
   e. Transportation to the port where the ship is berth

(Source: observation and interviews)

Follow the Figure 3 and table 6, seafarers carry out the process of looking for work and applying for jobs by visiting the companies they know one by one. So it takes extra cost and time to do it. Likewise seafarers do not know whether the company requires seafarers who meet their specifications or not. And by using this process the average seafarer costs more and takes more than 3 months to get a job on board.

5. Conclusion

Related to the problems of concern in this study, namely
1. The number of illegal seafarer certificates registered in the Indonesian seafarers database.
2. In Indonesia there is no official facility or institution that can receive complaints from seafarers regarding seafarers not receiving a salary.
3. Seafarers find it difficult to find work onboard.

from those problems finding, then the authors conclude that the problem is possible to solve by adopting a work system from the intelligence transport system (ITS framework) and the concept of data server decentralization (blockchain technology).

The following can be seen an overview of the intelligent transport system (ITS) architecture so that it is possible to be able to solve the problems in this study.

![Figure 4 ITS Framework Diagram][1]

Follow the Figure 4 where in the ITS architecture it accommodates user complaints or user needs so that it can bring together the needs of service providers and users. In data processing, data analysis is needed and one of the components in the ITS architectural framework is the data analysis method, it is called cost benefit analysis [1], [2], [4], [18].

Where the inter-stakeholder needs linkages can be seen in the following figure 5:
Following Figure 5 regarding the linkage of needs between stakeholders will be explained in the following table:

| Stakeholder who need it      | Education and training institution | Providers | Seafarer |
|-----------------------------|------------------------------------|-----------|----------|
| Education and training institution | 1. Share information related to the needs of each training institution.  
2. Share information regarding what matters are needed by international shipping companies so that sailors produced by training institutions can be accepted by shipping companies with pleasure. | 1. Training institutions require graduates to be accepted to work in companies.  
2. Training institutions require information related to the specifics of expertise and skills of seafarers expected by shipping companies | 1. Training institutions require training participants  
2. Education and training institutions need information related to data on seafarers who have met the requirements for education and training which are then offered to take education and training in their place |
| Shipping companies          | Shipping companies need seafarers whose competencies are legally certified and have a good educational record | 1. share information related to the needs of each company.  
2. share information related to services obtained from seafarers and training institutions. | Shipping companies require experienced seafarers |
| Seafarer                    | 1. Seafarers need education and training to improve their competence  
2. Share information with seafarers regarding the latest knowledge | Seafarers need a good and decent job | Share experiences and knowledge |

(Source: observation and interviews)

Follow the Figure 5 and Table 7 In the diagram of stakeholder needs, the linkage of needs between them can be accurately informed and communicated using the ITS architecture so that every stakeholder's needs can be easily and quickly met.
Furthermore, related to the data obtained from this research will be used as follows:

1. Follow the data in Tables 3 and 4 are used for:
   a. Calculating times and costs required by seafarers to obtain certification to the highest level;
   b. Calculating seafarers' losses with widespread falsification of seafarer certificates.
2. Follow the Figure 2 shows that it is difficult to maintain the number of training participants so that the difference in numbers is much different from the previous year. In addition, the use of ITS architecture will make it possible for education and training institutions to be able to find sailors who have met the requirements to take training.
3. Follow the data in Table 5 is used to calculate how much currency exchange in one year is contributed by seafarers who receive US dollar wages so that it can be seen how much the state loses through foreign exchange earnings from the export of seafarers.
4. Follow the Figure 3 and the Table 6, the process of seafarers looking for and applying for jobs is very long, so it takes extra cost and time to do it. Likewise seafarers do not know whether the company requires seafarers who meet their specifications or not. It is also discovered that by using this process the average seafarer costs more and takes more than 3 months to get a job on board. Then using the telematics architecture is expected to shorten and make it easier for seafarers to obtain job vacancies and submit the applications.

Acknowledgment

The first author is thanks to the Ministry of Transportation, Human Resources Development of Sea Transportation Center.

References

[1] www.frame-online.net European ITS Fram ework Architecture, and the FRAME projects.
[2] Mikulski, Jerzy. 2010. Using Telematics in Transport.
[3] The Baltic and International Maritime Council (BIMCO). Manpower report 2015 executive summary.
[4] Nugroho, Setyo. 2018. Intelligent Transportation Architecture to Address Challenges of Traditional Shipping Operations (PELRA).
[5] International Labour Organization (2020). Recommended minimum wage for an AB – extra rates applicable from 1st January 2020.
[6] International maritime organization (IMO). Standard training certification of seafarer (STCW) 2010 as amendment.
[7] Kusumak Candra Ade. 2018. Manajemen Pengawakan Pelaut Kapal Niaga dan Tanggung Jawab Perusahaan Keagenan Awak Kapal.
[8] International Labour Organization (ILO). Maritime labour convention 2006.
[9] https://wartakota.tribunnews.com Retrieved 25 June 2020.
[10] https://pdppsdmpl.bpsdm.dephub.go.id Retrieved 4 January 2020.
[11] https://www.itseafarers.org Retrieved 17 August 2020.
[12] https://www.pelaut.club Retrieved 25 August 2020.
[13] https://pelaut.dephub.go.id Retrieved 8 February 2020.
[14] Badan Pengembangan Sumber Daya Manusia Perhubungan, PK.07/BPSDM-2016 Tentang Kurikulum Pendidikan Dan Pelatihan Pembentukan Dan Peningkatan Kompetensi dibidang Pelayaran.
[15] Kementerian Perhubungan, PM 70 Tahun 2013 Tentang Pendidikan dan Pelatihan, Sertifikasi Serta Dinas Jaga Pelaut.
[16] Kementerian Perhubungan, PM 140 Tahun 2016 Tentang Perubahan Atas Peraturan Menteri Perhubungan Nomor PM 70 Tahun 2013 Tentang Pendidikan dan Pelatihan, Sertifikasi Serta Dinas Jaga Pelaut.
[17] Kementerian Perhubungan, PP No. 07 Tahun 2000 Tentang Kepelautan.
[18] Williams B 2008 Intelligent Transport Systems Standards (ARTECH HOUSE, INC: Norwood).
[19] Sugihardjo. 2020. Pemberdayaan SDM dan Peluang Karir Pelaut di Sektor Kamaritiman. Jakarta: webinar Indonesia maritime club discussion series #18.