KEY PERFORMANCE INDICATORS (KPI) FOR EVALUATING ECONOMIC EFFICIENCY OF GENDER POLICIES IN SHIPPING COMPANIES WITH MIXED CREWS

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ABSTRACT

The performance of a business can be measured on the efficiency of processes developed within. This article proposes 55 Key Performance Indicators (KPIs) that can be used as effective measurement indicators for evaluating economic efficiency of shipping companies on shore with mixed crews, as well as efficiency of mixed crews on board a vessel. The KPIs were proposed, assessed, validated and re-assessed through a four-stage research methodology within the GECAMET transnational project. The results of the research provide useful quantitative and qualitative tools for evaluating the performance of the shipping companies, considering the perspective of shipping gendering. The approach of establishing particular KPIs for gendering shipping and mixed crews is so far the first ever made. Also provided in the article is a classification of the proposed KPIs in categories related to financial costs, time costs, health & safety, education, and social**.**

Keywords: *gender, management, female seafarer, crewing, assessment, benchmark*

1. INTRODUCTION

This article presents a part of the on-going research developed within the transnational project Gender Equality and Cultural Awareness in Maritime Education and Training (GECAMET), funded between 2017-2018 by the International Association of Maritime Universities (IAMU) and the Nippon Foundation.

In order to face the competitive environment in the maritime industry, shipping companies should update their HR policies by making them gender-friendly and by ensuring gender equality and cultural awareness on board their ships. The appropriateness of a gender policy can be measured by the management of a company through the metrics of Key Performance Indicators (KPIs), a tool used in performance measurement and holistic performance evaluation to make important strategic decisions. Overall, KPIs help management representatives to make important strategic decisions and to strive for the best position and benchmarking.

The aim of the research is to offer to shipping companies a useful tool for evaluating the effects of gender policies implementation. This is an original approach on establishing effective measurement indicators for evaluating economic efficiency of shipping companies with mixed crews. The research is relevant for knowledge advancement in the domain of performance management. The established KPIs can be used for further research analysis, scaling and validation.

2. RESEARCH METHODOLOGY

The gender KPI study started since 09-14 May 2017 when a consistent number of KPIs were proposed and discussed during three working meetings and discussion sessions organized within the GECAMET project, in Constanta, Romania, at the headquarters of Constanta Maritime University, with 10 transnational researchers of the GECAMET project from nine maritime education and training institutions across five continents. In the first stage of the study, the researchers had contributed to the discussions personally or through the online conference system in identifying an appropriate KPI database using their diverse and complementary professional experience cumulated in: efficiency assessment of shipping companies, professional expertise regarding multicultural (mixed) business work environments in both on shore and off shore business, experience in intercultural coaching, training and consultancy, organizational anthropology, study of the cultural differences and scientific expertise on performance and multicultural vessels.

The second stage of the research consisted of the assessment of the KPIs previously proposed, through 10 interviews made face to face and by phone with stakeholders from the maritime industry, namely crewing, shipping and ship management companies.

The third stage was represented by the comprehensive literature review on KPIs met in shipping and in other sectors, gender, shipping policies, and gender policies in shipping.

The final stage of the research consisted of a re-assessment of the KPIs previously proposed, by considering the opinions of the interviewed stakeholders and the insights gathered from the literature review. Other KPIs were added. The results of the final stage of the study consisted the establishment of a comprehensive classification of 55 KPIs needed for evaluating economic efficiency of mixed crews and for evaluation of shipping companies with mixed crews. The final stage of research, with results obtained so far and presented in the current article, ended in March 2018, though further research activities continued in an aggregated form until 31 May 2018.

The GECAMET initial research target, as discussed with the research financing body, was to propose 10 KPIs for evaluating economic efficiency of gender policies implemented by shipping companies, focusing namely on 5 KPIs for evaluating performance of shipping companies with mixed crews and on 5 KPIs for evaluating performance of mixed crews on board ship. During our research we have managed to maximise the proposed target number of KPIs from a minimum of 10 to an actual total number of 55, by identifying specifically 31 KPIs for evaluating performance of companies with mixed crews and 24 KPIs for evaluating performance of mixed (both gendered and multinational) crews.

For further understanding of this article, we shall assimilate to the generic term "shipping company" all the types of companies that include crewing and recruitment activities: crewing companies, crewing operators, or ship management companies.

During the four stages of our research we have considered the following five criteria for KPI selection, acknowledged and adapted from the 2015 study "Indicators of Gender Equality" (ECE/CE/37) prepared by the Task Force on Indicators of Gender Equality for the United Nations Economic Commission for Europe, UN, New York and Geneva [15]. The criteria were the following:

1. The indicator clearly addresses a relevant activity or policy issue related to gender equality and/or women's empowerment in shipping;
2. The indicator is conceptually clear, easy to interpret, and has or might have in the future an agreed international definition;
3. The indicator is sensitive to changes and any changes in the value of the indicator will have a clear and unambiguous meaning;
4. The indicator is feasible, robust and reliable; and
5. The indicator can be comparable over time and enables international comparison. Usually time periods are recommended to be within the framework of one year, but time periods can vary and are established at the discretion of the shipping companies.

3. LITERATURE REVIEW

Operational performance, efficiency and effectiveness of a business and of the processes undergone within are evaluated through financial indicators provided by the accounting departments. Key Performance Indicators (KPIs) represent measurable expressions for the achievement of a desired level of results, in an area relevant to the evaluated entity's activity [16].

KPIs originated from the shipping sector, precisely from the 13th century, while over centuries was spread to many industries and economy sectors on shore. According to Smart and Creelman (2013), the first use of KPIs was a reporting metrics tool for financial purposes invented in the 13th century by Venice merchants [13] and further formalized by the Italian monk Luca Pacioli in 1494 in a book of mathematics with the title *Summa de Arithmetica, Geometrica, Poroportioni et Proportionaltie*. Performance assessments date far back in history, apparently from the third century when the emperors of the Wei Dynasty (221-265AD) rated the performance of the official family members (Banner and Cooke, 1984) [1]. The industrial period of the 1800s re-activated the concept and also performance assessment was used in the military domain. In the last decades, the use of Key Performance Indicators became again a popular metrics tool in the shipping business, at least according to the frequency of the latest research written on this regard.

Assessment of performance in shipping requires the establishment of a set of elements through which valuable judgments needed to reveal essential knowledge are made. Such knowledge includes how to achieve goals and tasks and how to improve the activity in order to reach business excellence for all stakeholders of a shipping company. The managerial perspective of establishing KPIs resides in the necessity of establishing measures to evaluate performance. Another perspective is focused on benchmarking and quantitative and qualitative metrics useful for decisional processes. Not the least, from another point of view, performance measurement through KPIs is a suitable tool to check achievement of organization goals, especially in the case of the latest trends in shipping gendering.

A novelty of the domain is the term "shipping gendering" referring to a generalized new trend in updating the organisational culture, manifested on board ship, with gender equality requirements. Organisational shipping gendering implies focusing on clear organisational goals that include gender equality as a natural trait of the cultural space, both on board ship, as well as inside on shore shipping offices and in the administrative facilities of shipping companies. Through shipping gendering the standardized organisational culture is renewed and improved by including, contemporarily, gender, in a sector where gender stereotypes prevailed until the recent 2000s period.

Performance metrics, issues and development is a widely analysed concept within the international research mainstream and many researchers have made notable contributions in studying either key performance indicators in diverse domains or the performance framework applicable for further identification of valid KPIs. Among them, we have considered for our research the latest works of the following authors. Parmenter (2015) discussed misunderstanding, myths and unintended consequences of KPI measurement [9] while Brown, Gissel and Neely (2016) referred to financial auditors' performance and concluded that individual auditors' perceptions differ across experience level, gender and audit firm size for certain audit quality indicators [2]. Lin and Chang (2017) explained corporate performance connected to success in the international business and identified 20 key success factors generated along with the following four factor categories in the international market development: organizational capability, environmental scanning, international strategy and internationalization behaviour [8]. Ho et al. (2000) studied performance metrics as performance indicators used in comparison within and between organisations, focusing on improvements [5]. Lavy et al.

(2010) conducted a literature review on measuring building and construction performance by using Key Performance Indicators classified into four major categories: financial, physical, functional, and survey-based [7]. Later, in an updated review, Lavy and his team renounced the 4th category in KPIs, namely the survey-based category. The KPIs were presented from the perspective of benchmarking and building performance, among other facility performance measurement practices including balanced scorecard approach and post occupancy evaluation. The KPIs were arranged into three major categories, based on their purpose and content: financial, physical, and functional [7]. Similarly, we have classified the GECAMET proposed KPIs into three major categories: Financial costs, Time costs, Health & Safety, Training and other under-categorized KPIs.

Chan and Chan (2004) published a framework for measuring success of projects in the construction industry. They have developed a set of KPIs measured both objectively and subjectively through a comprehensive literature review and tested the validity of the proposed KPIs by case studies [3].

As regards performance in shipping and the relationship between employees' personality traits and their job performances, Shang, Chao and Lirn (2016) made an evaluation of performance of the freight forwarding service industry [12]. Tsai and Liou (2017) analysed performance and motivation, concluding that motivation is not merely dependent upon environmental needs (payment), emphasizing the importance of non-monetary remuneration for better performance of the seafarers within the seafarers' recruitment management system [14].

Duru et al. (2012) made an investigation of the role of key performance indicators (KPIs) in third party ship management and their contribution to the Shipping performance index (SPI), an unweighted average of KPI scores which is calculated from numerical outcomes of several performance indicators [4]. Popa and Dragomir (2014) presented a case study on the performance assessment of the outsourced ship manning service observed in one local crewing agency, presenting the methods by which the annual performance assessment of the manning service was based on the records of the annual audit made in accordance with the internal audit procedures specified in the Safety Management System implemented by the crewing company, records of visits made by the Fleet Manager (operation manager) from the owner company at every three months and distance evaluation records [10].

4. BRIEF OVERVIEW OF SHIPPING INDUSTRY KPIs

BIMCO and DNV are the largest entities on the international shipping market providing KPI analysis and KPI software for the use of shipping companies. The BIMCO Shipping KPI standard was launched for general use in 2010 by InterManager and later became a de facto standard set of key performance indicators, registered under the BIMCO brand, used for ship operations and ship management (Rialland et al., 2014) [11]. The Shipping KPI Standard is built up hierarchically with 8 Shipping Performance Indexes (SPIs), 33 KPIs and 64 Performance Indicators (PIs). There is a mathematical relation between SPIs (high level indexes) which are calculated from Key Performance Indicators, and KPIs which are calculated from Performance Indicators (lowest level). On the lowest level, PIs are based on data capture (measurements or counters) directly from a ship or from the shipping management. Data is collected once and re-used within the Shipping KPI Standard in order to reduce the amount of data. On the KPI level, a form of normalisation takes place. The KPI are scaled into a range from 0-100, where 0 indicates unacceptable and 100 is outstanding performance. This makes it possible to compare ships with different characteristics or amounts of data captured. Finally, on the highest level, the KPIs are combined into Shipping Performance Indexes in order to express performance within specific main areas [18].

5. RESEARCH RESULTS

Based on the research methodology previously presented, including the validation process through stakeholder interviews, the results of the research consisted of establishing 55 KPIs needed in evaluating efficiency of both mixed crews and companies with mixed crews on board, validated through interviews with maritime stakeholders. The KPIs are presented in Table 1 below. Our research focuses on gender equality and cultural issues, so compared to other KPI systems in the industry, the KPIs proposed by our team of researchers are missing the environmental KPIs (e.g., energy consumptions or emitted mass of CO_2, SO_x or NO_x) or technical KPIs related only to vessel performance, without considering the implication of seafarers (which express performance of a shipping company but which is outside the GECAMET research field of interest).

Table 1. Classification of KPIs needed for evaluating efficiency of on shore companies with mixed crews and of mixed crews on board vessel

	KPIs used for efficiency evaluation				
Type of KPI	**Financial Cost KPIs**	**Time Costs KPIs**	**Health & Safety KPIs**	**Educational KPIs**	**Social KPIs**
KPIs for evaluating efficiency of shipping companies with mixed crews (classification is made based on where the organisational culture is located, either onshore or on board vessel)	1. Number of females employed in administrative positions on shore in the shipping company 2. Number of crews (mixed or not) 3. Operative costs with mixed crew changing (*Note: recruiting female implies a larger pool of available seafarers to form a crew. The bigger pool, the easier and less costly for the company to contact, find and select the best employees in order to improve crew relief periods)* 4. Operational costs with crew combinations *(e.g., operation costs for using specific software or programs for crew combinations based on the personalities of crew members)* 5. Financial costs in the crew selection process: *(e.g., communication costs via phone, internet or post)* 6. Salary costs during relief 7. Number of crews 8. Overall salary costs 9. Salary costs per number of members in a crew 10. Financial costs with training provided for the recruitment officers (*training on multicultural communication and on shipping gendering*) 11. Financial costs with Participatory Gender Audit (*costs with the externalization of the audit)* 12. Financial costs in organizing social activities	13. Time length of contracts (*choosing multicultural crews influences the schedule's efficiency; if the company has a gender policy for employing seafaring women, the seafarer pool will increase and contracts might become shorter)* 14. Number of extra-working days until crew relief *(the number of extra-days needed for single gendered crew can be compared to the number of extra days needed for a mixed crew)* 15. Number of crew changes during one time period 16. Time for changing multicultural crews. 17. Time for crew selection *(e.g., time costs for communication needed for contacting, finding and selecting best crew members for a certain voyage)* 18. Administrative time needed by the recruiting officer for the process of changing crews 19. Crew retention *(expresses the loyalty of seafarer to join the same company)*	20. Costs with Health & Safety training on shore (*is also a financial cost KPI)* 21. Number of women-friendly policies and facilities on board (e.g., maternity leave, menstrual leave, etc.)	22. Number of in-house training courses to bridge language gaps, cultural barriers, and gender differences among the crew 23. Completion rate of course on prevention of harassment, sexual harassment and abuse	24. Number or Participatory Gender Audits in a time period 25. Number of positive media, press releases, interviews, news or social media presenting the positive impacts of gender equity manifested in the analysed shipping company. 26. Number of negative media, press release, interviews, news or social media presenting the negative impacts of gender equity manifested in the analysed shipping company 27. Number of social activities on shore with positive impact for teambuilding and crew cohesion 28. Number of corporate social responsibility activities 29. Number of partnerships for shipping gendering, social and educational campaigns, developed with NGOs, members of the local community and/or maritime education and training institutions 30. Operational costs to build ICT infrastructure on board for seafarers (e.g., internet access) 31. Company initiatives to identify/specify the contribution of women seafarers and their complementary roles to reinforce the industry workforce
KPIs for evaluating efficiency of mixed crews	1. Seafarer salary costs during voyage 2. Crew size *(number*	5. Time for standardized operations *(How fast a gendered crew*	10. Number of accidents medical problems or injuries happened	18. Number of in-house training to bridge language gaps in mixed	21. Participation rate of female and male seafarers in

	of seafarer officers and ratings during one voyage on one ship) 3. Number of seafaring females employed as crew members on board ship 4. Female cadets per vessel (expresses the company's efforts to take on female cadets)	*compared to a non-gendered crew can complete a usual operation, e.g. operations during ship manoeuvring).* 6. Time for drills (*How fast a gendered crew compared to a non-gendered crew can complete a drill)* 7. Time needed to handle a conflict *(time spent between the critical manifestation of a conflict until the conflict is solved, preferable through win-win solutions)* 8. Response time needed for emergency cases *(also health and safety KPIs)* 9. Social time spent on ship *(free time for social activities on board ship)*	on board *(happened on board ship)* 11. Number of conflicts on board ship (comparison between the number of conflicts which occurred in mixed crews and the number of conflicts which occurred in single gender crews) 12. Number of complaints made by seafarers, regarding working conditions on board ship 13. Number of reported bullying incidents 14. Number of reported harassment incidents 15. Number of suicides or fatalities on board ship 16. Number of health care and stress relieving facilities on board ship (e.g., gym, emergency kit, religious facility, karaoke, etc.) 17. Diversity of foods in meals for a mixed crew	crews 19. Number of in-house training courses to bridge cultural barriers in mixed crews. 20. Number of in-house training to bridge gender differences among the mixed crews.	social activities 22. Number of positive communication messages received from crew members, reporting crew satisfaction (e.*g., number of positive reports, number of positive informative emails etc.)* 23. Number of negative communication messages received from crew members reporting crew dissatisfactions (e.*g., number of negative reports, number of negative informative emails etc.)* 24. Number of social activities of teambuilding on board with positive impact for crew cohesion

6. DISCUSSION

The 55 KPIs proposed and validated through literature review and stakeholder interviews within the GECAMET research can be classified by at least three criteria of classification:

1. Classification of proposed KPIs according to the localization of the organizational culture: on sea or on shore, KPIs for evaluating performance of mixed crews on board ship and KPIs for evaluating performance of shipping companies with mixed crews on shore;
2. Classification of the proposed KPIs in five criteria of efficiency analysis: Cost KPIs, Time KPIs, Health & Safety KPIs, Educational KPIs and Social KPIs; and
3. Classification of the proposed KPIs according to the type of organizational shipping policies: HR / Crewing (STCW), Gender Equality, Cultural Awareness, Bullying, Ethical, Occupational Health & Safety, Drug and Alcohol, Corporate Social Responsibility (CSR), Security (SOLAS, ISPS), Safety (ISM Code), Emergency Response Policy, Environmental Protection, Quality of services (ISO 9001) and Confidentiality/Privacy Policy. Such classification can be further delivered in order to establish relevant, feasible and reliable actions needed to assess both crew, company and policy effectiveness.

In Table 1, due to space constraints, only the first two classifications were presented.

From Table 1, it can be concluded that KPIs regarding operative financial costs have the following particularities: they need quantitative methods of assessment, they are expressed in financial units as money or currencies, and their optimal value is the minimum. Organizational decisions must be planned and performed towards minimization of such KPI values.

KPIs on operative time constraints also need quantitative methods of assessment. They are expressed in time units (year, months, days, hours, minutes, even seconds). The optimal value is the minimum value in most cases.

The Health & Safety, Educational and Social KPIs are expressed through abstract values without using

special units of measurement. Most of them need quantitative assessment but some of them need also qualitative, in-depth methods of assessment. Not all of them meet the optimal values through minimization. There were more Health & Safety KPIs identified on board than the ones identified on shore at the headquarters of the shipping companies. This result appears natural, considering the risk inherent to seafaring activities.

7. CONCLUSIONS

The proposed 55 KPIs can be designated to organizational policies that will imply specific measurable gender equality and cultural awareness actions needed for improving performance in both on shore organization and on board ship.

These proposed KPIs are useful for consolidating or updating and assessment of a responsible gender and multiculturalism policy, integrated with other organizational policies in the companies from the shipping sector.

Also, the proposed KPIs can be used in the learning process designated for students of maritime education and training institutions, especially in programs with curricula in shipping management.

In shipping companies, specialized training on multiculturalism and shipping gendering, considering the above KPIs, should be organized both for administrative personnel on shore, as well as, minimally, for ship masters and officers.

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