

# Analysis of training programmes and education schemes for skills development on marine transport

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**Abstract.** The more important and global role the marine transportation has taken nowadays, suggests that a larger number of skilled workforce are currently in demand. New technologies and efficient information management creates an opportunity for better service, more reliable operation and profit. This paper mainly analyses the current situation with skills development and education schemes for marine transportation in different countries. Statistical data from sample countries were collected and compared through different management levels, education forms and job groups. The conclusions of the paper show that the available training schemes and education programmes for skills development on marine transport are unsatisfactory in the countries under study. For the marine industry to ensure a steady growth in a long run, improvements in the current skills development schemes supported by the deployment and implementation of advanced technology in the future are needed.

**Keywords:** Management levels, strategic, tactical, operational, training programmes, university education, marine transport, skills development.

## INTRODUCTION

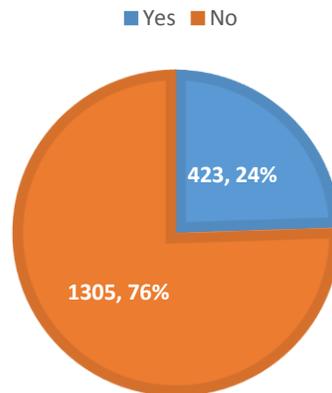
Due to globalisation and internationalisation, transportation has become one of the key components of global economic growth. Generally, the transport requirements of moving people and freight in Europe as well as in many other countries are more pressing than ever before Banister *et al.* (2000). The transport industry provides more than 4.6% Gross Domestic Product (GDP) in European countries. In addition the manufacturing of transportation equipment represents 1.5% employment (Statistical Office of the European Communities, 2011). Not just for Europe, transport development affects globalization hence every countries' and citizens' life in a long term. To keep up with such developments governments need to concentrate their efforts on developing and launching training schemes to support transport education and skills development for the entire sector.

Cannon *et al.* (2019) developed a study with the aim to

gain a better understanding of existing training schemes, programmes and courses for rail and to also identify potential gaps in the availability of training schemes and programmes in the entire rail sector across different sample countries, primarily from Europe. The findings suggest that apprenticeships and other schemes for skills development for job categories in the operational management level were the least provided training schemes overall. In contrast, skills development for job categories in the strategic and tactical management levels in the rail sector has more university-based and academic schemes available.

Uliyanov *et al.* (2019) analysed the existing training programmes and schemes for road transport primarily in Europe, but additionally Australia was also added in their studies. After having collected a comprehensive data a number of countries for different job categories in road transport, a comparison of results revealed a vast diversity

## NUMBER OF ALL **AVAILABLE** TRAINING SCHEMES AND PROGRAMS



**Figure 1.** Number of all education programmes.

and lack of standard in skills development for road transport. Ulianov *et al.* (2019) did not identify any evidence for any harmonised procedure and best practices in skills development for road transport. Instead they reported that each country has developed and implemented training programmes and courses for a specific audience, targeting a specific learning outcome.

This paper looks at available resources for developing skills and knowledge in marine transport. Specifically we are looking at the current situation of marine transport training schemes in 12 different countries. One of the main challenges faced by marine transport is the demand for new employees, followed by the skills reinforcement of the current marine workers to meet the requirement of a rapidly growing and modernising sector (Dijkgraaf *et al.*, 2009).

The objective of this paper is to review the existing knowledge re-sources and skills development programmes, and to critically analyse the potential trends for skill development in marine transport. We mainly discuss a number of marine transport training programmes with the aim to understand the current trends of marine education structure, and organise a comparison of training programmes targeting different job categories in marine transport.

### METHODOLOGY

The methodology in this study follows the approached employed by Cannon *et al.* (2019) and includes data collection for existing training schemes for a number of job categories in various management levels using excel spreadsheets followed by statistical analyses. Specifically templates have been developed to collect information about the targeted training programmes. Information collected has been analysed through the three

management levels of transport planning (operational, tactical and strategic), considering six education fields/types (College, University, Professional Training, Apprenticeships, Vet&Cvet (vocational education and training) and Other) and 6 job categories/groups (“Shipping Line & Agency Job”, “Supply Chain/Logistics/Transport”, “Shipping Operations”, “Chartering, Brokering and Research”, “Legal/Insurance” and “Marine Recruitment”). There are 144 variables in one Excel spreadsheet. We produced one spreadsheet for each country included in this study.

The information collected is coded as YES or NO for each answer. Next, for transforming the nominal answers to numerical statistics, YES was gathered as 1 and NO was gathered as 0.

For a sample of 12 countries, Figure 1 demonstrates that among all three management levels, we collected 423 positive responses vs 1305 negative responses. That is to say that 24% of all possible variables have a YES answer.

The information about marine training programmes were collected for the following 12 countries: Australia, Belgium, Bulgaria, China, Germany, Greece, Ireland, Netherlands, Portugal, Slovakia, Spain and United Kingdom.

Figures 2 and 3 illustrate the number and percentage of training schemes and programmes in all fields among different countries. The red line is the average number on all levels. From Figure 2, we can see that Greece offers most training programmes in marine transportation: 84, while Portugal provides the fewest: 8.

### Management levels

The information sample data collected for the existing training programmes in marine is organised into the three

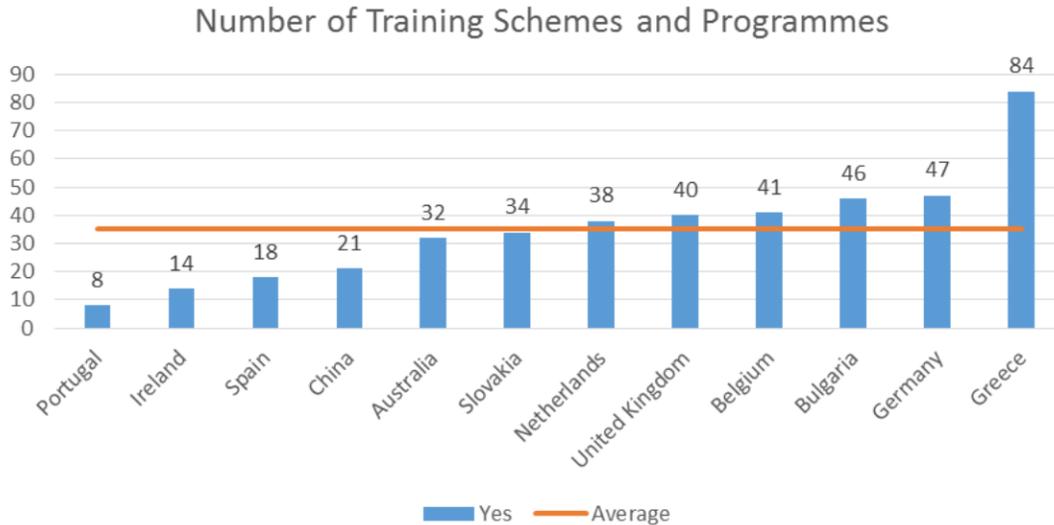


Figure 2. Education programmes demonstrated in country categories.

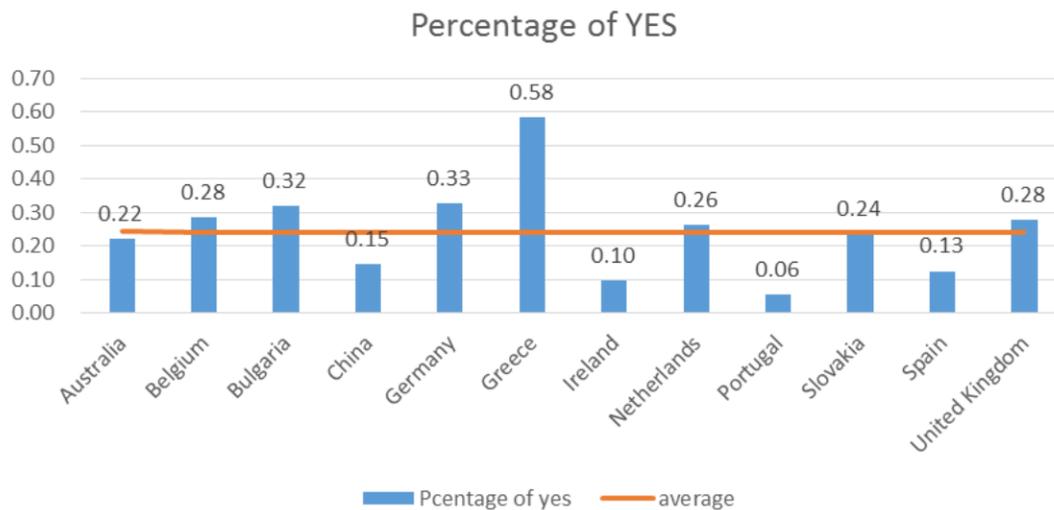


Figure 3. Yes answer percentage in sample countries.

management levels Strategic, Tactical and Operational (Marinov *et al.*, 2013).

- 1) Strategic mainly concerns long term developing of specific transportation mode, which containing the resource assessment, strategic adjustment of operating structure, reconstruction and relocation of the transportation facilities. Decisions made in this level set the objectives of transport operating.
- 2) Tactical means a medium-term consideration of the transport mode, all the plans and schedules are made in this stage. Generally speaking, tactical planning is to guarantee an effective arrangement over a medium-term to improve the transportation system performance.
- 3) Operational means short-term planning, which might be implemented in the same time of service delivery. A

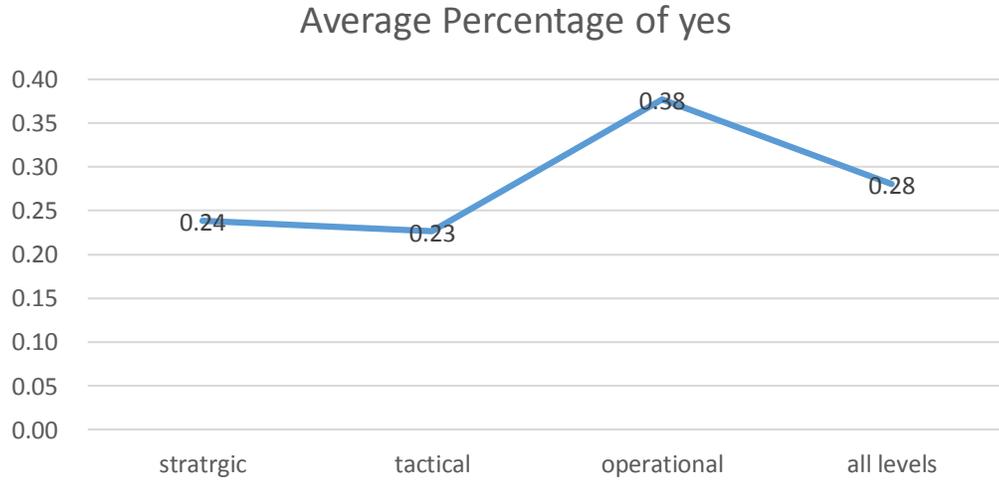
“day-to-day” policy is executed for the timetable planning to improve the service efficiently (Friedlaender and Spady, 1981).

**Distribution amongst management levels**

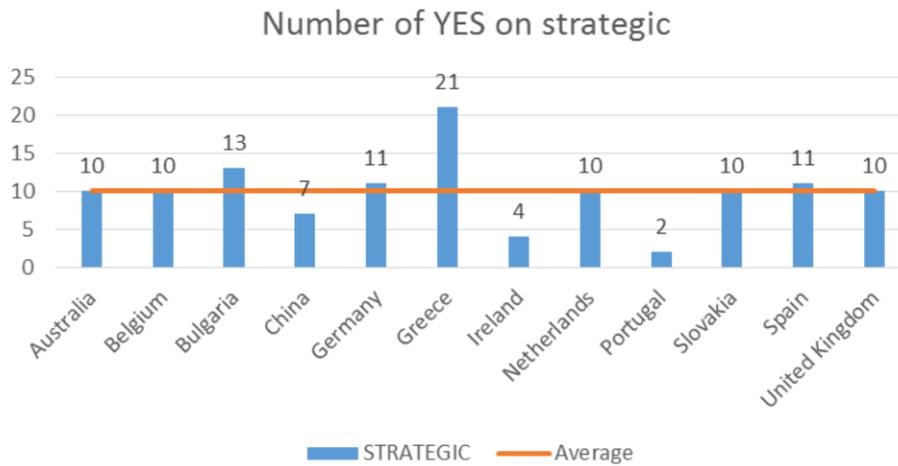
Figure 4 shows that most training programmes are provided for “operational” level as the average percentage of YES-answer is 38%.

**“Strategic” level**

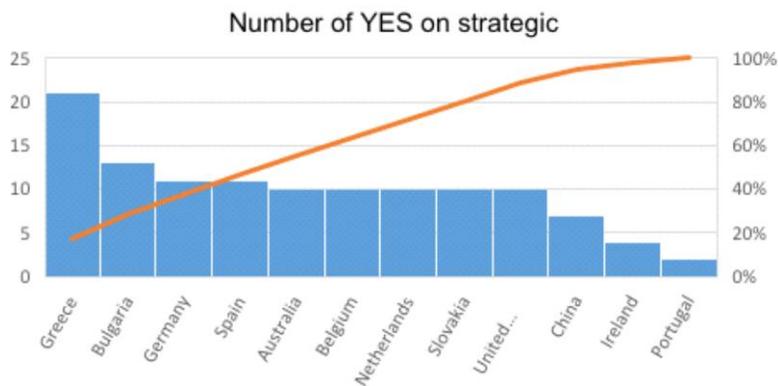
For Strategic, Figures 5 and 6 show the number of “YES” answers in all 12 countries. Specifically Figure 6 shows



**Figure 4.** Distribution amongst management levels.



**Figure 5.** “Strategic” level distribution among different countries.



**Figure 6.** Strategic: Numbers and percentage of programmes.

the data of different countries in descending order; the red line is the Pareto line to describe the characteristics of data distribution. Greece owns the most training

schemes, 21, when Portugal has the least programmes, 2. The red line in Figure 5 shows the average number of YES answers in Strategic with a value of 10.

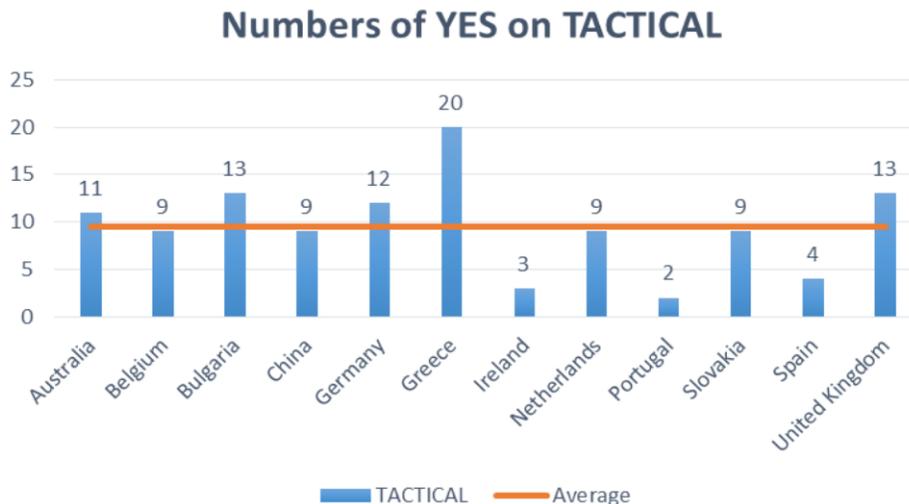


Figure 7. “Tactical” level distribution among different countries.

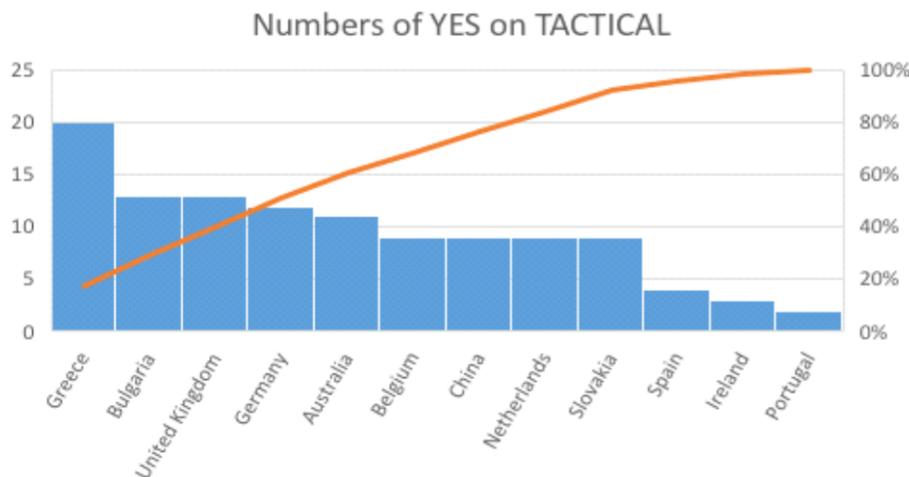


Figure 8. Numbers and percentage of tactical program.

**“Tactical” level**

Figures 7 and 8 describe the data and percentage distribution for the 12 sample countries on “Tactical” management level. It can be seen that Greece has the most marine training programmes of 20 and Portugal owns the least marine scheme of 2. The average “YES” answer of “Tactical” level is 9.5 in each country.

**“Operational” level**

Figures 9 and 10 show the statistical results of “YES” answers for “Operational” level. Greece owns the maximum number of YES-responses, 43, where Spain owns the minimum number of YES-responses, 3, which means Greece still has the largest part of marine training programmes amongst all the 12 countries. Figure 9 also

shows that the average education scheme number for “Operational” level in each country is 15.83.

**Education fields**

Different categories of education fields are identified within the 3 management levels, which means each management level has same 6 subcategories of different education title. The fields of education include: College, University, Professional Training, Apprenticeships, Vet&Cvet (vocational education and training) and other.

**Distribution amongst fields of education**

Figures 11 and 12 show that the most training programmes are provided by Universities, 44%, and the

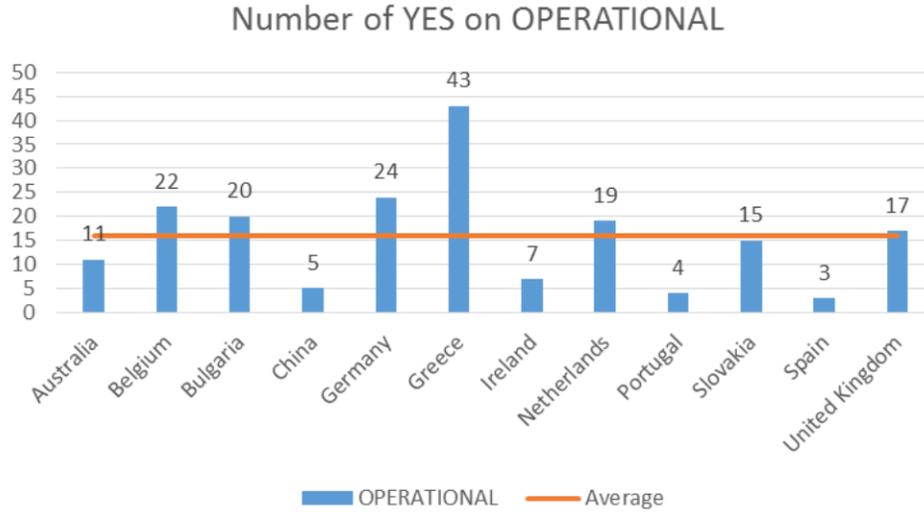


Figure 9. “Operational” level distribution among different countries.

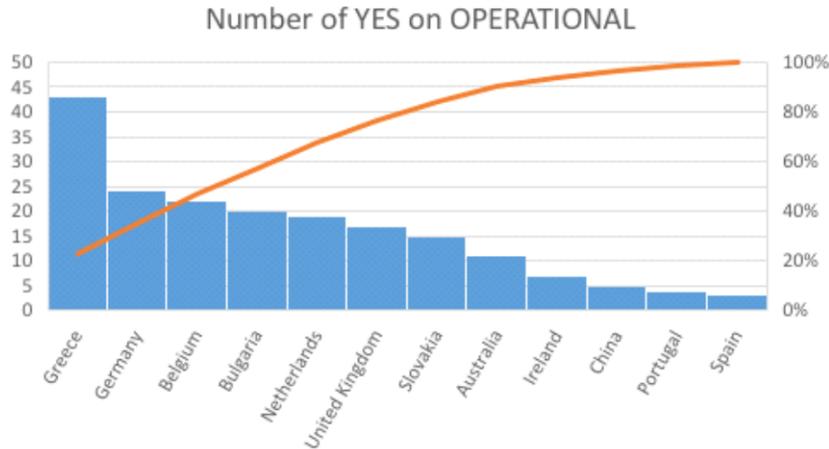


Figure 10. Numbers and percentage of operational program.

least programmes are offered as Apprenticeships, 2%. Professional Training provides 81 programmes in marine transport, or 19%, followed by College, 15% and Vet&Cvet, 12%. Some 8% of training schemes are provided by other sources of skill development.

**Distribution of education categories within management levels**

Figure 13 describes the distribution of all marine transport programmes and training schemes over the 3 management levels. Like Figure 4 demonstrated, the programmes for “Operational” level take the largest percentage, 45%, followed by “Strategic” level, 28% and “Tactical” level, 27%.

The distribution training programmes amongst the 3 management levels is demonstrated in Figure 14. On

Strategic level, fewer courses are provided by education fields of Vet&Cvet, Other and Apprenticeships. Apprenticeships own the lowest number of training programmes, 2. More courses are provided by University, Professional Training and College, it appears that University owns the most courses, 52.

On Tactical level, fewer programmes are supplied by Vet&Cvet, Other education fields and Apprenticeships. The most programmes are provided by university as 50, then followed by Professional Training of 22 and College of 18. On Operational level, the most courses are provided by University, which is more than twice of the Professional Training programmes. The fewer courses are provided by College (29), Vet&Cvet (23), Other (15) and Apprenticeships (4).

Figure 15 illustrates that on Strategic level, University courses take the largest percentage, 44%, then followed by the Professional Training, 19%, College, 15%,

### DISTRIBUTION OF EDUCATION CATEGORIES

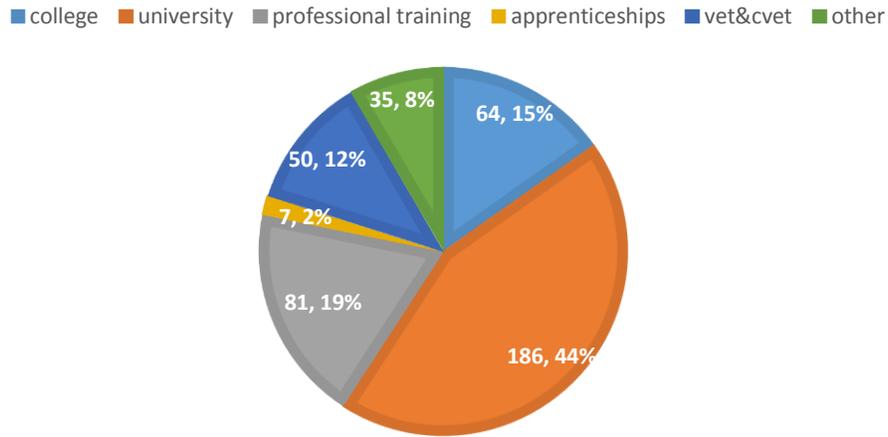


Figure 11. Program distribution among education fields (1).

### DISTRIBUTION OF TRAINING SCHEMES AND PROGRAMMES AMONGST FIELDS OF EDUCATION

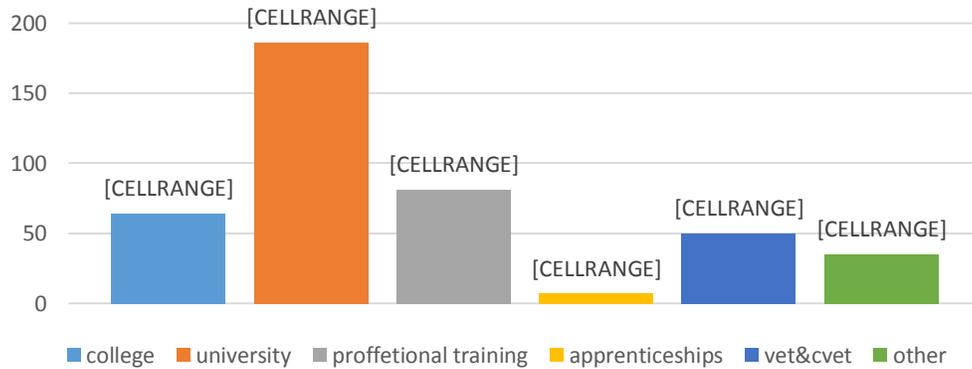


Figure 12. Program distribution among education fields (2).

### DISTRIBUTION OF TRAINING SCHEMES AND PROGRAMMES AMONGST MANAGEMENT LEVELS

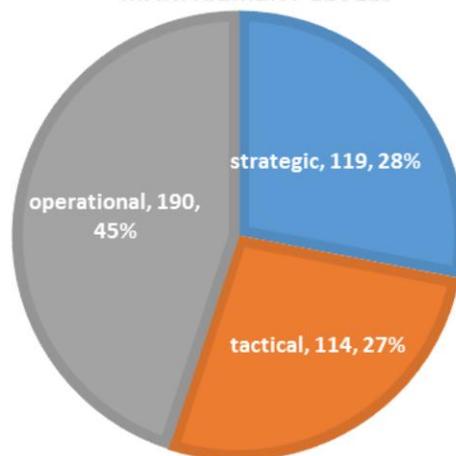
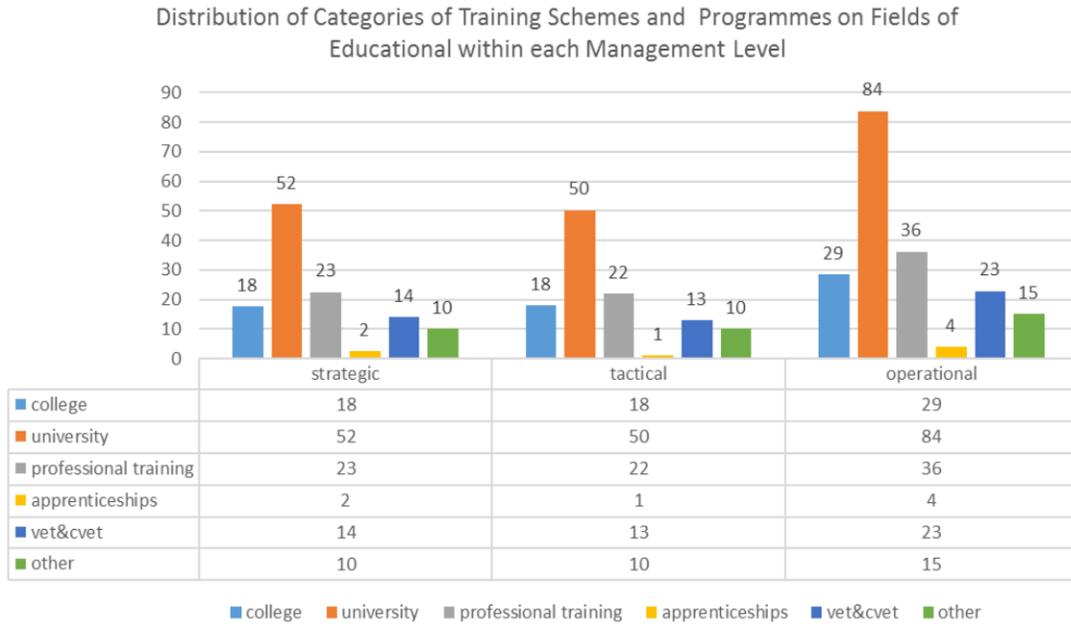
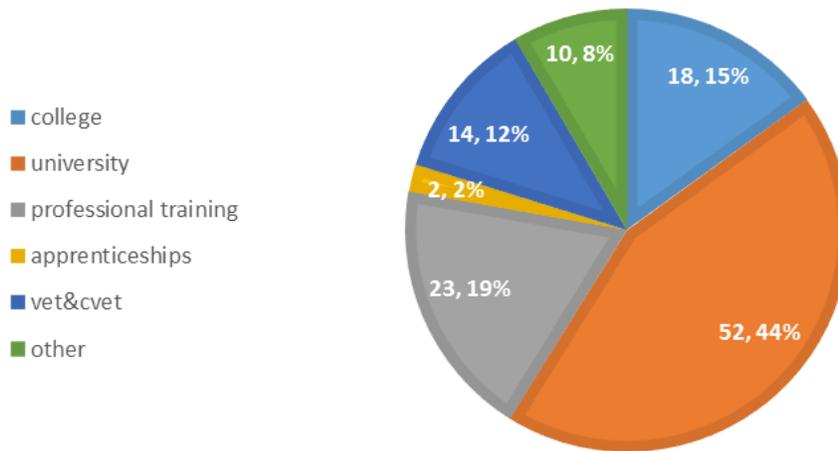


Figure 13. Management level distribution.



**Figure 14.** Education field distribution among management levels.

**DISTRIBUTION OF TRAINING SCHEMES AND PROGRAMMES  
WITHIN THE MANAGEMENT LEVEL STRATEGIC**



**Figure 15.** Education fields distribution in strategic level.

Vet&Cvet, 12% and Other Courses, 8%. The Apprenticeships field takes the least part, of only 2%.

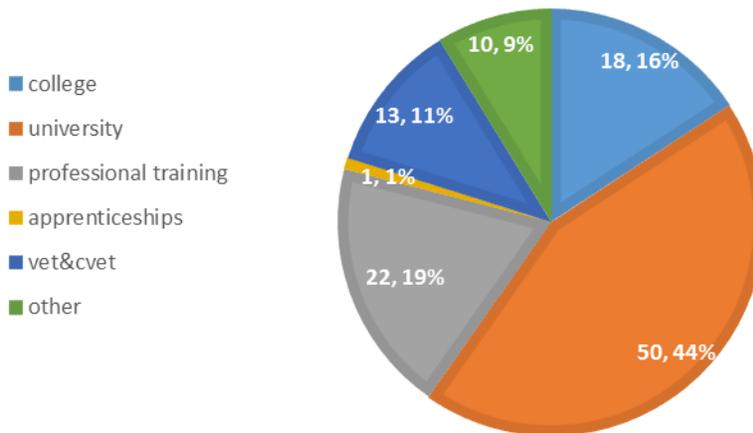
Figure 16 shows that in Tactical level, the largest part of marine transport programmes is provided by University, 44%; the courses of Professional Training, College, Vet&Cvet, Other and Apprenticeships take 19, 16, 11, 9 and 1%, respectively.

Figure 17 shows the education courses percentage in operational level that University programmes takes the largest part, 44%, which is followed by Professional Training, 19% and College, 15%. Both Vet&Cvet and

Other take a share of 12 and 8% separately. The Apprenticeships field takes the smallest percentage, 2% among all education fields.

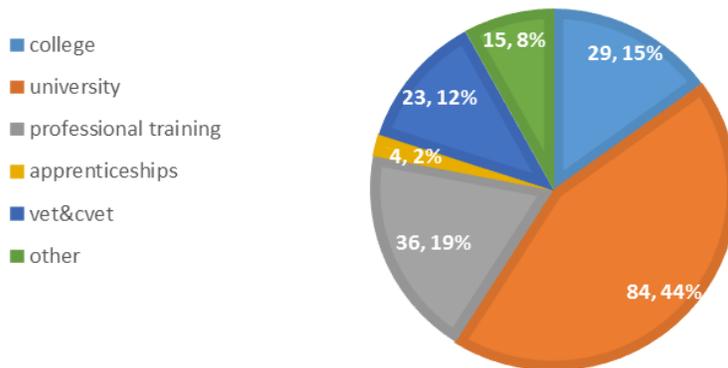
Figures 18 and 19 discuss the management level distribution in different education fields. It can be seen from Figure 18 that the programmes on Operational level always take biggest part in all education fields. Tactical level courses take the smallest part. In University field, the number of Operational courses reaches 84. Figure 19 added the management level course number in different education categories, which can describe the data in the

**DISTRIBUTION OF TRAINING SCHEMES AND PROGRAMMES WITHIN THE MANAGEMENT LEVEL TACTICAL**



**Figure 16.** Education fields distribution in tactical level.

**DISTRIBUTION OF TRAINING SCHEMES AND PROGRAMMES WITHIN THE MANAGEMENT LEVEL OPERATIONAL**



**Figure 17.** Education fields distribution in operational level.

two subcategories more intuitively.

**Job groups**

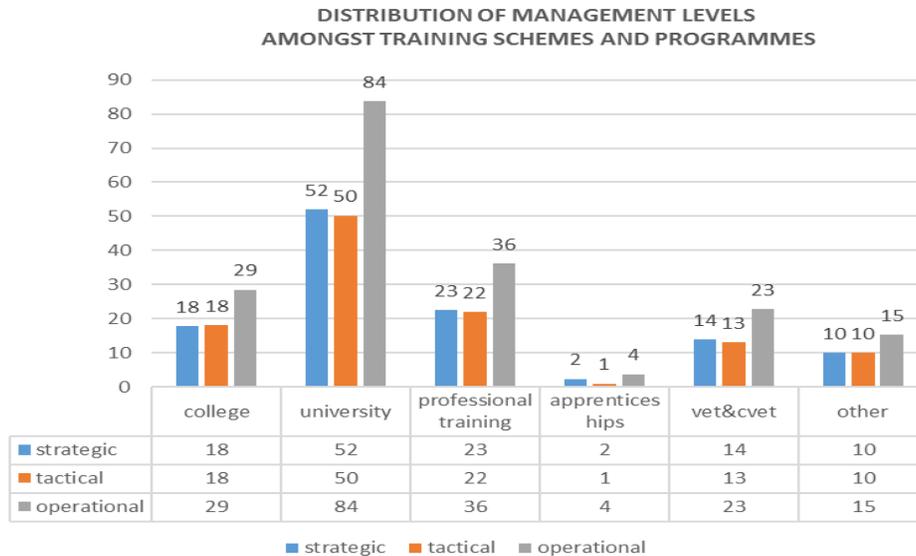
Amongst each management levels, the categories of job groups are designed for marine transportation. The job matrix contains: “Shipping Line & Agency Job”, “Supply Chain/ Logistics/ Transport”, “Shipping Operations”, “Chartering, Brokering and Research”, “Legal/ Insurance” and “Marine Recruitment”.

**Distribution amongst job groups**

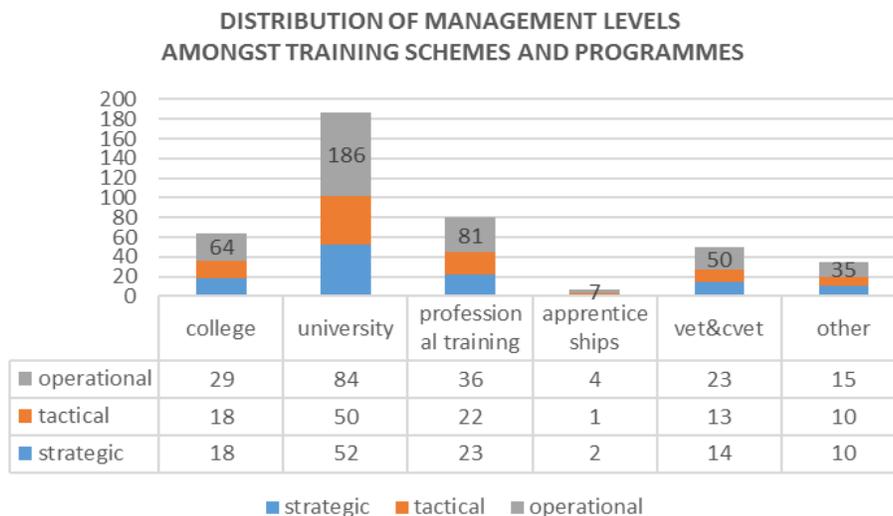
Figure 20 illustrates the relationship between job groups

and management levels. As Operational level takes biggest part of the three management levels, in each job category the Operational level also is the predominant level type. From Figure 20 it can be roughly estimated that the Marine Recruitment Job title owns the most training program of marine transportation.

Figure 21 is made to research the job group distribution in percentage. Marine Recruitment takes the largest percentage, 21% (89 programmes) in job categories, followed by Supply Chain/Logistics/Transport, 20% (85 programmes). The Shipping Line & Agency Job, Shipping Operations and Legal/Insurance take percentages of 17% (69 programmes), 16% (68 programmes) and 14% (59 programmes) separately. Chartering/Brokering/Research category owns the least training schemes, 52, and takes the share of 12% in total.



**Figure 18.** Management level distribution among education fields (1).



**Figure 19.** Management level distribution among education fields (2).

To analyze the data through job groups, management levels and education fields in a more specific way, the job categories Supply Chain/Transport and Marine Recruitment are taken as examples to illustrate the marine transportation training distributions. The data distributed in management levels and education fields in each example job group are concluded and made as bar charts.

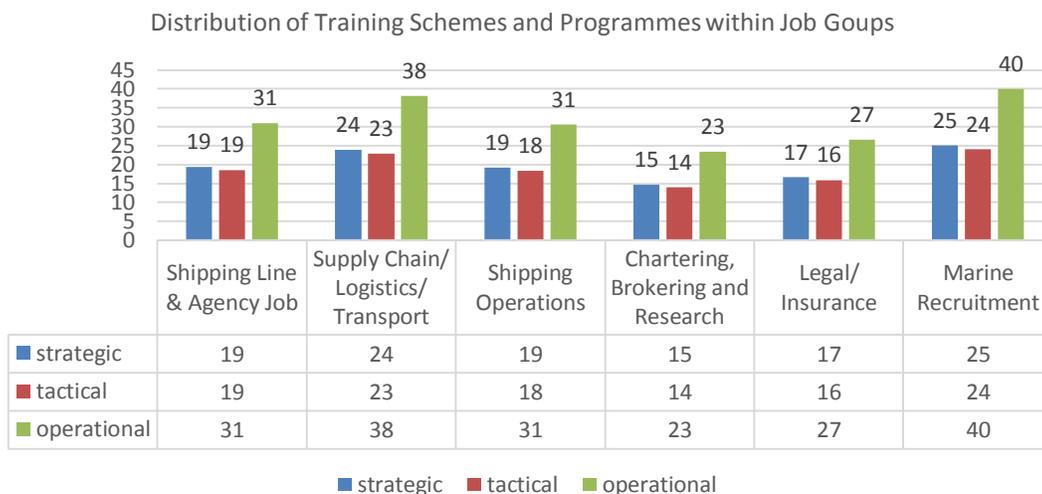
**Job group “Supply chain/ logistics/ transport”**

In Supply Chain/Logistics/Transport job category, the data among management levels and education fields are described in Figure 22. On the strategic level, most

courses are provided by Universities, 10, fewer courses are supplied by Professional Training, College and Vet&Cvet5, 4 and 4 respectively. Apprenticeships field provides no programmes for the Supply job category on Strategic level.

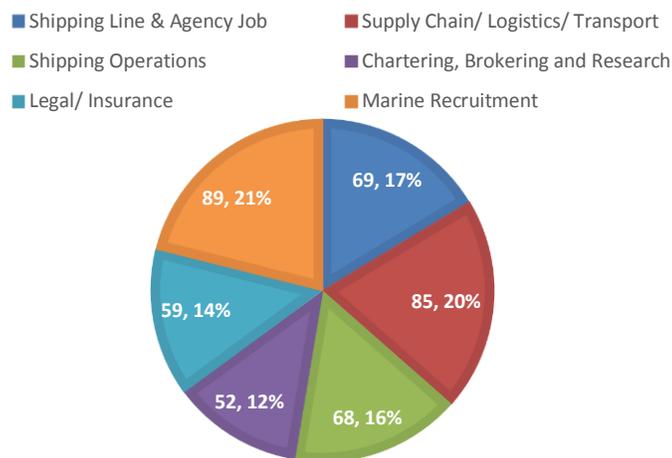
On Tactical level, fewer programmes are provided by Professional Training, College and Vet& Cvet as the same number of 4. University field provides the most schemes, 10 and Apprenticeships field provides no courses in this subcategory.

On Operational level, University field supplies the most programmes, 19, which is followed by the Professional Training courses, College courses and Vet& Cvet courses 7, 6 and 6 separately. Programme provided by other is just 1 and Apprenticeships field provides no



**Figure 20.** Management level distribution among job groups.

**DISTRIBUTION OF TRAINING SCHEMES AND PROGRAMMES WITHIN JOB GOUPS**



**Figure 21.** Job groups training schemes distribution.

courses.

Figure 23 shows the distribution of different management level programmes in different education fields. Operational level programmes takes the largest part in each education field, as 6, 17, 7, 6 and 2 in College, University, Professional Training, Vet&Cvet and Other respectively. Both Tactical level and Strategic level show similar figures in each education category as 4, 10, 4(5), 4 and 1. None of the three management levels showed Apprenticeships.

**Job group “Marine recruitment”**

Figure 24 shows the data of education programmes

within different management levels in Marine Recruitment job group.

On Strategic Level, University provides most training programmes, 7. Fewer courses are supplied by Vet&Cvet, Other, College and Professional Training, 4, 4, 3 and 3 separately. Apprenticeships just provide 1 training course of the Marine transportation of Marine Recruitment. The programme distributions at Tactical and Strategic levels show the same pattern.

On Operational Level, most programmes are provided by University, 16, which is followed by the Vet&Cvet, Other, Professional Training and College 8, 8, 7 and 6 respectively. Apprenticeships operates the least programmes on this level, only 2.

The distribution of different management level

### Distribution of Education Categories in Job Group "Supply Chain/Logics/Teansport", all Countries

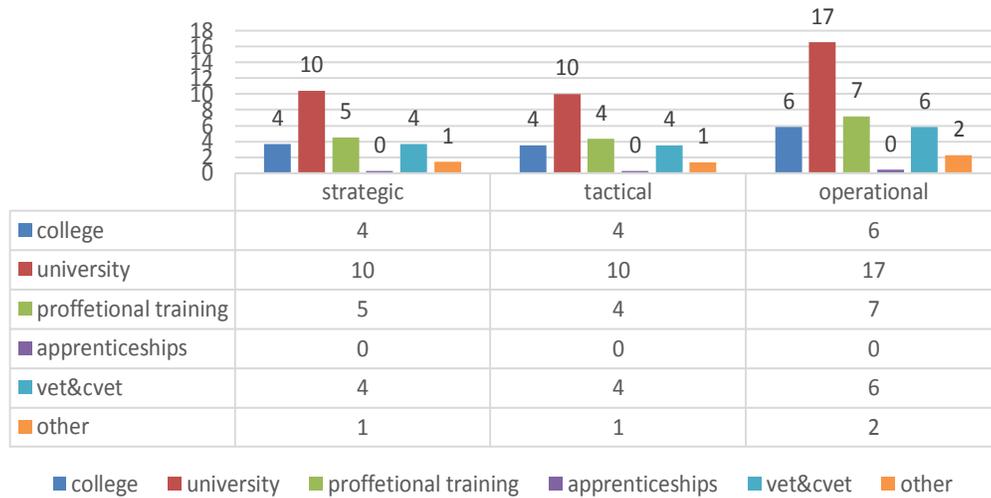


Figure 22. Education fields programmes distribution within management levels.

### Job Group "Supply Chain/Logics/Teansport": Distribution of Training groups in Education Categories

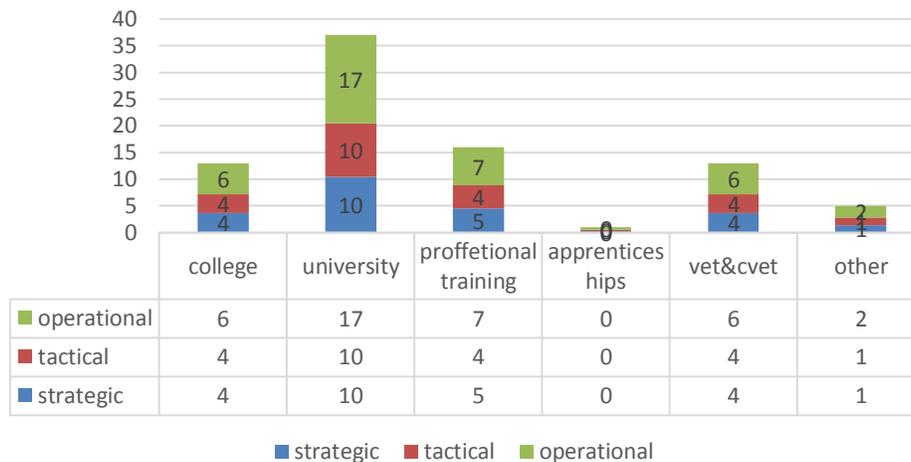


Figure 23. Management level programmes distribution within education fields.

programmes within different education fields in Marine Recruitment is demonstrated in Figure 25. The Tactical level and Strategic level courses own the same structured distribution as University, Vet&Cvet, Other, College and Apprenticeships providing 7, 4, 4, 3, 3 and 1 programmes respectively. The Operational level programmes take the biggest part in each education field, 16, 8, 8, 7, 6 and 2 separately.

To conclude, in the job group of Marine Recruitment, programmes for job categories at Operational level take the largest percentage of 52% (46). It is followed by programmes for Strategic as 25% (22) and programmes for Tactical as 23% (21) (Figure 26).

## CONCLUSIONS

This study discussed the marine transportation training programmes within 12 countries (Australia, Belgium, Bulgaria, China, Germany, Greece, Ireland, Netherlands, Portugal, Slovakia, Spain and United Kingdom), considering the three management levels of transport planning (Operational, Tactical and Strategic), six education fields (College, University, Professional Training, Apprenticeships, Vet&Cvet (vocational education and training) and Other) and six job groups ("Shipping Line & Agency Job", "Supply Chain/ Logistics/ Transport", "Shipping Operations", "Chartering, Brokering

Distribution of Education Categories in Job Group "Marine Recruitment", all Countries

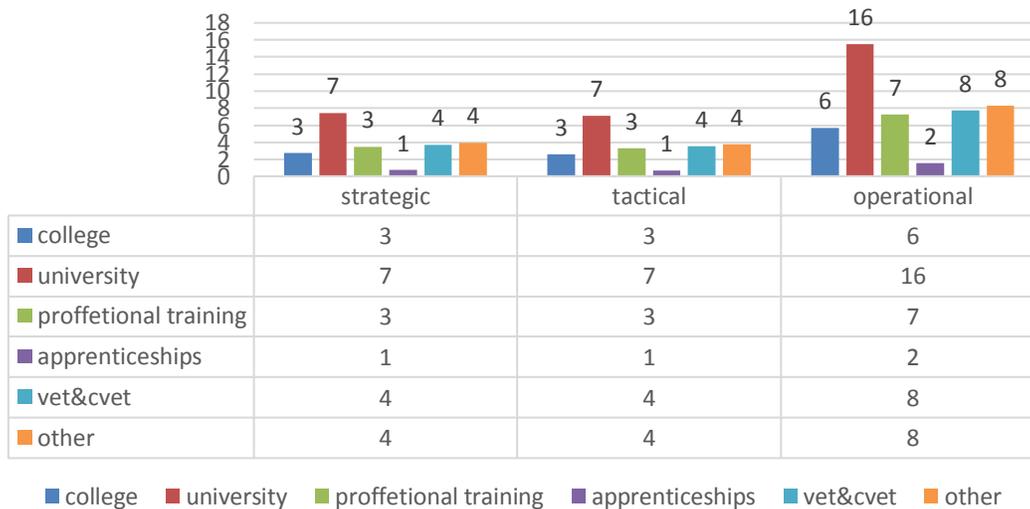


Figure 24. Education programmes: Distribution within management levels.

Job Group "Marine Recruitment":  
Distribution of Training groups in Education Categories

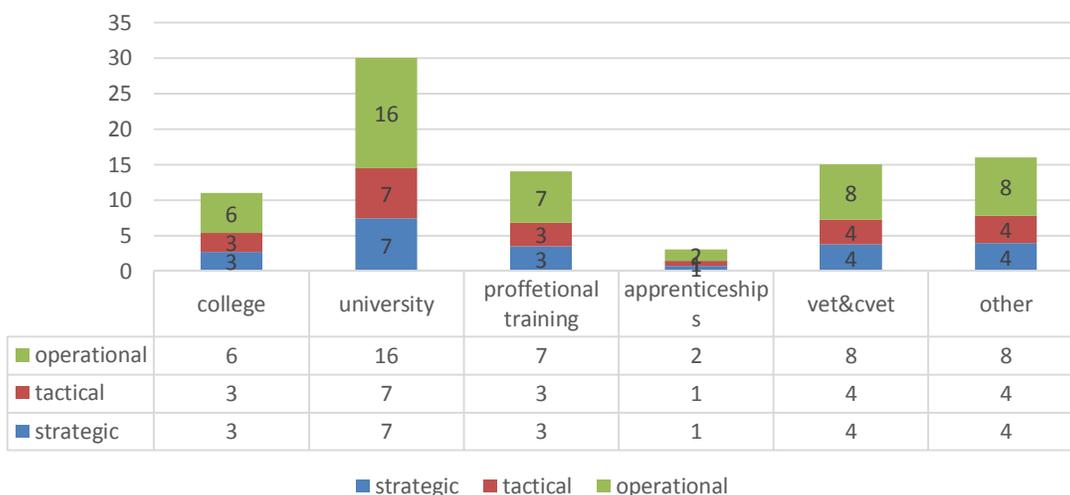


Figure 25. Programme distributions within education fields per management level.

and Research”, “Legal/ Insurance” and “Marine Recruitment”).

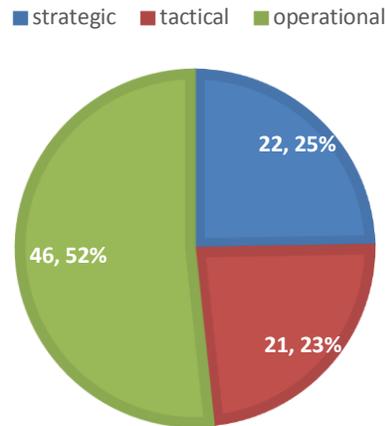
In the countries’ analysis, based on the data set collected Greece offers the most marine training schemes and programmes and provides a variety of degree programmes delivered by different education institutions that are suitable for different job categories for the entire sector.. Especially at Operational Level, many universities offer relevant training courses for different job categories. However, the apprenticeships is not popular for all management levels. Spain provides the least

training schemes for marine education amongst all the sampled countries. At the Operational Level, for vessel operators there are only two opportunities provided by Spanish University.

As for all three management levels, it appears that all the countries offer more courses on Operational Level. The training programmes at Strategic and Tactical have similar distribution structure. In each education field, the courses at Operational level take the largest part of marine transportation training.

University education for job categories for marine

JOB GROUP "MARINE RECRUITMENT":  
DISTRIBUTION AMONGST MANAGEMENT LEVELS



**Figure 26.** Management level distribution in marine recruitment.

appears to be the predominant institute which provides the most training programmes for skills development. Apprenticeship field has low supply of marine education programmes. The programmes of different job groups have relatively uniform distribution, with a largest share of 21% (Marine Recruitment) and a lowest share of 12% (Chartering/Brokering/Research).

The marine transport education systems in most countries under study appear to be unsatisfactory to support the labor demand as it stands at the moment. As mentioned in Ribeiro *et al.* (2007), the working population is expected to age and shrink, and as a result the shortage of working force in marine transportation will limit the growth and development of marine markets. To face the future challenge of employment, the education resources need to be improved to support the sustainable development of more skilled workforce. The training schemes need to be more focused on both global knowledge and strategic skills development, thus more comprehensive university degrees and innovative training schemes on different education fields and levels need to be set and developed.

## ACKNOWLEDGEMENT

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## REFERENCES

- Banister D, Akerman J, Stead D, Nijkamp P, Dreborg K, Steen P (2000). European transport policy and sustainable mobility. Taylor & Francis.
- Cannon C, Marinov M, Robinson M (2019). Data analysis of current and emerging skills development and training schemes in the rail transport sector. J. Edu. Res. Rev. 7(3):57-75.

Dijkgraaf E (2009). Investing in the future of jobs and skills: scenarios, implications and options in anticipation of future skills and knowledge needs: sector report other services. European Commission.

Friedlaender AF, Spady RH (1981). Freight transport regulation. MIT Press Cambridge, Mass.

Marinov M, Şahin I, Ricci S, Vasic-Franklin G (2013). "Railway operations, time-tabling and control," Research in Transp. Econ. 41(1):59-75.

Ribeiro SK, Beuthe M, Kobayashi S, Gasca J (2007). "Transportation and its infrastructure."

Statistical Office of the European Communities. (2011). EUROSTAT: Employment of Transport Industry. Available: <http://ec.europa.eu/eurostat>.

Ulianov A, Marinov M, Robinson M (2019). An evaluation of training courses and programmes in various management level job categories for road transport: A quantitative data analysis. J. Edu. Res. Rev. 7(2):31-56.