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Editorial

Journal of ETA Maritime Science (JEMS), published by UCTEA Chamber of Marine Engineers, started its academic career in 2013. It first indexed in the DOAJ in 2014 and proved its quality. Later in 2016, it entered into the "Index Copernicus" citation index. In the same year, it was entitled to enter into TUBITAK TR indexes. Finally, we are pleased to inform you that "Journal of ETA Maritime Science (JEMS)", published by UCTEA Chamber of Marine Engineers, has been selected for coverage in Clarivate Analytics products and services of WoS. JEMS will be indexed and abstracted in Emerging Sources Citation Index (ESCI).

There is an Editorial Board behind this short story of JEMS's full of success. This board members consist of highly qualified academics from different nationalities and fields, working with great devotions all around the world. In addition, the Associate Editors of JEMS, consisting of young academicians who prepare JEMS for publication four times in a year, are voluntary servants of the JEMS. Besides, the Authors who generate the journal's intellectual capital by sharing their valuable researches in JEMS have a great share in these successes. The entry of JEMS into the Web of Science Emerging Sources Citation Index (ESCI) has welcomed by the Board of UCTEA Chamber of Marine Engineers. This success will increase the attractiveness of JEMS and enable the selection of the best quality articles among many more quality articles.

In this issue, we present to your attention two remarkable articles highlighting the issue of "women and sea". In addition, we present an impressive article about the scope and academic perspective of polar research prepared by Prof. Dr. Ersan Basar in the academic perspective section of our journal. We also thank him for the cover photo of this issue.

Prof. Dr. Selçuk NAS
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The Moderating Role of Sea Service Period on the Relationship between Perceived Organizational Justice and Job Satisfaction: Evidence from Seafarers

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ABSTRACT

Although the number of organizational justice studies has increased rapidly in recent years, little research has focused on fairness perceptions of seafarers. Therefore, this paper intended to fill the gap by investigating the effect of organizational justice perceptions of seafarers on their job satisfaction described by three facets including procedural justice, distributive justice and interactional justice. The data obtained through face-to-face survey technique were analyzed using SPSS 22 and AMOS 22 (with PROCESS macro) statistical package programs. The findings generated from regression analysis point that justice perception of seafarers positively affects their job satisfaction level. Furthermore, the length of seafarers' sea service has a moderating role between perceived organizational justice and job satisfaction. The managerial implications of the results are discussed in light of the particular context of the maritime industry with some suggestions for enhancing justice and satisfaction perceptions of seafarers.

Keywords

Organizational Justice, Job Satisfaction, Seafarers.

1. Introduction

Determining antecedents of job satisfaction (JS) has been an overriding effort of scholars for years and nowadays many of them have recognized the role of perceived organizational justice (POJ) of employees in designing this desired work attitude. After all, researchers have seemed to agree that organizational justice is a powerful determinative of JS [1][2][3]. However, it is apparent that the linkage between justice and JS is too complex and thus it is beneficial to explore the relationship in different cultural and work settings. Although, how to maintain and promote JS in the workplace is crucial for all professions, to strengthen the feelings of JS among seafarers is even more important

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due to circumstances specific to life on a ship. Seafarers live an isolated life on board for months away from their families and society which makes seafaring a highly unsatisfied and stressful occupation.

Seafarers suffer from long working hours, shift work and watchkeeping, high job demands and high stress, poor quality sleep, hectic pace, physical work hazards, and ill health [4][5][6][7]. In addition, permanent job-related physical factors on vessels including noise, temperature, vibration, and ship motion decrease seafarers' satisfaction, both during work hours and during leisure time [8][9]. Thus, relative to other areas of employment, disadvantageous working conditions create high turnover rates in the shipping industry which in turn costs the organization time and money [10][11][12]. Many pieces of research have indicated that poor and unfavourable working conditions at sea are negatively influencing both the recruitment of young people into a seafaring career and retaining in-service seafarers [11][12][13][14][15]. All these mentioned aspects jointly decrease the overall performance and competitiveness of marine organizations.

One possible solution may increase JS of seafarers that may have a significant impact on employee behavioural responses, such as job performance, productivity and efficiency, intention to quit, organizational turnover, absenteeism, work engagement and organizational identification [16][17][18][19][20][21][22]. In general, JS refers to an employee's subjective perception of his/her work and all aspects of the work environment. It is influenced by many organizational elements, ranging from salaries, job security, job autonomy, career prospects, to the relationship between employees and colleagues. Organizational justice raises above all these potential elements because seafarers who feel that their contributions and sacrifices are not reciprocated by the organisation will be frustrated and most likely to respond negatively.

For that reason, the data of this study are drawn from marine employees in order to analyze the linkage between POJ and JS in the maritime industry which is strategic for the economy of countries. Although the positive effects of POJ on employees' JS have been confirmed, to the best of the authors' knowledge, this connection has not been investigated in the shipping industry. It is vital to determine the predictors of seafarers' satisfaction due to high demands of the job and the strategic value of their motivation and psychological well-being to enhance firm performance and competitiveness. Therefore, the current study is important in filling the void in the literature by focusing on shipping organizations that seems to expose their employees to high levels of emotional and work-related stresses leading to decreased JS which in turn can affect absenteeism, performance, productivity and turnover [23][24][25].

2. Theoretical Background and Hypotheses

Organizational justice is a concept basically used to describe subjective fairness perceptions in the work environment. As Adams put forward years ago in his well-known equity theory, employees compare their input (contributions) and output (rewards) with those of relevant workers and conclude if they are being treated fairly or not [26]. For instance, when an individual explores that a co-worker with the same seniority and experience has a higher status than himself/herself, s/he is likely to perceive the situation as unfair. Besides, social exchange theory which assumes sources are exchanged via a process of repayment is a breeding ground for perceived justice [27] whereby one party tends to reciprocate the good or bad actions of another party[28]. Accordingly,

the positive judgement of employees regarding the supervisor or organization may probably result in a sense of obligation to reciprocate positively[29]. So, it seems logical to expect that positive justice perception of seafarers is likely to turn into desired responses such as motivation, satisfaction and commitment.

Recent progress and perspectives in this area describe three sorts of organizational justice including procedural, interactional and distributive [30]. Building on the equity theory [26], distributive justice placed emphasis on the equitableness of the outcomes (e.g., pay, rewards, promotions) while procedural justice on the fairness of the process like policies and procedures [30][31]. On the other hand, interactional justice focuses the degree to which employees are treated with dignity, politeness, gentleness and respect by supervisors in the application of related operations [32]. Researches on organizational justice have proved that fairness perceptions at work may affect individuals' critical work manners and behaviours like organizational commitment [33][34], organizational citizenship behaviour [35][36][37] performance [30] [38] innovative behaviour [39][40] and turnover intentions [41][42].

Most of the previous studies conclude that three dimensions of justice perception act in a holistic way but participants felt justice in different ways. For instance, Robbins [43] argued that in high perceptions of procedural justice, employees look up positively to their supervisors, even if they are dissatisfied with their salaries, job opportunities, and other personal variables. Some individuals may feel justice in the way the outcomes were distributed while others feel it in management support. These different perceptions with regard to dimensions of organizational justice may be explained by Maslow's well-known hierarchy of needs in which needs and expectations are categorized. When employees' contributions are rewarded in terms of their own needs and expectations, their perception of justice would increase as well. Accordingly, perhaps the conditions of specialty settings differentiate according to what employees value most and these incoherences (between perceived importance and perceived fulfilment) significantly influence seafarers POJ. Thus, the following is proposed;

Hypothesis 1: There are significant differences among seafarers' perception mean scores with regard to dimensions of organizational justice.

There is also a considerable amount of research indicating that there exists a significant correlation between POJ and JS [2][44][45][46][47][48]. Job satisfaction is explained as a positive emotional response of an employee at the workplace resulting from the assessment of five dimensions such as satisfaction with work, pay, promotion opportunities, supervision, and co-worker [49]. Karimi et al. [50] referred to JS as employees' feeling of job or the emotional reaction to the work environment. Such a perception depended on the gap of employees acquired rewards and the expected deserved rewards in the specific work environment. The smaller gap would present higher satisfaction, while the larger gap would result in lower satisfaction. In other words, JS relied on individuals assessing the objective environment and various factors and comparing past experiences with reference to other groups [51]. Organizational scholars recognize the importance of investigating the antecedents of JS because it has been discovered not only to reduce absenteeism and turnover intentions [52][53][54][55] but also increase employees' commitment [53][55] [56][57].

High turnover rates present a number of risks to the shipping industry and thus place great importance on seafarers JS

because it is directly related to the retention in the seafaring profession. Accordingly, Li and colleagues investigated the main factors that contribute to JS and found that promotion is the key factor in the JS of the Chinese seafarers [58]. In another study, [59] participants stated that income as the only source of pleasure related to the job and the primary reason for being in this job. In addition, they also emphasized financial stability and security as a source of satisfaction. Studies have also shown that organizational support, job demands, and team cohesion are among the important factors related to JS of seafarers [60], [61]. Factors including salary, promotion opportunities, fringe benefits, supervision, co-workers, job conditions, the nature of the work, organizational support and communication have been frequently linked to satisfaction and thus inconsistent or unfair treatment of these factors may lead to low JS [15][58][60][61][62][63]. Consequently, employees would perceive the organization as fair if the comparison of these elements results in a positive way which leads to the development of the following hypothesis to be tested;

Hypothesis 2: Seafarers' POJ positively affects their JS.

Reviewing past studies also reveals that demographic characteristics such as age marital status, gender, job position, education, job satisfaction, organizational tenure may influence the perceptions of individuals. Different needs and expectations of different demographic and personality groups can affect the feeling of organizational justice. However, it is also important to note that all members of the same demographic group do not necessarily share similar experiences and hence have the same justice perceptions [64]. For instance, in some studies, gender differences found to moderate the POJ and JS [65]) whereas some others found no significant differences [66]. Organizational tenure is another demographic variable that is frequently linked to both justice and satisfaction. Relatedly, Pignata & colleagues [67] found that academic staff's tenure predicted perceived justice which was the strongest determinant of academic staff's JS. This result is also supported by two studies of Bidarian & Jafari [68] which point that there is poor but positive linkage between perceived justice and the length of work experience. Accordingly, it is proposed;

Hypothesis 3: Seafarers' sea service period moderates the relationship between POJ and JS.

Consequently, past studies revealed significant relationships between the three facets of justice and JS. However, the topic is generally investigated by using samples drawn from the employees of west organizations with similar occupations. The lack of studies investigating the relationship between POJ and JS on a particular working environment of seafarers increase the importance of this study. Consequently, the present study intends to enhance the literature by examining the following research model in Figure 1 with data drawn from a probability sample of seafarer's from Turkey.

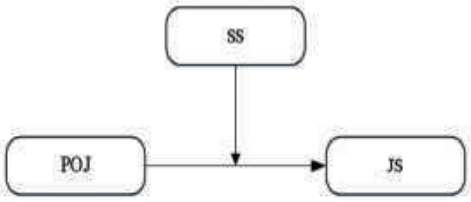

Figure 1. *Research Model*

3. Method

This study was conducted to measure the organizational justice perceptions of seafarers and to examine the causal relationships between their POJ and JS. The data were collected using face-to-face survey method, and analyzed by SPSS 22 and AMOS 22 statistical package programs

using descriptive statistics, skewness and kurtosis coefficients, convergent and discriminant validity in confirmatory factor analysis for validity analysis, Cronbach's alpha and composite reliability coefficients in reliability analysis. Correlation analysis, dependent-samples one-way analysis of variance (ANOVA), path analysis and structural equation modelling were used to test research hypotheses.

3.1. Sample

The sample consists of Turkish seafarers working on merchant ships. The data were collected using convenience sampling method and face-to-face survey from seafarers working on ships including ferries, passenger boats and sea buses used for passenger transportation in the Marmara Region.

3.2. Data Collection Tools

The survey form consists of two sections. The first section includes questions about the seafarers' demographic features such as age, gender, education and working time at sea, and the second section includes two scales to measured the research variables including POJ and JS. Five-point Likert scale (scoring between 1= strongly disagree and 5= strongly agree) is used to rate the perceptions of seafarers. POJ scale configured by Neiehoff & Moorman [69] and adapted to Turkish by Yıldırım [70] covers 20-items relating to three facets of justice; distributive justice perception (DJP) (5 items), procedural justice perception (PJP) (6 items) and interactional justice perception (IJP) (9 items). Some of the scale items are as follows: "I think the arrangements on my working hours onboard are fair", "Seafarers' opinions are asked before any decision about works on board", and "My supervisor onboard explains every decision about my job very clearly and in details". According to the results of the exploratory factor analysis (EFA) applied using varimax rotation and principal components analysis techniques to determine the consistency of POJ scale, it was revealed that the scale had a three-dimensional structure (PJP, DJP and IJP) with eigenvalues greater than 1 as in previous studies (KMO=0.954; χ 2=4466.375; df=190; $p<0.001$; factor loadings ranging between 0.565-0.878; total explained variance: 64.7%). Table 1 presents the goodness of fit indices of the first and second-order confirmatory factor analysis (CFA) performed to determine the structural validity of the scale. Accordingly, both the first (χ2/df: 2.477; GFI: 0.894; CFI: 0.945; TLI:0.936; RMSEA:0.066) and second (χ2/df: 2.410; GFI: 0.897; CFI: 0.948; TLI: 0.939; RMSEA: 0.065) order fit indices were within acceptable values [71],[72]. In addition, the average variance extracted (AVE) and composite reliability (CR) values were calculated to determine the convergent and discriminant validity in DFA, and results are given in Table 2. Accordingly, the factor loadings of observed variables varied between 0.577 and 0.857, and the t-test values were statistically significant ($p <0.001$). The standardized β coefficients of observed variables were higher than the threshold value of 0.50, and the AVE values were higher than the critical value of 0.50. Furthermore, the CR values were higher than the critical value of 0.70 and AVE values suggested a convergent validity between the dimensions of the measurement model. However, due to correlation coefficients between the dimensions of the measurement model lower than the square roots of AVE values, the discriminant validity was also achieved [73]. In the reliability analysis, the Cronbach's Alpha (CA) coefficients ranged between 0.842-0.928 and the CR coefficients between 0.888-0.960. Accordingly, the organizational justice perception scale is valid and reliable [72][73].

JS scale developed by Chen et al. [74]

Table 1. *Confirmatory Factor Analysis Goodness of Fit Indices*

Scales	$\chi 2$	sd	$\chi 2/sd$	GFI	CFI	TLI	RMSEA
First Order POJ	406.190	164	2.477	.894	.945	.936	.066
Second Order POJ	392.824	163	2.410	.897	.948	.939	.065
JS	10.138	4	2.535	.988	.957	.983	.068

Table 2. *Confirmatory Factor Analysis Results*

Factors	Observed Variables	Standardized β	t Values	AVE	CR	CA
PJP	PJP1	.577	7.701***	.522	.866	.842
	PJP2	.766	11.128***			
	PJP3	.829	11.716***			
	PJP4	.803	11.482***			
	PJP5	.717	10.635***			
	PJP6	.605	-			
DJP	DJP7	.746	12.689***	.587	.876	.873
	DJP8	.786	13.332***			
	DJP9	.734	12.499***			
	DJP10	.857	14.407***			
	DJP11	.698	-			
IJP	IJP12	.727	13.416***	.582	.926	.928
	IJP13	.782	14.552***			
	IJP14	.758	14.072***			
	IJP15	.710	14.861***			
	IJP16	.830	15.563***			
	IJP17	.838	15.736***			
	IJP18	.727	13.423***			
	IJP19	.739	13.665***			
	IJP20	.746	-			
JS	JS1	.730	9.282***	.519	.841	.728
	JS2	.842	9.735***			
	JS3	.562	7.634***			
	JS4	.724	9.222***			
	JS5	.715	-			

***p< 0.001

and adopted to Turkish by Turunç and Çelik [75] is used to rate JS levels of seafarers. Some example items are as follows: "I am satisfied with my job onboard" and "I feel like the day will never end when I do my work onboard" (reverse coded). According to the EFA results applied using varimax rotation and principal analysis to determine the consistency of the JS scale, it was revealed that the scale has a one-dimensional

structure with an eigenvalue greater than 1 as in previous studies (KMO = 0.731; $\chi 2 = 368.170$; df = 10-factor loads ranging from $p < 0.001$; 0.589-0.896; total explained variance: 57.2%). Table 1 presents the DFA goodness of fit indices calculated to determine the structural validity of the scale. Accordingly, the fit indices of this single-factor JS scale ($\chi 2$/df: 2.535; GFI: 0.988; CFI: 0.957; TLI: 0.983; RMSEA: 0.068) were within acceptable values [71],[72]. In addition, the average variance extracted (AVE) and composite reliability (CR) values were calculated to assess the scale's convergent and discriminant validity in DFA, and the results are given in Table 2. Accordingly, the factor loadings of observed variables varied between 0.524 and 0.842, and the t-test values were statistically significant ($p<0.001$). The standardized β coefficients of observed variables were higher than the threshold value of 0.50, and the AVE values were higher than the crucial value of 0.50. Furthermore, the higher CR values than the critical value of 0.70 and the AVE values suggest a convergent validity of the measurement model. Cronbach's Alpha (CA) and CR coefficients of the scale were found as 0.728 and 0.815 respectively which indicates JS scale is valid and reliable [72][73].

Before testing the research hypotheses, the skewness and kurtosis coefficients of the observed variables were examined to determine whether the data had a normal distribution. As the coefficients ranged between -1.5 and + 1.5, the data were considered to have a normal distribution.

4. Results

4.1. Demographic Characteristics of Participants

Table 3 presents the seafarers' demographic characteristics. Accordingly, 94.3% (n=316) of them are male, 30.4% (n=102) are 31-40 years old, 49.2% (n=170) are high school graduates, 25.4 % (n=85) have work experience between 4-7 years, and 60.3% (n=202) are deck crew.

4.2. Hypothesis Testing

Table 4 presents the means, standard deviations and correlation coefficients of the research variables.

Table 3. *Demographic Characteristics of Participants*

Variables	Groups	n	%	Variables	Groups	n	%
Gender	Female	19	5.7	Work Experience	3 years and under	71	21.2
	Male	316	94.3		4-7 years	85	25.4
	Total	335	100.0		8-11 year	64	19.1
Age	20-25	57	17.0		12-15 years	36	10.7
	26-30	68	20.3		16 and over	79	23.6
	31-40	102	30.4		Total	335	100.0
	41-50	77	23.0	Department	Deck	202	60.3
	51 and over	31	9.3		Engine	101	30.1
Education status	Primary	55	16.4		Galley	32	9.6
	High school	170	49.2		Total	335	100.0
	University	110	32.8				
	Total	335	100.0				

Table 4. *Means, Standard Deviations and Correlation Coefficients*

Values	Means	SS	1	2	3	4
1. PJP	3.688	.785	1			
2. DJP	3.628	.845	.794**	1		
3. IJP	3.936	.735	.734**	.716**	1	
4. POJ	3.751	.719	.924**	.914**	.888**	1
5. JS	3.796	.636	.373**	.363**	.415**	.419**

**p< 0,01

There is a moderate and statistically significant relationship among seafarers' mean scores of JS, POJ, and three dimensions of justice. Mean scores of three dimensions of justice point a difference among justice perceptions of seafarers. The dependent samples' one-way analysis of variance was performed to reveal whether these differences were statistically significant or not. Firstly, Levene's test, a prerequisite of one-way analysis of variance, was conducted to check homogeneity between the groups (Table 5).

Table 5. *Levene's Test*

Values	Levene's Test	df1	df2	p
1. PJP	1.599	4	330	.174
2. DJP	1.395	4	330	.235
3. IJP	2.064	4	330	.085

Accordingly, the dimensions of organizational justice were homogeneous [α (0.05)<p], and thus the prerequisite of variance analysis for these variables was met. After the dependent samples' one-way analysis of variance confirmed that the model was statistically significant [α (0.01)>p; F:66.653], binary comparisons were applied to determine whether the difference between groups was significant (Table 6).

Consequently, the difference between seafarers' mean scores on organizational justice perception subscales was statistically significant. Therefore, Hypothesis 1 was accepted. The goodness of fit indices (χ2/df:2.239; GFI:0.876; CFI:0.932; TLI:0.924; RMSEA:0.061) regarding the structural equation modelling in Figure 2, which was implemented to reveal the effect of POJ on JS were within acceptable values [71],[72]. The path analysis revealed that POJ had a significant positive effect on JS (std. β: 0.507; t: 6.518; p<0.001; R^2:25.7) and explained around 26% of the variance of JS. Therefore, Hypothesis 2 was accepted, too.

Table 6. *Variance Analysis Binary Comparison*

(I) Factor1 (J) Factor 1	Average Difference (I-J)	Std. Dev.	p
PJP DJP	.059*	.029	.040
IJP	-.248*	.030	.000
DJP PJP	-.059*	.029	.040
IJP	-.308*	.033	.000
IJP PJP	.248*	.030	.000
DJP	.308*	.033	.000

*p< 0.05

To discover the moderating role of seafarers' service (SS) period at sea in the relationship between POJ and JS, the PROCESS macro plugin in SPSS 22 program was used[76]. The results of the moderating role analysis with the Bootstrap 5000 sample are shown in Table 7.

Table 7. *Moderating Effect Analysis*

	B	SE	t	95% CI LL	UL
Constant	3.790	0.031	120.685	3.729	3.852
POJ	0.411***	0.045	8.994	0.321	0.501
SS	0.007	0.021	0.370	-0.033	0.049
POJ*SS	-0.073*	0.029	-0.249	-0.131	-0.015
Model Summary		R^2 = 0.196; F=27.030; p < 0.01			
Change in R-sq.		ΔR^2= 0.015; F=6.246; p < 0.05			

*p< 0.05; ***p< 0.01

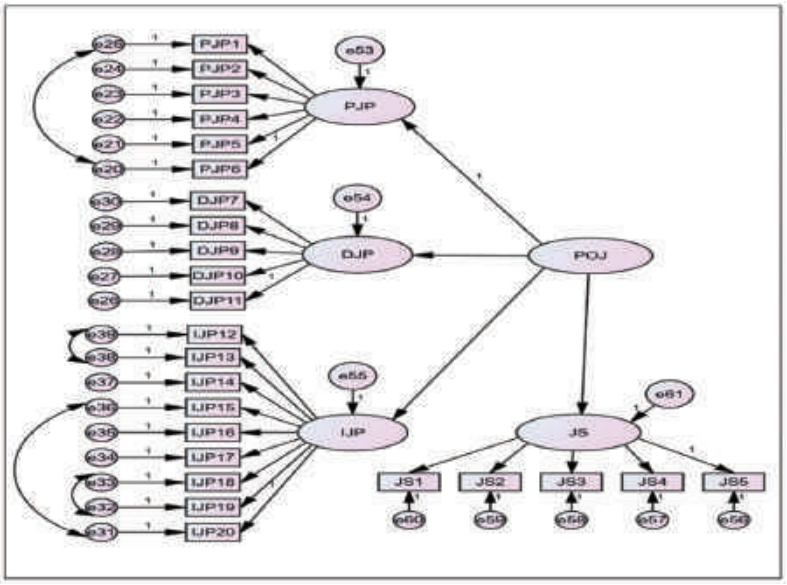

Figure 2. *Structural Equation Modeling*

The results presented in Table 7 points that moderating effect of SS period is significant (R^2 = 0.196; F = 27.030; p <0,01) and the effect of the interaction term (POJ * SS) on JS is also significant (B = 0.073; t = -0.249; p <0.05; -0.113 <LL 95% CI <-0.015; ΔR^2= 0.015). Therefore, Hypothesis 3 was accepted. Slope test was performed to determine whether POJ differs from zero from the average of working time at sea, a standard deviation from the average of working time [77], and the results are presented in Figure 3.

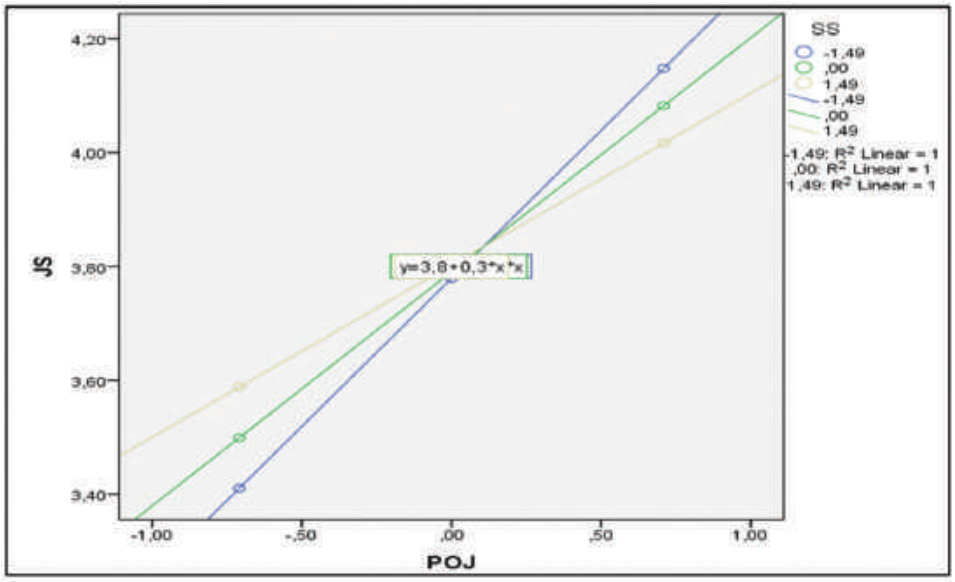

Figure 3. *Slope Graph of Organizational Justice Perception and Sea Service Interaction*

It is understood from Figure 3 that the relationship between POJ and JS is more powerful for seafarers whose length of sea service is shorter.

5. Discussion and Conclusions

The current study tests the effect of justice perception between seafarers on JS. The results show that the difference among seafarers' mean scores on organizational justice perception subscales is statistically significant. Accordingly, the level of distributive justice perception of seafarers (X:3.628) is lower than perceived procedural (X:3.688) and interactional justice (X:3.936). This result provides support for the organizational justice literature that suggests individuals from different contextual circumstances focus on a different criterion to rate justice [78],[79],[80]. Like Ambrose & Schmin [80] claim employees view justice dimensions differently and are apt to perceive one higher that serve the needs of the individual. Therefore, the low level of distributive justice might be due to the perception that salaries, promotional opportunities and organizational resources are generally insufficient when hidden costs involved for working onboard a ship is considered. This finding of the study suggests that seafarers perceive equity in the amount of compensation they receive and thus shipping companies need to find a delicate balance between seafarers' contributions and compensation.

The study also reveals that the level of perceived interactional justice (X:3.936) is greater than the other two dimensions of organizational justice. The attributes of the maritime companies may play a considerable role in seafarers' justice judgement. Shipping firms generally operate in a closed business environment where power and decision making is centralized, and communication channels follow a strict hierarchy. Besides, isolation is an innate characteristic of the prevalent system onboard which may lead to a tendency to reduce interpersonal relationships. These characteristics of the working environment are well known among sea labour and thus may have created a negative bias and expectation towards interactional justice which seems to be the reason for rating the perceived interactional justice higher. In other words, unlike common practice, in the application of related operations, the ship managers within the scope of the current research seem to treat seafarers with dignity, politeness, gentleness and respect. Thus, seafarers who do not have many expectations in this regard may have felt interactional justice more than the other dimensions of justice.

So far, scholars have pointed out the link between POJ and JS but testing the similar link within the maritime context is neglected. Drawing on this idea, perhaps the most important benefaction of the current study is that it provides empirical support for the interaction between justice perceptions of seafarers and their satisfaction. The path analysis which was performed using the structural equation modelling has revealed that as predicted justice perception of seafarers positively affects their JS level (std. β:0.507; t:6.518; $p<0.001$) and explained around 26% of the variance in JS(R^2:25.7). This finding of the study is consistent with previous studies that found POJ to be positively related to JS [81], [82]. Although such connection is intensely verified among different occupations in the literature, this study extends prior researches by investigating the link between organizational justice and satisfaction for the first time in the shipping industry.

Furthermore, the results confirm that the length of seafarers' sea service has a moderating role ($B = 0.073$; $t = -0.249$; $p < 0.05$; $-0.131 <$ LL 95% CI < -0.015) between POJ and JS. Short-tenured seafarers have

reported more positive views of fairness at work which moderates the relationship between POJ and JS. A possible explanation for this result is that seafarers entering a company may be more responsive to justice in the work environment which in turn influence their satisfaction levels. Maybe, it is more important for younger employees to have a job and that's why seafarers who have less experience with the organization are more likely to tolerate the shipping organization for making a justice violation. On the other hand, seafarers who have contributed to the organization with their experience and knowledge for years may think that they are not getting enough compensation for this long-term relationship.

The findings of the study should be judged given some constraints. For instance, there is some evidence in the literature that the different dimensions of organizational justice can have different effects on individuals' behaviours. According to Cohen-Charash & Spector's meta-analysis [64], distributive justice is the dominant factor that impacts satisfaction whereas Colquitt and colleagues [83] meta-analysis concluded procedural justice as the more effective determinant. Future studies that investigate which dimension of organizational justice has a higher impact on seafarers' job satisfaction would contribute to the literature. On the other hand, there is also some evidence in the literature that the amount of organizational justice demanded by staff from their organizations may be influenced by their national culture which in turn would affect their level of satisfaction. The individuals from high power distance culture may demand less interactional justice compared to those with low power distance since it basically requires the cooperation and communication between employees and the administrators. From this point of view, further studies can be performed to investigate the effect of culture on the relationship between research variables. Second, the generalization of sampling is arguable because the survey was realized in a particular context. Therefore, the moderating effect of the length of seafarers' service at sea on the relationship between POJ and JS may be deepened with data obtained from different industries and the comparison of different industries will deepen the understanding of the process.

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Analysis of Operational Performance of Crude Oil Refining and Petrochemical Jetties in Nigeria

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ABSTRACT

This paper assessed the performance of jetty operations in Warri Refining and Petrochemical Company (WRPC). Primary data for the study consisted of ship turn round times, volume of cargo and number of vessels handled at the jetties for years 2004 to 2018. These variables served as key performance assessment criteria. In addition, copies of questionnaires on postulated factors affecting terminal performance were administered to a random sample of WRPC staff. Our findings showed that the jetties were being operated at less than optimum level. Trend analysis of the key performance indicators showed existence of continuous decline in operational performance of WRPC over the years covered in the study. Significant factors accounting for this performance outcome were found to include: inadequate berthing facilities, shortage of manpower supply, pipeline vandalisation, inadequate maintenance of jetty facilities and poor documentation process. The study recommended deployment of trained workforce to jetty operations, maintenance of berthing facilities, adequate funding and improved documentation of processes during jetty operations.

Keywords

Cargo Throughputs, Turn round Time, Ship Visits, Operational Performance, Petroleum Products Jetties.

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1. Introduction

The demand for petroleum and petroleum products in Nigeria is increasing everyday judging from the population growth at geometric rate. Increase in demand for petroleum products has necessitated the need for efficient supply chain and functional terminal/ jetty operations. Efficient and productive terminal operations are of essence given the technological advancement and globalization which has greatly influenced the pattern of production and consumption of goods [1]. After the discovery of oil in 1956 at Oloibiri, the first shipment of crude oil from Nigeria to Britain occurred in 1958. Importation of petroleum products was necessitated by growth in Nigeria's economy and increase in demand for the petroleum products. However, in order to meet the product needs of country, Shell BP built a refinery of 38,000 barrels per day production in 1965 near Port Harcourt [2]. Furthermore, rapid growth and increased economic activities led to the establishment of Warri refinery and Kaduna refinery in 1978 and 1980 respectively while the new Port Harcourt refinery was completed for operation in 1989. However, local refineries started experiencing decline in performance in the early 1990's as a result of interference by politicians [2]. The refineries were characterized by poor governance, poor turnaround time maintenance, vandalisation of pipelines supplying crude to pipelines and those conveying products from them; thus, leading to low capacity utilization [2]. The inability of the four refineries in Nigeria to meet demand for products led to frequent acute shortage of petroleum products. These challenges could be attributed to lack of innovative drive, shortage of manpower, defective operational process, re-appointment of retired staff as contract staff, buying back of refined products which were exported as refined crude oil and payment of subsidy by Nigerian government [3].

1.1. Problem Statement

Nigeria's four refineries have been operating below installed capacities which have made supply of petroleum products to Nigerians (population about 200 million) insufficient given high energy consumptions required by Nigeria whose population is growing rapidly. The problems of refining industry in Nigeria include corruption, theft of petroleum products, poor maintenance of pipelines and other operational challenges [4]. Warri Refining and Petrochemical Company (WRPC) which is one of the refineries in Nigeria is also saddled with these operational challenges. WRPC has a capacity of 125,000 bpd but it has never achieved full capacity utilization as production has declined steadily except in the early 1990's during which there was a brief upsurge in production [5]. The collapse of loading berth 1 and 2 at WRPC out of 4 berths in 2015 and 2016 respectively was due mainly to these operational challenges. It is anticipated that except these constraints are controlled they are likely to negatively impact performance of the refinery. Against this backdrop, this paper seeks to empirically identify significant factors affecting operational performance of Warri refinery.

1.2. Objectives

This study seeks to evaluate trends in performance of WRPC based on the following operational indicators: cargo throughput, vessel traffic and vessel turnround times. The study will also assess the extent in which WRPC operational performance is affected by inadequate berthing facilities, inadequate funding, shortage of manpower supply, poor maintenance of jetty facilities and slow documentation process.

2. Literature Review

2.1. Description of Warri Refinery and Petrochemical Company Jetty

Warri refinery was established in 1978 with a refining capacity of 100,000 barrels per stream day [6]. The refinery which is operated by Warri Refining and Petrochemicals Company limited, a Nigerian National Petroleum Corporation subsidiary is situated at Ekpan, Warri, Delta state. The major products handled by WRPC are crude oil, Premium Motor Spirit (PMS), Dual Purpose Kerosene (DPK), Automobile Graded Oil (AGO), Polypropylene, Carbon Black and so on. However, WRPC jetty has Four berths but among these four berths, it is important to note that loading berth 1 (LB1) and loading berth 2 (LB2) gone out of operation (collapsed) in year 2016 and 2017 respectively [7]. Table 1 below gives a detailed description and status of the berths as at the time of carrying out this study.

2.2. Overview of Operational Performance Measurement

Performance indicators (or metrics) are used for measurement or assessment of performance which activity is vital for the growth and success of an organisation [8]. Key Performance Indicators (KPIs) is a set of quantifiable measures which could be used as guides for achievement of organization's strategic and operational goals [9]. These may differ from one organization to other depending on their priorities [9]. In evaluating the operational performance of any terminal or jetty such as oil jetty, fishing jetty, cargo jetty and so on, some key performance metrics are applied. Three performance indicators in respect to terminal or jetty operations are physical indicators, factor productivity indicators, economic/financial indicators [8]. Physical indicators address issues relating to ship turnround time, berth occupancy rate, cargo throughput and cargo dwell time. Factor productivity indicators measures variables relating to labour input and output and capital (equipment) required for stevedoring operations. Lastly the economic and financial indicators measure the income and expenditure aspect of the operation.

There are five types of performance indicators applicable to operation of oil and gas companies and these are namely: environmental performance indicators, health and safety performance indicators, social responsibility performance indicators, economic performance indicators and normalization factors [9]. Environmental performance indicators show effect of operation on the environment which includes hydrocarbon spills to the environment, greenhouse gas emissions, the extent of flared and vented gas, the level of controlled discharges to the water, biodiversity, and other environmental factors. Health and Safety performance metrics include the rate of occupational hazards, product-related health risks and workforce health. Social responsibility performance indicators include human rights, training, and development, labour practices, resettlement and land right, social investment, non-discrimination and equal right opportunity policy. Economic performance indicators include transparency of payment, capital expenditure and so on. Lastly, normalization factors include terminal, refining and pipeline throughputs, amount of cargo

Table 1. *Description of Characteristics of WRPC Berths*

Berth	Length (M)	Draught (M)	Status
Cargo berth 1 (CB1)	105	8	In operation
Cargo berth 2 (CB2)	105	12	In operation
Loading berth 1 (LB1)	125	5.9	Collapsed
Loading berth 2 (LB2)	125	12	Collapsed

Source: *WRPC reports (2018)*

transported and production of crude oil condensates, natural gas liquids and dry gas in barrels of oil equivalent.

3. Methodology

The primary data for this study were obtained from copies of questionnaires administered to a random sample of WRPC staff, while the secondary data on cargo throughput, ship traffic and vessel turnround time from 2004 to 2018 were obtained from WRPC annual reports. The questionnaire was divided into two sections. Section A elicited information on demographic characteristics of respondents. Section B consisted of questions related to the effect of manpower, pipeline vandalization, documentation procedures and funding on operational performance of WRPC. A five-point Likert scale was used as the rating response format and this was specified as follows: strongly agree, agree, undecided, disagree and strongly disagree. One hundred copies of questionnaire were administered to staff of WRPC in nine departments. These departments are Accounts, Marine Logistics, Maintenance, Operations, Electrical, Right of Way, Human Resources, Safety and Sales. Eighty copies of questionnaires returned were completely filled. We applied test of proportions and statistical trends to analyse the data discussed.

3.1. One Sample Proportions-Test

This will be employed to test for significant differences if any, in the opinion of respondents regarding some questions. Test of proportion can be used to test the opinion of respondents on factors affecting performance of jetties. For example, to test the null hypothesis that operational performance of the jetties is not affected by inadequate berthing facilities, we set the null $H_0 : P \neq 0.5$ i.e. proportion of respondents who agree, is not equal to 0.5 (or 50% of the sample), against the alternative hypothesis: $H_1 : P = 0.5$ i.e. the proportion who agreed is at least 50%. The categorical data obtained from copies of questionnaires administered were recoded to make them suitable for calculating test of proportions. Thus, scores from 1 to 3 were coded as 0 to represent 'disagree' while scores 4 to 5 were coded as 1 to represent 'agree'. The Z-statistics for one sample population proportion is calculated thus:

$$Z = \frac{\hat{P} - p}{\sqrt{\frac{pq}{n}}} \qquad (1)$$

$P=0,5$ is the hypothesized proportion.
$\hat{P}$ is calculated from the sample and $q=1-p$
Where n is sample size from population of respondents.
Critical region: $Z<Z_{\alpha/2}$ and $Z<-Z_{\alpha/2}$ (For a two-tailed test)
Decision: Reject H_0 if $Z>1,96$ or $Z<-1,96$ or if p-value < 0,05
The sample size n of the population under study is 80. This was made up personnel working in WPRC.

3.2. The Linear Trend Model

The linear model is represented by the equation as shown:

$$Y_t = \beta_0 + \beta_1 t + \varepsilon_t \qquad (2)$$

Where
Y_t: Value of the dependent variable Y (e.g. Volume of cargo throughput) during period t.
t: i^{th} unit of time (years 2004 -2018).
ε_t: Random movement unexplained by the trend variable during period t.

The trend analysis of cargo, vessel throughputs and turnround times were conducted to assess the performance of the jetties during the observational period. In other words, we sought to find out the direction of jetty performance (upward or downward) during the study period.

4. Data Presentation and Analyses

4.1. Analysis of WRPC Operational Performance

The description of operational activities in the jetties under study for the period between 2004 and 2018 is captured in Table 2 using two indicators. Cargo volume and number of vessels handled are both indicators of output. For the period, on average about 8 billion metric tonnes of cargo and 341 vessels were handled at the jetties. Based on Table 2, we note that on average vessels that called for service at the jetty spent 46 days before leaving jetty upon completion of ship operation. Ship turn round time is an indicator of service and represents in this case the quality of service received by calling vessels. It should be noted that the values of standard deviations are high in each of the variables examined.

The trend in cargo throughputs (made up loaded and discharged tonnage) in the jetties during the study period is shown in Figure 1. The slope of the graph is negative with a value of -380.21 (R^2 = 60.4%). Thus, it can be stated that in terms of output, performance of the jetties declined in the period. The same can be stated for the vessel throughput. See Figure 2. The trend in vessel traffic also declined considering the negative slope of value of 12.02 (R^2 = 63.6%).

Considering ship turnround times which is a measure of performance of quality of service rendered to the vessels that called for service at the jetties, we notice a marked increment in average time spent by the vessels. A careful observation of the figures shows that in years 2004-2005, there was average turnround time of 44 days, while in years 2006 to 2008, ships spent average of 33 days. Similarly, average turnround time of vessels peaked to 44, 56 and 66 days for years 2009-2014, 2015-2016 and 2017- 2018, respectively. Figure 3 indicates that there was positive slope (of value 1.88 and R^2= 64.3) in the trend of ship turnround time over time. This outcome is an indication of poor performance since obviously vessels that called for service at the jetties experienced delays.

So far, the analyses of secondary data in the study showed the following: poor performance evidenced in declining level of cargo, vessel throughputs and increased turnround times. The opinion of the personnel in these jetties was sought and

Table 2. *Descriptive Statistics: Operational Data of Warri Refining and Petrochemical Company (2004 – 2018)*

Variable	Mean	Std. Dev.	Min	Max
cargo volume (000, m/t)	8,209,240	2187418	3,291,000	10,800,000
vessel traffic (count)	341	67.424	192	409
ship turnround time (days)	46	10.479	33	66

Source: *Authors, based on field work, (2019)*

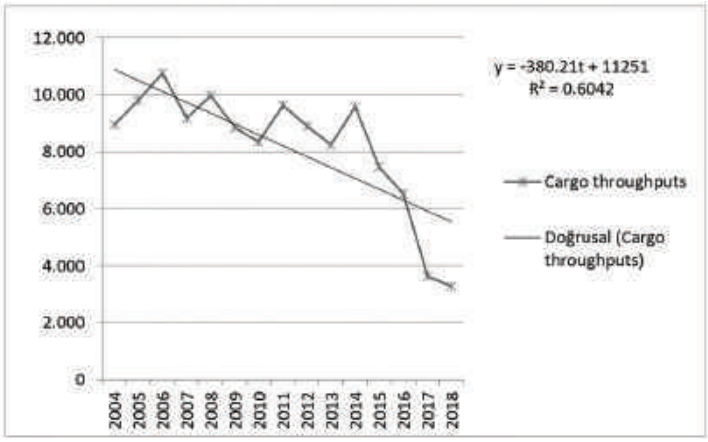

Figure 1. *Trends in Cargo Throughputs Handled in Warri Refinery Company Jetties (2004 -2018)*

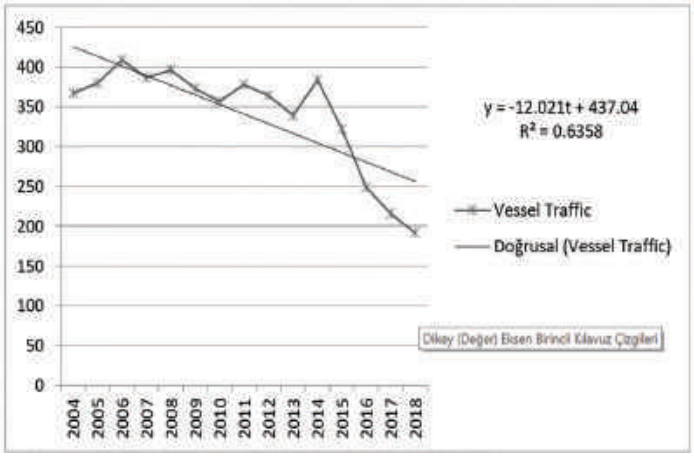

Figure 2. *Trends in Vessel traffic (counts) Over the Study Period*

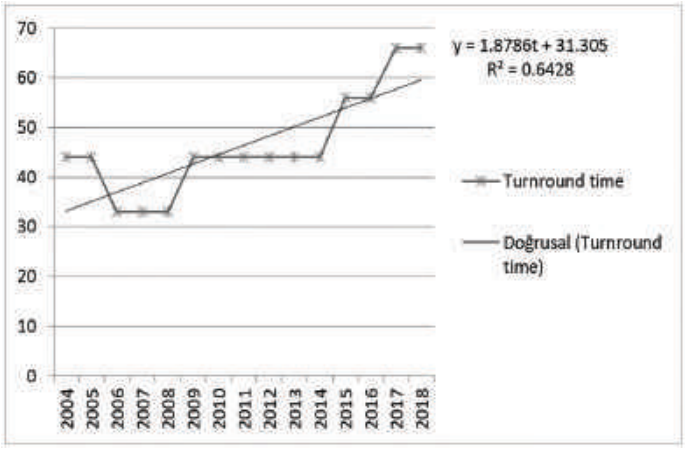

Figure 3. *Trends in Turnround Times of Vessels at the Jetties*

the findings are summarized in Table 3. The following factors affecting performance were examined: cargo handling facilities, funding, manpower resources, vandalization of pipelines feeding the jetties, jetty maintenance, and documentation procedures. From the table, the mean score of the rating response on each factor is greater than 2.5 (the mean of 5 on a Likert scale of 1 to 5 continuums). This outcome implies that these factors can be considered to collectively affect performance of jetty operation. The respondents' opinion on the level of performance at the jetty was also sought and Table 3 shows their response with a mean score of 3.75.

To address the hypotheses implied in this study, we employed test of proportions by calculating the proportion of respondents who agreed versus those who disagreed with respect to determinants of performance and level of performance at the jetties. In Table 4, we present the results of inferential statistics and their significant values. The results show that the following significant factors affect jetty performance: inadequate berthing facilities, funding, and manpower constraints. Others are pipeline vandalization, poor maintenance of jetty facilities and poor documentation processes. These factors were statistically significant given that the calculated Z statistic (Z-cal.) in each case is greater than the calculated Z statistic (Z-tab.). From the output in Table 4, significant proportion of the respondents also agreed that the level performance of jetty operation was below optimum during the period.

Table 3. *Descriptive Statistics: Determinants of Operational Performance in WRPC*

Constructs	Obs.	Mean	Std. Dev.	Min	Max
Inadequate berthing facilities	80	3.70	1.43	1	5
Inadequate funding	80	3.94	1.45	1	5
Inadequate supply of manpower	80	4.00	1.21	1	5
Pipeline vandalisation	80	3.68	1.34	1	5
Lack of maintenance of jetty facilities	80	3.69	1.22	1	5
Poor documentation	80	3.53	1.47	1	5
Rating on perceived level of performance by the Respondents					
WRPC has not performed optimally	80	3.75	1.33	1	5

Source: *Authors*

Table 4. *Variable/Construct Examined*

Item Nos.	Factors Affecting Jetty Performance	Po	P	Std. Error.	Z-cal.	Z-tab.	Decision: Reject Ho
i.	Inadequate berthing facilities	0.5	0.70	0.05	3.58	1.96	Yes
ii.	Inadequate funding	0.5	0.73	0.05	4.02	1.96	Yes
iii.	Inadequate supply of manpower	0.5	0.37	0.05	5.14	1.96	Yes
iv.	Pipeline vandalization	0.5	0.73	0.05	4.02	1.96	Yes
v.	Lack of maintenance of jetty facilities	0.5	0.75	0.05	4.47	1.96	Yes
vi.	Poor documentation	0.5	0.68	0.05	3.13	1.96	Yes
Response on Performance Level							
vii.	WRPC has not performed optimally	0.5	0.73	0.05	4.02	2.96	Yes

Source: *Authors own calculation*

4.2. Discussion of Findings

Within the framework of the methodology adopted for this study, we sought to assess the level of operational performance in WRPC jetties. The indicators of output at the jetties were obtained from the volume of cargo throughputs and the number of vessels handled at the jetties during the study period. It was deduced from the trend analyses of these indicators that performance decreased. The trend in turnround time, which gives indication of quality of service received by calling vessels on the average increased- meaning that calling vessels experienced delays during the period under observation. These findings are not surprising given that the respondents stated that performance level was not optimal. Significant majority also stated that the observed sub-optimal performance was due to constraints related to the following: funding, manpower, documentation and available facilities and their maintenance.

However, it should be expected that given the consistent reduction in volume of cargo handled and vessels serviced, some facilities should have been available or idle. The possible explanation to inadequate facilities (as reported) may be that due funding, vandalization and poor facilities maintenance, the quantity and quality of available facilities were negatively affected. It is apparent from the findings that efforts should be made to improve jetty performance to improve service to vessels and increase cargo and vessel throughputs and hence improve revenue earnings. In addition, jetties provide complimentary service to ports since their operations reduce demand for service pressures evident in conventional ports.

5. Conclusion and Recommendations

The findings from this study showed that shortage of manpower, inadequate berthing facilities, poor documentation processes, pipeline vandalization and inadequate funding significantly affected the operational performance of WRPC. The trend analysis showed a downward trend in cargo throughput and vessel traffic while upward trend was observed in the turnround times of calling vessels. In respect to cargo throughput and vessel traffic this downward trend implied a continuous decline in operational performance of WRPC while the upward trend in respect to vessel turnround time means increase in time spent by vessels at WRPC jetty which is an indication of poor service delivery.

The study made the following recommendations as follow;

i. There is need to improve manpower resources through adequate training that will enhance their performance. It must be noted that a well-trained work force is essential for effective and efficient performance of any organization.
ii. There is need to improve berthing facilities and introduce some changes in the maintenance management policy such as the preventive and turnaround maintenance of the facilities.
iii. WRPC should be well funded and have mechanisms in place that will ensure that funds provided are spent for the purpose which they are meant for.
iv. Documentation procedures should be enhanced especially through deployment of Information, Communication and Technology (ICT) facilities.

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Appendix 1: Sample Questionnaire Used for the Study

SECTION A: Respondent Profile						
Please tick the appropriate option where applicable.						
1. Sex	Male [ ] Female [ ]					
2. Marital status	Single [ ] Married [ ] Divorced [ ] Others [ ]					
3. Educational qualification	SSCE [ ] OND/NCE [ ] HND/BSC [ ] MSC [ ] OTHERS[ ]					
4. Department	Accounts [ ] Marine Logistics [ ] Maintenance [ ] Operations [ ] Electrical [ ] Right of way [ ] Human Resources [ ] Health and Safety [ ] Sales [ ]					
5. Current position:						
6. Work experience	0-5 [ ] 6-19 [ ] 11-15 [ ] 6-20 [ ]21 and above [ ]					
SECTION B: Please tick the appropriate option that best suits your answer in respect to the operational performance of Warri Refining and Petrochemical Company (WRPC) in the table below. KEY: SA- Strongly Agree A- Agree U- Undecided D- Disagree SD- Strongly Disagree						
Respondent view on WRPC operational performance						
S/N	STATEMENT	SA	A	U	D	SD
1	WRPC Jetty is has not performed optimally.					
2.	Inadequate supply of manpower has negatively affected operational performance					
3	Pipeline leaks as a result vandalisation caused delays in cargo/ship loading and discharge operations WRPC					
4	Lack of maintenance of jetty's facilities has affected performance of WRPC					
5	Inadequate berthing facilities has affected operational output of the jetties					
6	Documentation procedures at the jetties have affected operational outputs.					
7	Operations at the jetties have been hampered by insufficient funding.					

Appendix 2: Data on WRPC's operational performance indicators (2004-2018)

Year	Cargo throughput (Metric tons)	Average Vessel Turnround time (days)	Vessel Traffic (counts)
2004	8,947,500	44	367
2005	9,810,900	44	380
2006	10,758,700	33	409
2007	9,174,000	33	387
2008	9,968,300	33	396
2009	8,843,700	44	373
2010	8,359,200	44	357
2011	9,625,400	44	378
2012	8,905,000	44	364
2013	8,240,300	44	339
2014	9,584,800	44	384
2015	7,473,800	56	322
2016	6,528,000	56	249
2017	3,628,000	66	216
2018	3,291,000	66	192

Source: *Field study, 2019*

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Gender Discrimination Perception among Maritime Students in Turkey

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ABSTRACT

Gender discrimination is a controversial issue that is being debated around the world, independently the level of development of countries. This discrimination is tried to be prevented by legal regulations. However, it is a practice problem rather than law in business life.

The maritime sector is one of the sectors considered to be more prevalent in stereotypes of gender roles. It is thought that this discrimination is applied more in occupational groups that require physical force. It was aimed to determine the perceptions of associate degree students in maritime programmes about gender discrimination related to maritime profession at public universities across Turkey.

The result of the study reveals that the perception of gender discrimination is higher among female students than male. Especially Underwater Technology students' perception of gender discrimination is higher than Maritime Transport and Management, and Yacht Master students. It proves that women can not find any job in the industrial diving sector due to restrictions of Turkish Labor Law although they have education in Underwater Technology programmes.

Keywords

Gender Discrimination, Maritime Profession, Perception of Maritime Students.

1. Introduction

Literally, "equality" is the right of different groups of people to be subjected to similar social positions and practices. Gender discrimination is defined as a situation where people who are equal in quality are treated differently depending on their gender only [1].

The roles and responsibilities expected from individuals born and equipped with different genetic, physiological, and biological features, are expressed as the concept of gender. Although judgments about the importance attributed to gender discrimination vary in different societies at different times, it is seen that there are different attitudes according to the gender of the individuals in terms of using

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opportunities, benefiting resources, and accessing services [2]. This concept, which we encounter in many areas of society, is also one of the most important issues of the labor markets. An important part of the labor force, which forms the basis of development and economic growth, is exposed to the issue of discrimination based on gender and this causes the economy to lose its ability to adapt to change [3].

Throughout history, women, like men, have been involved in working life in order to contribute to the family and national economy. Despite the difficulties and gender discrimination they faced in business life, they tried to acquire their own position and title in every field of life.

It is undeniable fact that deep legal changes are needed to guarantee women's rights in the world. Discrimination against women in social and legal norms continues in many countries. As of 2014, 143 of 195 countries have recognized equality between women and men, but 52 other countries have not take any steps in this regard. There has been gender discrimination in the economic and political sectors over the past decade, and women earn 24% less than men in the global job market [4]. The gender barrier denies the potential of many women in terms of opportunities and empowerment, both in current and business life. Gender equality and women's empowerment can be described as the basic dimensions of human development. Development and improvement activities involving half of humanity and without women are not universal [5]. World Economic Forum founder Klaus SCHWAB emphasized that societies, where women are ignored, will lose their talents, ideas, and perspectives for new opportunities against global challenges. He says that there is a relative gap between women and men are in the fields of health, education, economy, and politics and he emphasizes that the integration of women into the talent pool in the innovative capacity of countries should be made imperative [6].

Gender discrimination remains one of the biggest obstacles to social development. Another dangerous aspect of discrimination is that negativity in the quality of social cohesion can also slow human development [7].

According to the Global Gender Gap Report 2020 of World Economic Forum Iceland is the top performer country in gender discrimination and Turkey is ranked at the 130 of 149 [8]. The report provides data that it would take 108 years for women to have equal rights with men and 202 years for men to have equal pay. Turkey as a member of OECD, draws a chart that falls far behind the OECD countries also. Women's labor force participation rate was 32.8% in the OECD's report for the last quarter of 2018, while that of men was 69.9 % [9]. This ratio reveals its place in the working life of women in Turkey.

TurkStat 2017 data, which includes labor force participation rates based on educational status in Turkey, shows that women are more likely to join the labor force as education levels rise. The labour force participation rates are as follows: illiterate women %15.9 high educated women %27.7 high school graduate women %34.3, vocational or technical high school graduate women %42.9, higher education %72.7. According to the results of the household labour force survey; in 2017, the proportion of men employed in Turkey aged 15 and above was 65.6%, while the proportion of women was 28.9% [10].

In today's working life, there are stereotyped prejudgements about gender in some occupational groups. The maritime sector is also a gender-discriminated occupational group. The place of female seafarers among 1.25 million sailors worldwide does not exceed 1-2 %. In addition, women's participation in the maritime transportation sector is 17-18% [11].

According to data from the T.R. Ministry of Transport and Infrastructure May 2017, the proportion of female officers in the sector is 2 %. This data is shown below in Table 1 [12].

Table 1. *Licenced Turkish Women Officers on Maritime Sector*

Rank	Women Officers	Total Officers (Women + Men)
Oceangoing Watchkeeping Officer	141	2813
Oceangoing Chief Officer	48	1886
Oceangoing Master	31	3423
Oceangoing Watchkeeping Engineer	26	1530
Oceangoing First Engineer	1	937
Oceangoing Chief Engineer	7	1886
Total	254	12475

Source: *[12].*

In addition, according to the Food and Agriculture Organization (FAO) data, the employment participation rate of women in fisheries and aquaculture areas is only 14% in 2014. Despite the new arrangements intended to improve the existing situation, women are still excluded from mainstream maritime activities and many countries still pursue gender-blind maritime policies [13].

As in the world, women are a minority in the maritime sector in Turkey. This makes it necessary for women to make more effort to get themselves involved in the industry. Efforts to establish women's identity in the sector are not much supported by family members and employers. The entry of women into the men-dominated maritime sector is seen as an invasion by men [14]. However, women's performance in the maritime sector should not be measured by their gender.

Prejudice and attitudes towards gender discrimination are not limited only to the reaction of family and employers. Articles stated in labor law like "It is forbidden to employ men under eighteen years of age and women of all ages in underground or underwater works such as mine and cable laying, sewerage and tunnel construction" completely abolishes the employment of women divers. Women divers who are allowed to receive training in the underwater sector are prevented from working in the sector by this regulation.

International Maritime Organization (IMO) nominated the year of 2019 as "The Year of Maritime Women & Increasing Awareness of Maritime Women". International Labor Organization (ILO) and the International Transport Workers' Federation (ITF) put regulating rules against gender discrimination as the International Maritime Organization. These non-governmental organizations strive to break the taboo that maritime is a male-dominated sector. Despite these positive efforts, women seafarers consist of 1.2 million seafarers population [15].

It can be stated that gendered approaches have been adopted in the maritime sector in the world and in Turkey. This study is based on the idea that there are stereotypes of gendered attitudes in industrial divers, ship officers, and yacht master professions. In this context, it is aimed to identify the perceptions of gender discrimination in the maritime profession of associate degree students who are studying in the fields of Underwater Technology, Maritime Transportation and Management, and Yacht Master Programs in Turkey. Some studies on gender discrimination and their results are shown below in Table 2.

Table 2. *Previous Studies on Gender Discrimination*

Authors	Researches	Aim of Researches	Outcomes
Sanchez ve Brock (1996) [16]	Outcomes Of Perceived Discrimination Among Hispanic Employees: Is Diversity Management A Luxury Or A Necessity?	Investigating the effect of discrimination perception on employee production	The perception of discrimination affects employees above and beyond other factors causing work stress and affects the production of employees.
Gutek et al. (1996) [17]	Reactions to perceived sex discrimination	To investigate the relevance of perceived discrimination in business and organizational life to individuality	While workers perceived relatively less discrimination, women perceived more discrimination against them than men, and when the two sexes were dealt with at the same time, it was determined that women were discriminated against more than men
Brickman (2008) [18]	Maritime Education And Training of Women: Their Impact On The Program At The United States Merchant Marine Academy	To investigate changes in maritime education and training following the inclusion of women as students in the Maritime Academy	Changes in maritime education and training have been achieved following the inclusion of women as students in the Maritime Academy.
Onay (2009) [19]	The Consequences Of Perceived Gender Discrimination And An Empirical Research Related With The Topic	To be able to identify the relationship between variables that help to identify the concept of sex discrimination in individuals	Female employees perceive discrimination more than men. In addition, gender discrimination among employees affects their organizational commitment and increases employees' intention to quit.
Arlı (2013) [20]	Gender Segregation and Gender Bias Perceived in Marine Tourism: A Research on the Students of Karamürsel Vocational Higher School	To identify what is the perception of gender discrimination and gender bias among university students in maritime tourism education	It was determined that there was a statistically significant difference between female and male students' perceptions of occupational sex discrimination and prejudice against women. It was also determined that female students were aware of the gender discrimination applied to women in this area
Nas (2014) [21]	A Study On Short Historical Process Of Professional Turkish Women Seafarers	To explain the process from the admission of Turkish women to maritime education institutions to the professional careers they reach today.	The proportion of female seamen candidates in maritime training institutions was found to be 5% of the total student quota of these institutions. While this proportion in educational institutions has been maintained, very few of the female sailors working on ships have achieved the high-level qualifications of the maritime profession.
Cömert (2014) [22]	Thoughts about Their Sectoral Working Areas and Sex Discrimination in Employment by Students Who Are Taking Tourism Training	To determine the thoughts about their sectoral working areas, whether gender factor affects these preferences, and students ' thoughts on gender factor in recruitment and promotion processes from tourism sector.	The department where male employees want to work the most is the service (32.5%) and the department where female employees want to work the most is the housekeeping service (15.9%). The perception that some jobs are considered women's work and some jobs are considered men's work is supported.

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Table 2. *Previous Studies on Gender Discrimination (Cont')*

Authors	Researches	Aim of Researches	Outcomes
Davras & Davras (2015) [23]	Thoughts about sex discrimination in tourism sector by students who are in Gastronomy and Culinary Program	The aim of this study was to identify the students' thoughts on gender discrimination in the recruitment and promotion processes in the kitchen.	Students stated that the most gender discrimination was in promotion and recruitment, while the least was in the salary. Female students' perceptions of gender discrimination were higher than male students'
Nemlioğlu Koca (2015) [24]	The Perception of Gender Discrimination And Prejudice in Maritime: A Research on the Students of Barbaros Maritime School	Gender discrimination in maritime education and students' perceptions of bias were tried to be determined.	A statistically significant relationship between gender and gender discrimination and prejudice has been revealed. Accordingly, the result is that the gender of the students influences their thoughts on gender discrimination and prejudice. It is revealed that there is a directly proportional relationship between gender discrimination and prejudice, and that gender discrimination can also be eliminated by eliminating prejudices
Özcan et al. (2017) [25]	A Research About Prediction on Gender Discrimination Related to Engineering	Gender perceptions and prejudices for senior students in industrial engineering and engineering profession are examined.	Students found Industrial Engineering appropriate in terms of their gender. While students' perception of men's profession as an engineering profession differed significantly by gender, it did not differ by other demographics. Prejudices regarding gender discrimination in the engineering profession differ only by their gender.

Source: *Created by author*

2. Method

2.1. The Goal of the Present Research

The aim of the study is to determine the perceptions of gender discrimination in the maritime profession of associate degree students who are studying in the maritime field (underwater technology, maritime transportation and management, and yacht master) which have not yet been introduced into their working lives. In addition, the findings on gender discrimination according to the profile variables of the students and the existence and reasons of occupational sex discrimination in the maritime profession were tried to be determined.

2.2. Hypothesis

(1) Students' perceptions of gender discrimination differ in terms of profile for bulleted lists.

- "gender".
- "education programme".
- "class level".
- "region where their family lived".
- "family education level".
- "family income level".
- "whether there is a relative in the sector".

2.3. Population and Sample of the Research

The population and sample of research are indicated below in Table 3. In determining the population of the research, it was calculated by taking twice the 2018 quota of the institutions providing underwater technology, marine transportation and management, and yacht master associate degree education in Turkey. However, the number of active students in schools are below the specified set of population (quotas).

2.4. Instruments

The first part of the questionnaire involves students' demographic characteristics: gender, education programme, class level, region where their family lived, family education level, family income level, and whether there is a relative in the sector. 10 items of gender discrimination perception have been used with the permission of Prof. Sanchez on 18 April 2018 and developed by Sanchez

Table 3. *Population and Sample of The Research*

STATE UNIVERSITIES IN TURKEY PROVIDING EDUCATION IN THE FIELD OF UNDERWATER TECHNOLOGY PROGRAM	**POPULATION**	**SAMPLE**
EGE UNIVERSITY- (İZMİR) Urla Maritime Vocational School	100	51
İSTANBUL UNIVERSITY -CERRAHPAŞA Vocational School of Technical Sciences	60	19
İSKENDERUN TECHNICAL UNIVERSITY- (HATAY) Maritime Vocational School	60	16
ÇUKUROVA UNIVERSITY- (ADANA) Yumurtalık Vocational School	50	5
SİNOP UNIVERSITY Vocational School	60	14
RECEP TAYYİP ERDOĞAN UNIVERSITY- (RİZE) Vocational School of Technical Sciences	70	34
STATE UNIVERSITIES IN TURKEY PROVIDING EDUCATION IN THE FIELD OF MARITIME TRANSPORTATION AND MANAGEMENT PROGRAM	**POPULATION**	**SAMPLE**
EGE UNIVERSITY- (İZMİR) Urla Maritime Vocational School	120	92
YALOVA UNIVERSITY- Yalova Vocational School	120	71
MERSİN UNIVERSITY- Maritime Vocational School	110	-
KOCAELİ UNIVERSITY- Karamürsel Vocational School	160	71
YALOVA UNIVERSITY- Yalova Vocational School (Evening Edu.)	70	-
ORDU UNIVERSITY- Fatsa Vocational School	120	46
GİRESUN UNIVERSITY- Vocational School of Technical Sciences	40	10
MERSİN UNIVERSITY- Maritime Vocational School (Evening Edu.)	70	-
GALATASARAY UNIVERSITY- (İSTANBUL) Vocational School (Evening Edu.)	50	25
STATE UNIVERSITIES PROVIDING TRAINING IN THE FIELD OF YACHT MASTER PROGRAM	**POPULATION**	**SAMPLE**
MUĞLA SITKI KOÇMAN UNIVERSITY- Bodrum Maritime Vocational School	60	19
Total	**1320**	**402**

Source: *Created by the authors*

and Brock's (1996) and Gutek et al. (1996). In the present study, the questionnaire's overall Cronbach's internal consistency reliability estimate is 0.850 (n=402) (r ≥ 0.70).

2.5. Analyses

Data collected by the questionnaire were analysed with SPSS 25.0 program.

• Frequency analyses of the responses of the students to the questions aimed at revealing their demographic characteristics were carried out. Also, skewness and kurtosis values of these variables were used to determine whether the distribution of variables were parametric or not. For kurtosis and skewness values, it is assumed to be a normal distribution when it is -1.5 to +1.5 [26].

• ANOVA test has been used in the parametric variables of the field of education programme, region where their family lived, family education level, and family income level. Mann Whitney U test was used in the nonparametric variables of gender, class level, and whether there was a relative in the sector.

• 'e^2' (eta-squared) value was used for measuring the effect size of significant differences in ANOVA tests. The effect size was small if e^2 value is smaller than 0.01, medium if e^2 value between 0.01-0.059, and large if e^2 is bigger than 0.138. In Mann Whitney U test 'r' value has been used for measuring the effect size. The effect size is small if r value is smaller than 0.1, medium if r value is between 0.1-0.3, and large if r

Table 4. *Frequency Analyses*

Education programme			**Gender**			**Class level**		
	N	**%**		**N**	**%**		**N**	**%**
MTM	244	60	Male	340	84	1.grade	225	56
UT	139	35	Female	62	16	2.grade	177	44
YM	19	5						
Total	402	100	***Total***	402	100	***Total***	402	100
Region where the family lived			**Mother education level**			**Father education level**		
	N	**%**		**N**	**%**		**N**	**%**
Marmara	120	30	Primary	153	38	Primary	109	27
Aegean	110	27	Secondary	111	28	Secondary	137	34
Akdeniz	74	18	High school	102	25	High school	94	23
Karadeniz	58	14	Higher	36	9	Higher	62	16
İç Anadolu	22	5						
Doğu Anadolu	10	3						
Güneydoğu Anadolu	8	3						
Total	402	100	***Total***	402	100	***Total***	402	100

Family income level			**Whether there is a relative in the sector**		
	N	**%**		**N**	**%**
1000-3000 TL	215	54	Yes	76	19
3000-6000 TL	154	38	No	326	81
6000 or above TL	33	8			
Total	402	100	***Total***	402	100

Source: *Created by the authors*
(UT: Underwater Technolgy, MTM: Maritime Transportation and Management, YM:Yacht Master)

value is bigger than 0.5 [27].

• The students' perceptions of gender discrimination have been indicated low from 1.00 to 2.39, moderate from 2.40 to 3.39, and high from 3.40 to 5.00 [24].

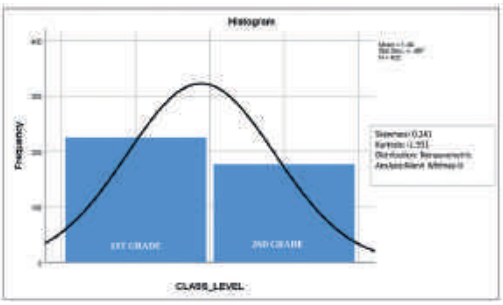
3. Findings

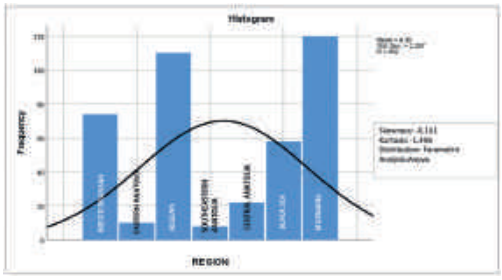
3.1. Frequency Analysis

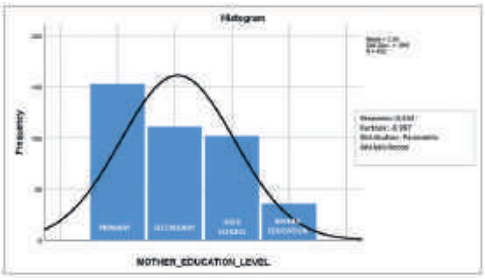
The frequency analyses of the demographic characteristics of the students participating in the study are given in Table 4.

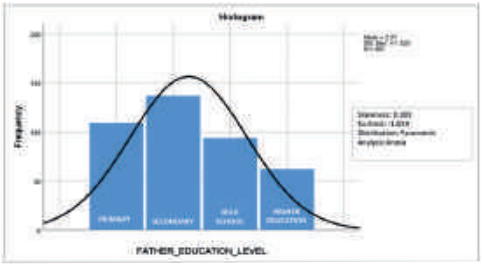
3.2. Distribution of Profile Variables

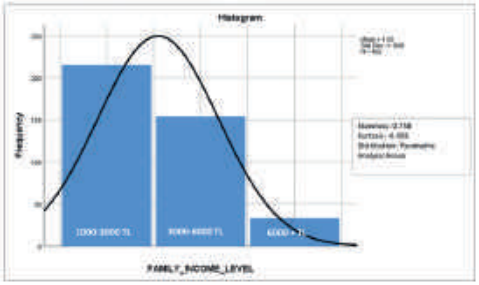
Skewness and kurtosis values were used to determine the analysis methods for variables of gender, education program, grade level, the region of family, education level of parents, the total income of the family, whether or not they were familiar with the sector. The skewness and kurtosis values of the variables are shown below in Figure 1.

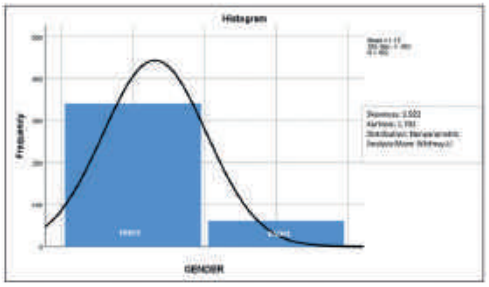












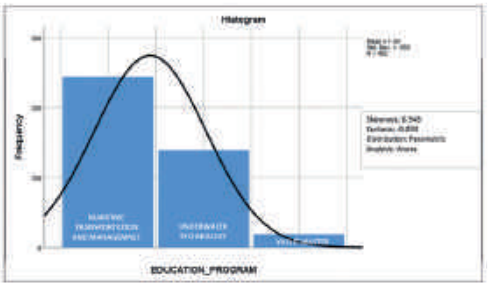


Figure 1. *Distributions of Profile Variables and Analysis Methods*

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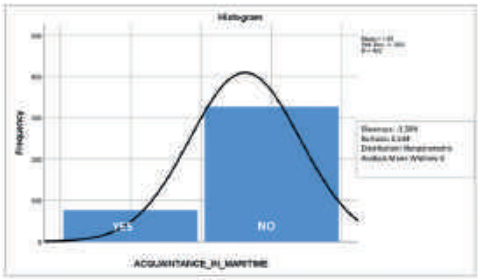

Figure 1. *Distributions of Profile Variables and Analysis Methods (Cont')*

3.3. Distributions of Students' Responses to Statements About Gender Discrimination Perception

Distributions of students' responses to statements about gender discrimination perception are shown below in Table 5. When the response distributions are examined, it is understood that they participate in "I believe women are being treated biased in the maritime industry" (3.6393±1.180), "I believe there are stereotyped negative thoughts about women working in the maritime industry" (3.6294±1.162) and "I believe men are more favoured in recruitment in the maritime sector" (3.7214±1.099) expressions at a high level. It was also revealed that they participated moderately in "I believe that seafaring is perceived as a male profession" (2.6418±1.402), "I believe there is different remuneration for men and women employees in the maritime sector" (2.5448±1.143), and "I believe that different legal arrangements have been made for men and women employees in the maritime sector" (2.6219±1.170) expressions and gave the lowest score.

3.4. Hypothesis Test Results on Gender Discrimination Based on Students' Profile Information

Hypothesis tests based on profile information showed significant differences in the variables of gender, education programme, and whether there was an acquaintance in the maritime sector. There were no significant differences in the tests according to the variables of the class level, the region where the family lived, the education level of the parents, and

Table 5. *Distributions of Students' Responses to Statements About Gender Discrimination Perception*

	Strongly disagree		Disagree		Undecided		Agree		Strongly agree			
ST.	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**Mean**	**SD**
1	110	27.4	109	27.1	51	12.7	79	19.7	53	13.2	**2.6418***	1.402
2	24	6.0	59	14.7	57	14.2	160	39.8	102	25.4	**3.6393***	1.180
3	26	6.5	53	13.2	58	14.4	172	42.8	93	23.1	**3.6294***	1.162
4	14	3.5	56	13.9	62	15.4	166	41.3	104	25.9	**3.7214***	1.099
5	38	9.5	111	27.6	87	21.6	108	26.9	58	14.4	3.0920	1.222
6	33	8.2	99	24.6	72	17.9	130	32.3	68	16.9	3.2512	1.231
7	34	8.5	86	21.4	81	20.1	143	25.6	68	14.4	3.2612	1.192
8	29	7.2	93	23.1	94	23.4	127	31.6	59	14.7	3.2338	1.171
9	76	18.9	137	34.1	113	28.1	46	11.4	30	7.5	**2.5448***	1.143
10	74	18.4	124	30.8	117	29.1	54	13.4	33	8.2	**2.6219***	1.170

Source: *Created by the authors*

the income level of the family. The data for variables with significant differences are shown below in Table 6. The perception of being treated with prejudice by women in the maritime sector was higher among women participants (272.16) than men (188.61) and this significant difference had a large effect size (r=-0.52). The perception of stereotyped negative thoughts towards women in the maritime sector was higher among women participants (259.97) than men (190.84) and this significant difference had a moderate effect size (r=-0.23). The perception that men were preferred in recruitment in the maritime sector was higher among women (262.47) than men (190.38) and this significant difference had a moderate effect size (r=-0.24). The perception that men advance more easily in the maritime sector was higher among women (236.53) than men (195.11) and this significant difference had a small level of effect size (r=-0.13). The perception that men were more supported in the maritime sector was higher among women participants (254.94) than men (191.76) and this significant difference had a moderate effect size (r=-0.20). The perception that definitions for the stereotyped roles of men and women were used in the maritime sector was higher among women participants (263.02) than men (190.28) and that this significant difference had a moderate effect size (r=-0.23). The perception of attaching different weights to the thought of women and men in the maritime sector was higher among women participants (258.97) than men (191.02) and this significant difference had a moderate effect size (r=-0.22). The perception of different remuneration between men and women in the maritime sector was higher among women participants (233.23) than men (195.71) and this significant difference had a small effect size (r=-0.12).

The perception that men preferred in recruitment in the maritime sector was higher among Underwater Technology programme students (4.1295) than Marine Transportation and Management programme students (3.4918) and this significant difference had a medium effect size (e^2:0.07). The perception that men advanced more easily in the maritime sector was higher among Underwater Technology programme students (3.5683) than Marine Transportation and Management (2.8402) and Yacht Master (2.8421) programmes students and this significant difference had a medium effect size (e^2: 0.08). The perception that men were more supported in the maritime sector was higher among Underwater Technology programme students (3.5827) than Marine Transportation and Management programme students (3.0656) and this significant difference had a small effect size (e^2: 0.04). The perception that definitions for the stereotyped roles of men and women were used in the maritime sector was higher among Yacht Master programme students (3.7368) than Marine Transportation and Management programme students (3.0738) and this significant difference had a small effect size (e^2: 0.04). The perception that different remuneration between men and women in the maritime sector was higher among Yacht Master programme students (3.2105) than Marine Transportation and Management (2.2910) and Underwater Technology (2.8993) programmes students and this significant difference had a medium effect size (e^2: 0.08). The perception that the existence of different legal arrangements for men and women in the maritime sector was higher among Underwater Technology programme students (3.0504) than Marine Transportation and Management (2.3975) and Yacht Master (2.3684) programme students and this significant difference had a medium effect size (e^2:0.07).

The perception that the existence of different remuneration between men and women in the maritime sector was higher among the students who had not an acquaintance in the maritime sector (210.80) than the students who had (161.61) and this

significant difference had a medium effect size (r=-0.17). The perception that different legal arrangements for men and women in the maritime sector was higher among the students who had not an acquaintance in the maritime sector (213.71) than the students who had (149.13) and this significant difference had a medium effect size (r=-0.22).

Table 6. *Hypothesis Test Results on Gender Discrimination Based on Profile Information*

SCALE TO DETECT PERCEPTION OF GENDER DISCRIMINATION	**PROFILE VARIABLES**					
	Gender *"Mann Whitney U Test" Differences**		**Education programme** *"Anova Test" Differences**		**Whether there is a relative in the sector** *"Mann Whitney U Test" Differences**	
1- I believe that seafaring is perceived as a male profession.	--	--	--		--	--
2- I believe women are being treated biased in the maritime industry.	U:6159.000 **p: 0.000** r: -0.52	Male : 188.61 Female : 272.16	--		--	--
3- I believe there are stereotyped negative thoughts about women working in the maritime industry.	U:6915.000 **p: 0.000** r: -0.23	Male : 190.84 Female : 259.97	--		--	--
4- I believe men are more favoured in recruitment in the maritime sector.	U:6760.000 **p: 0.000** r: -0.24	Male : 190.38 Female : 262.47	F: 16.021 **p: 0.000** e^2: 0.07	UT (4.1295)* MTM (3.4918)*	--	--
5- I believe men advance more easily and quickly in the maritime industry.	U:8368.000 **p: 0.008** r: -0.13	Male : 195.11 Female : 236.53	F: 17.440 **p: 0.000** e^2: 0.08	UT (3.5683)* MTM (2.8402)* YM (2.8421)*	--	--
6- I believe in the maritime industry that men are more supported in professional development	U:7227.000 **p: 0.000** r: -0.20	Male : 191.76 Female : 254.94	F: 8.103 **p: 0.000** e^2: 0.04	UT (3.5827)* MTM (3.0656)*	--	--
7- I believe definitions are being used for the stereotypical roles of men and women in the maritime industry.	U:6726.000 **p: 0.000** r: -0.23	Male : 190.28 Female : 263.02	F: 8.226 **p: 0.000** e^2: 0.04	YM (3.7368)* MTM (3.0738)*	--	--
8- I believe that the words or opinions of men and women employees in the maritime sector are valued differently.	U:6977.000 **p: 0.000** r: -0.22	Male : 191.02 Female : 258.97	--		--	--

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Table 6. *Hypothesis Test Results on Gender Discrimination Based on Profile Information (Cont')*

SCALE TO DETECT PERCEPTION OF GENDER DISCRIMINATION	PROFILE VARIABLES					
	Gender *"Mann Whitney U Test" Differences**		**Education programme** *"Anova Test" Differences**		**Whether there is a relative in the sector** *"Mann Whitney U Test" Differences**	
9- I believe there is different remuneration for men and women employees in the maritime sector.	U:8572.500 **p: 0.015** r: -0.12	Male : 195.71 Female : 233.23	F: 17.218 **p: 0.000** e^2: 0.08	YM (3.2105)* MTM (2.2910)* UT (2.8993)*	U:9356.500 **p: 0.001** r: -0.17	Yes : 161.61 No : 210.80
10- I believe that different legal arrangements have been made for men and women employees in the maritime sector	--	--	F: 3.822 **p: 0.023** e^2: 0.07	UT (3.0504)* YM (2.3684)* MTM (2.3975)*	U:8408.000 **p: 0.000** r: -0.22	Yes : 149.13 No : 213.71

Source: *Created by the authors*
(UT: Underwater Technolgy, MTM: Maritime Transportation and Management, YM:Yacht Master)

4. Conclusion

In this study, it was aimed to determine the perceptions of gender discrimination among university students receiving associate degree maritime education and whether the perceptions differ according to demographics. The presence of perceived gender discrimination in the maritime sector, particularly by female students, has been revealed. According to 72nd Article of Turkish Labor Law No. 4857 (10.06.2003) [28] "It is forbidden to employ men under eighteen years of age and women of all ages in underground or underwater works such as mine and cable laying, sewerage and tunnel construction" completely abolishes the employment of women divers. The study is thought to be the result of this regulation, in particular, that Underwater Technology Program students are more involved in the existence of gender discrimination than other programs. Although the regulation article is tried to be intended to protect women against the dangers in underwater, it prevents women to work in the underwater sector other than tourism. On the other hand, there is no obstacle for women to receive education in schools that offer underwater technology education. However, female divers graduated from these schools are unable to find a place in the industrial diving sector due to the limitation of the field of work provided by the regulation.

In Maritime Transport and Management sector, there was not any restriction in law for women employment. But, both Turkish Trade Law and Turkish Maritime Labour Law still do not recognize women seafarers, and women are still enforced to get "Seamen's Book" instead of "Seafarer's Identification Books". This shows that existing legislations are insufficient in recognition of women in all fields of maritime industry [29]. Increasing participation of women in the maritime industry will prevent existing discrimination and inequality in law and practice. Also, the maritime sector, in which women are more involved, will have well-based working standards, and conditions.

It was concluded that there is prejudice

against women in the maritime profession, negative thoughts about women, and the perception that men find work easier than women. The fact that there are prejudices and negative thoughts about the existence of women both in the underwater sector and in the maritime transport sector. This situation restricts the ability of women to plan careers in the maritime sector. Therefore, as stated by Nas (2014), the proportion of women in maritime training institutions does not exceed 5 %.

The fact that female students' perceptions of gender discrimination were higher than male students' proved that the perspective of women was negative in the sector. Particularly, recording a high level of difference between male and female students in the second question of the scale has indicated that the prejudice against women in the maritime sector has not yet been demolished and that more should be done on the subject. In addition, the perception that the maritime profession is a male profession is not perceived differently by female and male students. This is a promising aspect of the research.

In order to increase the employment rate of women in all branches of the maritime sector, equal approaches should be provided to women both in education, legally, and in work environments. The fact that women are more involved in both a mentally and physically demanding profession, such as maritime, will be an important factor in demolishing stereotyped prejudices in society. It is also thought that the increase in the number of women who contribute to the quality understanding in the sector they enter, will increase dynamism and affect maritime in a positive way.

5. Discussion and Suggestions

This study has revealed the existence of gender discrimination in the maritime sector in parallel with the studies conducted by Gutek et al. (1996), Onay (2009), Arlı (2013), Davras & Davras (2014) and Nemlioğlu Koca (2015). In this study gender discrimination has not been analyzed from general perspective. Instead of this approach, the perception of officers candidates and divers candidates were measured separately because of their different dynamics.

To eliminate the prejudice against women in the maritime sector, it is necessary to raise awareness of the sector's dignitaries. Although there have been positive developments, it is thought that there is a further path to be taken both in terms of legislation and in terms of demolishing negative thoughts.

Conducted the study on only the associated degree maritime students is one of the limitation of the study. The other limitation is focusing only to the students on maritime. In future studies, it will be useful to make gender discrimination research on women seafarers and women workers in the maritime sector.

Future studies of the perceptions of gender discrimination in the maritime and aviation sectors, which have similar disciplines, are thought to be useful to ensure that possible differences are looked at from different points of view.

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Investigation of the Effect of Number of Longitudinal Rounded Grooves on Hydrodynamic Forces acting on Cylinders in Cross Flow at Re=10^5

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ABSTRACT

Crossflow over cylindrical structures has been extensively studied by both academia and industry in various fields. It is responsible for in-line and transverse vibrations of marine risers. Flow-induced structural vibrations may end up with the failure of these tubular systems in oceans and seas. First experimental studies in literature signified that longitudinally grooved cylinders inspired by Saguaro trees may offer reductions both in drag and lift forces. In the present study, the performance of 2 dimensional (2D) unsteady Reynolds averaged Navier-Stokes (URANS) simulations is tested in predicting hydrodynamic force coefficients of cylinders. First, CFD runs are conducted on a smooth cylinder and a cactus-like cylinder in literature. Then flow over 8-, 10-, and 12-grooved cylinders with a diameter of 0,5 m are solved to analyze flow features in detail and evaluate the capability of 2D URANS solver for the problem at hand. k-ω SST turbulence model is employed in URANS solver. It is shown that as the number of grooves increases, mean drag slightly decreases and amplitude of drag decreases by 29%. Separation angle is significantly improved with a number of grooves from 92° to 120°. However, the amplitude of lift force increases with the number of grooves with reference to 2D CFD simulations.

Keywords

Cylinder, Longitudinal Rounded Grooves, Flow Induced Forces, CFD, Marine Riser.

1. Introduction

Cylindrical-shaped bodies in crossflow stream are subject to unsteady aerodynamic fluctuating drag and lift forces due to arising vortex shedding behind the object [1]. In response, the cylindrical structure fluctuates in streamwise and transverse directions [2],[3]. The cylindrical body may be an antenna, a riser in the ocean or supporting column of a floating petroleum platform in the sea. When vortex shedding frequency coincides with the natural frequency of the body, amplitudes of motion grow substantially and may result in the

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destruction of the structural system. Some engineering solutions have been devised to reduce fluctuating forces such as helical strakes [3] and fairings [4] on marine risers [5]. The main idea behind is to break down synchronous vortex shedding along the cylinder span with helical strakes [2] and to increase backpressure streamlining the body with fairings in order to decrease drag. In the tandem arrangement of two helical straked-cylinders, increase in fluctuating lift on a downstream cylinder was experimentally demonstrated [6]. On the other hand, helical strakes increase drag [7]. Fairings on marine risers reduce adverse pressure gradient on the downstream side, block vortices interactions, limit transverse motion of vortices and move away vortices from the body. These features diminish both mean drag and fluctuating lift forces [8]. Risers fitted with fairings are not suitable for use near sea surface due to frequent directional changes of surface waves. These techniques are frequently applied in production and drilling risers in the offshore oil and gas industry to suppress flow-induced vibrations [8]. While helical strakes are omnidirectional, fairings are unidirectional solutions.

There exist some other suggested modifications on the cylinder in scientific research studies. Sinusoidal wavy cylinders [9], circular rings around cylinder [10], cylinders with bumps [7], surface roughened cylinders [11] are in this list. It was revealed that wavy cylinders disrupts regular vortex shedding and increases three-dimensionality in the wake. These impacts yielded considerable decrease both in drag and fluctuating lift [12]. Tripwire or other attachments on cylinders were studied to make boundary layer turbulent before separation and delay flow detachment from the surface [13][14]. However, tripwire techniques are unidirectional; they immediately lose their benefits when the current direction changes. Longitudinal U-grooved cylinders were also experimented and found successful for a reduction in mean drag at Reynolds (Re) numbers greater than $4x10^4$. But the Strouhal (St) number slightly increased with Re number [15]. In experiments, longitudinal V-grooves on cylinders decreased the critical Re number where drag coefficient (C_d) drops [16].

Due to the special features of Saguaro trees, they have attracted much attention in recent years [17]-[19]. Saguaro trees have triangular grooves in spanwise direction and spines at the tip [17]. Although roots of Saguaros are very shallow, with an average root-length of 25 cm, these trees can withstand strong winds for years. Their long life ends up to 150-years [17]. Many experimental and computational research studies have been conducted on unsteady hydrodynamic characteristics on Saguaro trees [19]-[23]. It was demonstrated experimentally that both mean drag and root-mean-square (RMS) of lift force on cylinders can be reduced with longitudinal triangular grooves [23]. Grooves as vortex generators ensure attached flow and late separation resulting in less drag [18]. It was also reported that turbulence intensity (TI) around the cacti, which is partially responsible for the fluctuating forces on bluff bodies, decreased [18][19][22].

To the author's knowledge, aero/hydrodynamic characteristics of the longitudinal rounded grooved cylinder have not been investigated numerically before. Though fluctuating lift has been more widely researched, fluctuating drag forces damage the structure in the same level with their double frequency [24]. In this study, the effects of the number of rounded grooves on fluctuating lift and drag forces are investigated by 2D URANS Computational Fluid Dynamics (CFD) analyses. CFD simulations are first performed for flow around smooth and 8-grooved cylinders to test CFD solver in predicting flow field

and aero/hydrodynamic characteristics comparing with literature experimental data.

2. CFD Simulations

In this study, CFD simulations are carried out for one smooth cylinder and three grooved cylinders. 2D computational domain and its boundaries are shown in Figure 1a. Free stream velocity (U) and TI (%0.35) are specified at the inlet. Since derivatives of variables in a normal direction to the far-field boundary are expected to vanish, the symmetry boundary condition is applied. Gage pressure is set to zero at the outlet. No-slip boundary condition is applied on cylinder walls.

CFD simulations are performed by use of Ansys Fluent software [25]. k-ω SST, a fully turbulent flow model, is employed to model unsteady Reynolds averaged Navier-Stokes equations. This model is known to be successful in predicting adverse pressure gradient boundary layer flows in which flow separation occurs [26][27]. For a few decades, the k-ω SST model has been applied to solve turbomachinery flow problems by securing trade-off between computational accuracy and computation time [28]. Continuity and momentum equations derived by RANS modeling are as follows [27],

$$\frac{\partial \rho}{\partial t}+\frac{\partial}{\partial x_i}\left(\rho u_i\right)=0 \tag{1}$$

$$\frac{\partial}{\partial t}\left(\rho u_i\right)+\frac{\partial}{\partial x_j}\left(\rho u_i u_j\right)= -\frac{\partial p}{\partial x_i}+\frac{\partial}{\partial x_j}\left[\mu\left(\frac{\partial u_i}{\partial x_j}+\frac{\partial u_j}{\partial x_i}-\frac{2}{3}\delta_{ij}\frac{\partial u_i}{\partial x_i}\right)\right]+\frac{\partial}{\partial x_j}\left(-\rho\overline{u_i'u_j'}\right) \tag{2}$$

Here ρ, u, and p are density, time-averaged velocity component, and time-averaged pressure, respectively. The Boussinesq hypothesis is employed to relate the Reynolds stresses with the time-averaged velocity gradients.

$$-\rho\overline{u_i'u_j'}=\mu_t\left(\frac{\partial u_i}{\partial x_j}+\frac{\partial u_j}{\partial x_i}\right)-\frac{2}{3}\left(\rho k+\mu_t\frac{\partial u_k}{\partial x_k}\right)\delta_{ij} \tag{3}$$

Here μt (= $\rho k/\ \omega$) and k are turbulent viscosity and turbulence kinetic energy (TKE), respectively. ω is the ratio of turbulence dissipation rate (ε) to k. In the Boussinesq hypothesis, μt is assumed to be an isotropic scalar quantity which works well for shear dominated flows. k and ω equations are given below [27].

$$\frac{\partial}{\partial t}\left(\rho k\right)+\frac{\partial}{\partial x_i}\left(\rho k u_i\right)=\frac{\partial}{\partial x_i}\left(\Gamma_k\frac{\partial k}{\partial x_i}\right)+G_k-Y_k \tag{4}$$

$$\frac{\partial}{\partial t}\left(\rho\omega\right)+\frac{\partial}{\partial x_i}\left(\rho\omega u_i\right)=\frac{\partial}{\partial x_i}\left(\Gamma_\omega\frac{\partial \omega}{\partial x_i}\right)+G_\omega-Y_\omega+D_\omega \tag{5}$$

Here Γ_k and Γ_ω are effective diffusivities of k and ω. G_k and G_ω are the production terms for k and ω. Y_k and Y_ω are the dissipation terms for k and ω. D_ω is a cross-diffusion term. Further information about the k-ω SST turbulence model and its model constants can be found in [26][27].

Pressure-based solver with the pressure-velocity coupling algorithm is employed to achieve a converged solution in less number of iteration compared to the segregated algorithm. In spatial discretization, diffusion terms are discretized with a second-order cell-centered scheme and convective terms with a second order upwind scheme.

First-order implicit time integration is applied to advance in the solution of the unsteady problem. Dimensionless time step size Δt^+ $(=\Delta tU/D)$ is 0.011 which is approximately 1/200 of one period of the highest frequency wave of fluctuating forces. D is cylinder diameter. Gradients of scalar and vector variables in CFD computations are calculated employing the least square cell-based method.

Fully structured computational mesh with quad cells is generated by Ansys Meshing

(Figure 1b). Mesh independence study is conducted for the flow of air around the 8-grooved cylinder at a Reynold number of $1.1x10^5$. The coefficients of fluctuating drag and lift forces for varying number of computational cells are provided in Table 1. Relative change between variables of the last two consecutive mesh structures is maximum of 4.6%. To work with reasonable computation time and ensure sufficient grid convergence, the finest mesh structure is employed in CFD computations and no further mesh refinement is carried out. Average mesh skewness and its standard deviation are 0.27 and 0.17, respectively. Average and maximum aspect ratios of cells are 2.6 and 26, respectively. While average y^+ value is nearly 1, maximum y^+ is smaller than 4 on the cylinder wall. When determining parameters in computations, an iteration convergence study is conducted varying iteration number from 3 to 60 for the time steps. It is seen that 5 number of iterations at each time step is sufficient to reach a converged solution for the relevant time step. In the current study, 8 number of iterations is implemented for the time steps. The same mesh structure and solver parameters are applied to all cases.

Table 1. *Mesh Independence Study*

Mesh	Number of cells	Cd-mean	Cd-rms	f_d (Hz)	Cl-rms	f_l (Hz)
coarse	63,600	1.53	0.123	173	0.876	88
medium	113,880	1.52	0.131	172	0.843	87
fine	167,520	1.50	0.149	168	0.847	84
finest	253,500	1.46	0.156	164	0.841	82

3. Results and Discussion

3.1. Cross Flow over Smooth Cylinder at Re = 10^5

Although a cylinder has a simple shape, flow characteristics around are very sophisticated and depend on Re number. Flow behaviour around a smooth cylinder is classified as follows [1],[29]-[31].

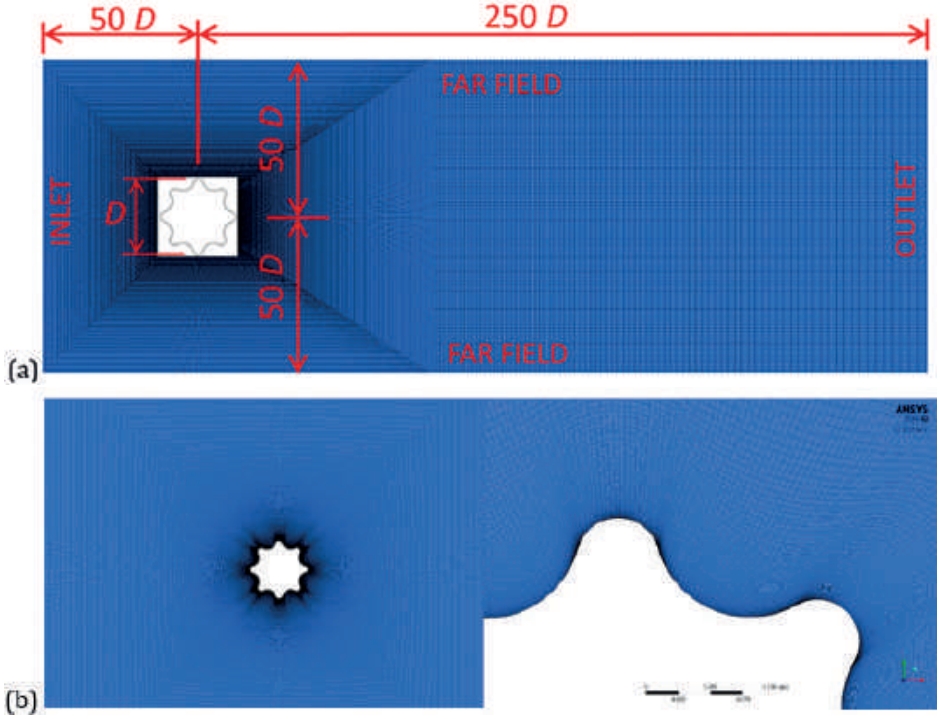


Figure 1. *2D Computational Domain* ***a)*** *Boundaries and Dimensions* ***b)*** *Mesh Structure*

- When Re < 190 flow is completely laminar both in the wake and boundary layer and, 2D vortex shedding is observed after Re = 40.
- Subcritical regime (300 < Re < $2x10^5$): Flow is laminar in the boundary layer, turbulent in the wake. Laminar boundary layer separation takes place and regular alternating vortices shed.
- Lower transition ($2x10^5$ < Re < $3.5x10^5$): Laminar boundary layer separates and then turbulent shear layer reattaches. The boundary layer separates once again. Laminar separation bubble (LSB) forms on one side of the cylinder wall. The cylinder is subject to large mean lift forces.
- Supercritical regime ($3.5x10^5$ < Re < $1.5x10^6$): Laminar boundary layer separates and then turbulent shear layer reattaches. Laminar separation bubble forms on the two side of the cylinder wall. St number is between 0.4 and 0.45 [32]. Mean drag is minimum.
- Upper transition ($1.5x10^6$ < Re < $4x10^6$): Laminar-turbulent transition occurs within the boundary layer without LSB.
- Transcritical regime (Re > $4x10^6$): Flow is turbulent both in the wake and boundary layer.

Besides the turbulent flow is of three-dimensional (3D) character, the flow field around a cylinder has its own special 3D features such as cellular shedding, oblique shedding, vortex dislocations and spanwise momentum transfer by streamwise vortices [1]. Laminar-turbulent transition, LSB, flow separation and 3D wake field make it difficult to predict flow structures around a cylinder by 2D CFD analyses. Performing 3D direct numerical simulations (DNS) is the ideal solution to tackle with the problem, but it requires supercomputers and substantial computation time [33]. 3D CFD simulations of Large Eddy Simulation (LES) or Detached Eddy Simulation turbulence modelling are the alternative solutions. Their computation cost is less than DNS, but they are still computationally costly and very fine mesh structures should be constructed [5]. Therefore, to estimate vortex-induced vibrations of cylindrical structures, experimental tests are more frequently carried out [4][7][22][31][34].

Flow regime around the cylinder at Re = 10^5 stays in a subcritical region where the boundary layer is laminar. Though k-ω SST is a turbulence model which considers the flow to be fully turbulent, low Re number terms in it offer very simple laminar-turbulent transition modeling capability [27]. The flow of water over a smooth cylinder at Re = 10^5 is solved by 2D URANS computations and compared with published literature data in this section. U = 0.275 m/s and D = 0.5 m. Parameters of fluctuating drag and lift forces are listed in Table 2. Strouhal number, St = f_l D/U. θ_s is the time-averaged flow separation angle measured from the upstream end of the cylinder (see Figure 7e). Backpressure coefficient is defined as follows,

$$C_{pb} = \frac{p_b - p_\infty}{(1/2)\rho U^2} \quad (6)$$

Here p_b, p_∞ , and ρ are back pressure on the cylinder surface, free stream pressure and fluid density, respectively.

Time-averaged drag coefficient ($C_{d\text{-}mean}$) predicted by CFD is smaller than the experimental value as seen in Table 2. Supporting this result, θ_s predicted is higher than the experimental. This implies that the wake width estimated by CFD is smaller. Even though the free stream TI in numerical simulation is rather small, the fully turbulent character of the k-ω SST model carries turbulence to the boundary layer, and possibly for this reason separation delays. CFD estimates C_{pb} to be greater, confirming predictions in θ_s and $C_{d\text{-}mean}$. Rms of lift coefficient ($C_{l\text{-}rms}$) estimated by CFD is much larger than the experimental value. In literature, employing 2D URANS simulations, fluctuating lift force was also

computed larger than the experimental [17]. It is known that vortices behind the cylinder have 3D character and dislocate, this results in attenuation in vortices' strength [1]. The synchronous alternating vortices in 2D URANS simulations may be the reason for such a large fluctuating lift force. fd is calculated as twice of fl as in the literature [24][35]. St number determined by CFD is 0.267 and greater than the experimental value of 0.20.

Table 2. *Comparison of Computational Predictions and Experimental Results*

Parameter	Computational	Experimental	Reference for Exp. Data	Error
$C_{d\text{-}mean}$	1.056	1.181	Schlichting and Gersten [13]	-11%
$C_{d\text{-}rms}$	0.099	N/A		
$C_{d\text{-}amp}$	0.116	N/A		
f_d (*Hz*)	0.293	N/A		
$C_{l\text{-}rms}$	0.909	0.511	Norberg [36]	78%
$C_{l\text{-}amp}$	1.264	N/A		
f_l (*Hz*)	0.147	0.11	Roshko [30]	34%
St^{**}	0.267	0.20	Roshko [30]	34%
C_{pb}	-1.06	-1.33	Williamson [1]	-20%
θ_s	~110°	78°	Achenbach [31]	41%

**Strouhal number is based on frequency of lift force.

3.2. Cross Flow over 8-Grooved Cylinder at Re = 1,1x10^5

An experimental work of El-Makdah and Oweis [18] is considered to test 2D URANS prediction capability of the flow field around a grooved cylinder. The experiments were carried out in an open wind tunnel. The grooved cylinder diameter is 69 mm as depicted in Figure 2a. The square test section has 45,5 cm side lengths. Therefore, in experiments, the aspect ratio of the grooved cylinder (L/D) and blockage ratio are 6.59 and 15%, respectively.

U, air viscosity (μ) and air density (ρ) are specified as 23.3 m/s, 1.79x10^{-5} Pa.s and 1.225 kg/m^3 in CFD solver. These parameters correspond to a Re number of 1.1x10^5 as in the experiment. The grooved cylinder transits the flow into the turbulence regime immediately after the first crest at θ = 45°. For this reason, it is expected that laminar-turbulence transition location is not critical for flow over the grooved cylinder. However 3D nature of both turbulence and vortex structures behind the cylinder still has an importance on fluctuating forces.

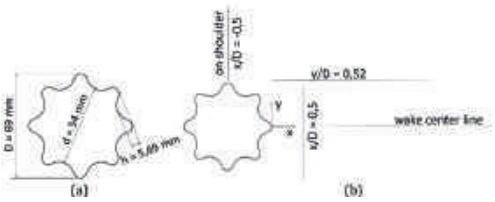


Figure 2. a) *Dimensions of the 8-Grooved Cylinder (Reproduced from [18])* ***b)*** *Origin, Axis Directions and, CFD Post-Processed Lines where Field Variables are Presented*

Time-averaged streamwise velocity profiles are depicted in Figure 3. Backflow in the near wake cannot be captured by CFD as seen in Figure 3a. It was reported that RANS simulations fail to predict reversed mean flow in the cylinder wake [5]. 60% of the free stream velocity recovers at a distance twice cylinder diameter both in the experiment and CFD. Wake recovers faster and wake width slightly wider in experimental results (Figure 3b). Mean shear in the wake is nearly the same for both cases. The maximum velocity in the shear layer is greater in experiments (Figure 3b). However, *U* was measured 1,6*D* upstream of the cylinder in experiments. With reference to the CFD solution, velocity is retarded

from *U* by 11% at this location. Therefore, streamwise velocity (*u*) possibly is less than reported in experiments. On the other side, blockage ratios in the experiment and CFD are 15% and 1%, respectively. Larger blockage ratio in the experiment may be the other consideration of higher velocity.

Time-averaged TI profiles on the vertical line (at *x*/D = 0.5) are shown in Figure 4a. TI predicted by CFD is much smaller than the experimental results. Free stream TI in the wind tunnel tests is not known. On the other hand, after comparison RANS simulations with LES and PIV experiments, Stetson [5] reported that Reynolds averaging in RANS modelling smooths out instantaneous peaks in turbulence fluctuations. This results in lower predicted fluctuating loads [5]. Magnitude and change in spanwise vorticity (ω_z) along upper and lower shear layers agree well with experiments as seen in Figure 4b. Vorticity magnitudes close to the cylinder is higher in CFD. Greater vorticity strength in the neighborhood of the cylinder may result in increased predicted fluctuating lift loads in CFD [19].

3. 3. Influence of Number of Grooves

3.3.1. Time Statistics

To investigate the effects of the number of grooves on hydrodynamic forces and flow field, 8-, 10- and, 12-grooved cylinders are considered. The 8-grooved cylinder in the previous section is scaled to be 0,5 m in diameter. Three cylinders with their dimensions are given in Table 3. In CFD, seawater cross flow over the three cylinders are simulated at Re = 10^5. *U*, μ and ρ are 0.275 m/s, 1.41×10^{-3} Pa.s and 1.027 kg/m^3, respectively.

Parameters of fluctuating drag and lift forces are provided in Table 3. After discarding the initial transient force data, the periodically repeated parts of force signals in Figures 5a, 5b, 5c and Figures 6a, 6b, 6c are utilized in Fast Fourier Transform (FFT) analyses. FFT function embedded in Matlab is employed to construct the frequency spectrum of time-varying force data. Kreyszig [40] summarized the mathematical theory behind FFT. The frequency spectrum of fluctuating drag and lift forces are presented in Figures 5d, 5e, 5f and Figures 6d, 6e, 6f, respectively. As the number of grooves increases, a slight decrease in $C_{d\text{-}mean}$ is observed. $C_{d\text{-}rms}$ of the 12-grooved cylinder is minimum and 29% smaller than that of 8-grooved cylinder. In the same way, the amplitude of drag coefficient ($C_{d\text{-}amp}$) of the 12-grooved cylinder is less than the 8-grooved cylinder by 35.5%. However, $C_{d\text{-}rms}$ and $C_{d\text{-}amp}$ of 10-grooved cylinder increased by 44% and 30%, respectively. Comparing with the dominant frequency of drag force (f_d) of the 8-grooved, f_d of the 10-grooved decreases by 69%, and f_d of the 12-grooved remains the same.

While the dominant frequency of lift coefficient (f_l) of 8-, 10, -12-grooved cylinders are almost the same, $C_{l\text{-}rms}$ values for the 10-grooved and the 12-grooved increase by 12% and 24%, respectively. Lift forces on 8- and 12-grooved cylinders are sinusoidally changing, but that of the 10-grooved has two strong peaks in amplitude spectrum and therefore it is the sum of two sinusoidal force signals. St number of the three cylinders is changing between 22 and 25 (Table 3).

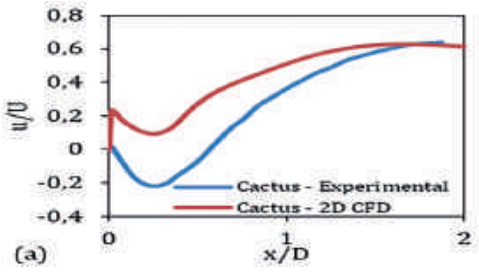


Figure 3. *Comparison of Time-Averaged Streamwise Velocity* ***a)*** *along the Wake Center Line*

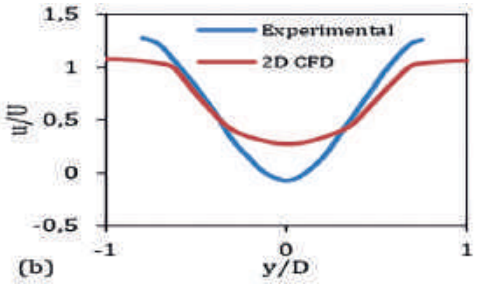


Figure 3. b) *along Vertical Line at x/D = 0.5. Experimental Data is from [18].*

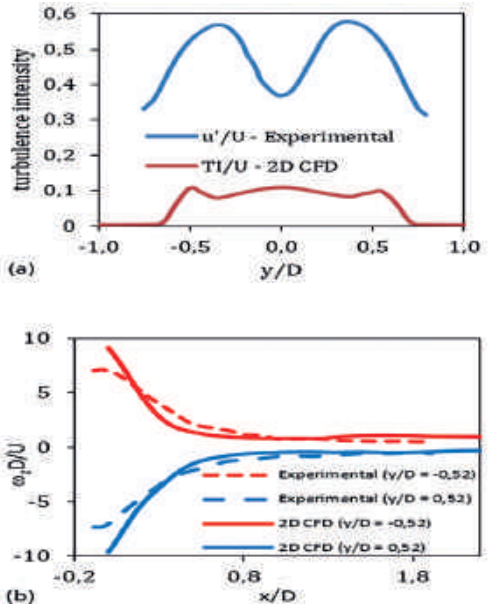
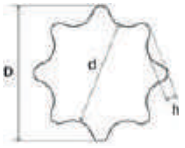
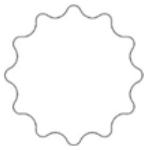


Figure 4. *Comparison of Flow Field Variables.* ***a)*** *Time-Averaged TI along Vertical Line at x/D = 0.5. Time Average of* $TI = \sqrt{0,5(u'^2 + v'^2)}$ *is Plotted.* ***b)*** *Time-Averaged* ω_z *along Horizontal Line at y/D = ±0.52. Experimental Data is from [18].*

3.3.2. Time-Averaged Variables

Time-averaged line plots based on 2D URANS simulations are shown in Figure 7. To generate time-averaged line plots, 20 snapshots per shortest time period of fluctuating forces are captured (this is the sampling rate) and a 5-10 repeated part of force signal with the longest time period is utilized. Streamwise velocities of 10-, and 12-grooved cylinders at the wake centerline reach slightly larger values at x/D = 2 (Figure 7a). This result implies reduced drag force with reference to 8-grooved cylinder [18]. Mean spanwise vorticity near the cylinders decreases as the number of grooves increases as seen in Figure 7b. As the flow moved away from the cylinders, the vorticity magnitudes converge to each other and, vorticity receives slightly greater value for the 10-grooved. Shear on grooved cylinders is expected to be less than the smooth cylinder because effective friction surface of grooved cylinders is smaller. This leads to a decrease in vortex strength [18]-[21]. Mean shear on grooved cylinder shoulders (at x/D = -0.52 in Figure 2b) is depicted in Figure 7c. Since the cavity of the 10-grooved is located on the shoulder, its velocity gradient (shear) is less than the others. Mean TKE on the cylinder shoulder increases by the number of grooves as depicted in Figure 7d. Increased momentum in boundary layers due to turbulence helps the flow to overcome adverse pressure gradient on curved surfaces and delay separation [13] [14][37]. This is the main reason for reduced $C_{d\text{-mean}}$ by an increase in the number of grooves. Time-averaged pressure coefficients (C_p) around the cylinders are depicted in Figure 7e. Lack of perfect symmetry in pressure distribution is possibly related to the sampling rate of time-varying data. θ_s increases with the number of grooves. This result again confirms the reduced drag by the number of grooves. Yamagishi and Oki [37] showed that more grooves on triangular grooved cylinders reduced critical Re number where C_d abruptly drops due change in boundary layer turbulence. As seen in Table 3, C_{pb} increases by the number of grooves verifying smaller drag. Due to the absence of spanwise flow in cylinders' wake of a 2D CFD computation domain, C_{pb} values are probably smaller than the values that can be obtained by 3D computations [1].

Table 3. *Geometry Data, Fluctuating Force Coefficients, Frequency of Forces, and Time-Averaged C_{pb} and θ_s for Cross Flow of Seawater over Grooved Cylinders at Re=10^5*

Parameter	8-grooved cylinder	10-grooved cylinder	12-grooved cylinder
			
D (m)	0.5	0.5	0.5
d (m)	0.391	0.411	0.427
h (m)	0.041	0.034	0.029
$C_{d\text{-mean}}$	1.443	1.408	1.426
$C_{d\text{-rms}}$	0.152	0.219	0.108
$C_{d\text{-amp}}$	0.200	0.260	0.129
$f_{d(Hz)}$	0.26	0.08	0.28
$C_{l\text{-rms}}$	0.841	0.944	1.044
$C_{l\text{-amp}}$	1.162	multiple peaks	1.473
$f_{l(Hz)}$	0.13	0.12 Hz (1.238 amp) 0.04 Hz (0.479 amp) ([1])	0.14
S_t	0.24	0.22 (2)	0.25
C_{pb}	-1.36	-1.25	-1.28
θ_s (3)	92°	108°	120°

[1] Multiple peaks exist in amplitude spectrum of lift coefficient (C_l).
[2] St number is specified based on the dominant frequency of C_l with maximum amplitude.
[3] θ_s is determined based on time-averaged C_p distribution around the cylinders. θ_s, as an effective separation angle, is specified when C_p starts to level off. There is no increase in C_p after this specified angle (see Figure 7e).

3.3.3. Instantaneous Flow Field

Instantaneous contours and velocity vectors for maximum lift force are shown in Figure 8. The high streamwise velocity, high vorticity [18] and separated flow are responsible for low pressure on upper surfaces of cylinders resulting lift force in +y direction. High-pressure stagnation zone at the front end of the cylinders is largest for the 8-grooved.

Vortices wrap around 12-grooved cylinder more closely. As a result, the flow separates at a larger angular position compared to the 8-, and 10-grooved cylinders. When vortices form farther than the cylinder, fluctuating side forces lessen [12],[19]. With reference to the conservation principle of momentum, flow stream of fluids exert force on the solid body in the opposite direction of flow [38]. Downward v-velocity (Blue colours of v-velocity contours

indicate downward velocity) occupies larger region for the 12-grooved as seen in contours of v-velocity in Figure 8. In the meantime, if the contours of v-velocity and velocity vector plot are examined, downward flow stream (downwash) for the 12-grooved is more closely compared to the other cylinders. These two points explain the greater fluctuating lift force on the 12-grooved cylinder regarding 2D URANS results.

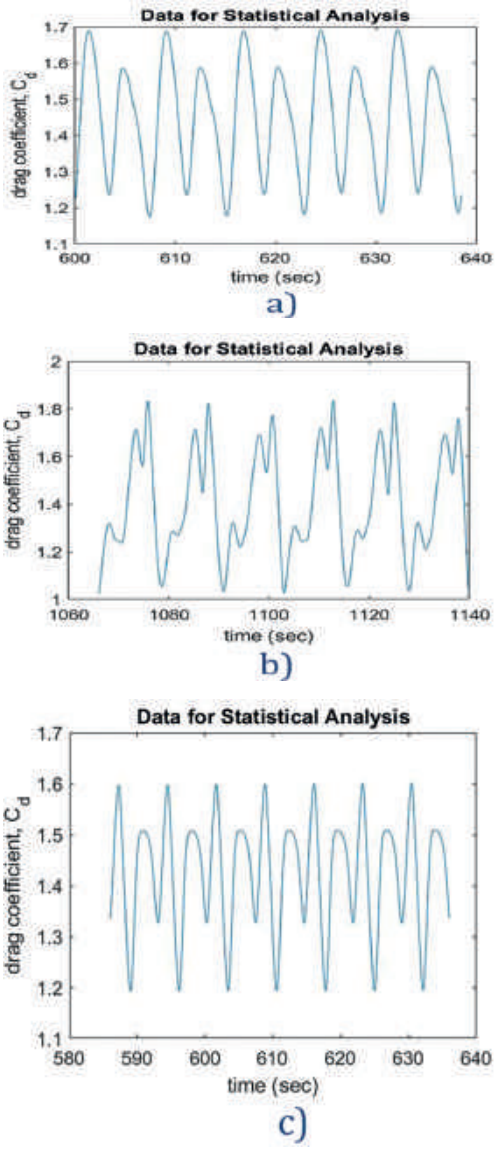


Figure 5. *Time Series* ***(a,b,c)*** *and Amplitude Spectrum* ***(d,e,f)*** *of Drag Coefficient for 8-Grooved Cylinder* ***(a,d)****, 10-Grooved Cylinder* ***(b,e)****, and 12-Grooved Cylinder* ***(c,f)***

Turbulence intensity contours show that the boundary layer gets into turbulence just after the groove of the stagnation region at the front end. The energized boundary layer can withstand pressure forces and flow separation is delayed.

For such a high Re number flow, the

hydrodynamic lift forces arise solely due to asymmetric instantaneous pressure distribution around the cylinders [1]. Friction force contribution to hydrodynamic forces for high Re is negligibly small [11][20]. In Figure 7e, as expected, time-averaged C_p around the cylinders is almost symmetrical. When the snapshots of the C_p distribution around the cylinders are considered, they should likely be asymmetrical due to alternating shedding vortices on the downstream side of the cylinders. Resulting pressure distributions of the grooved cylinders for maximum lift force are depicted in Figure 9. The area between C_p curves of upper and lower surfaces is proportional to lift force [39]. Confirming the reported fluctuating lift force ($C_{l\text{-}rms}$) data in Table 3, area for the 12-grooved cylinder is largest and that for the 8-grooved is smallest. From Figure 9, the instantaneous separation angles of upper and lower surfaces can be determined detecting start point of level-off in C_p distribution. In this regard, after cross-check with contours of *u*-velocity and vorticity in Figure 8, instantaneous separation angles of upper and lower surfaces of 8-, 10- and 12-grooved cylinders are specified as (90°,90°), (108°,72°) and (120°,90°), respectively.

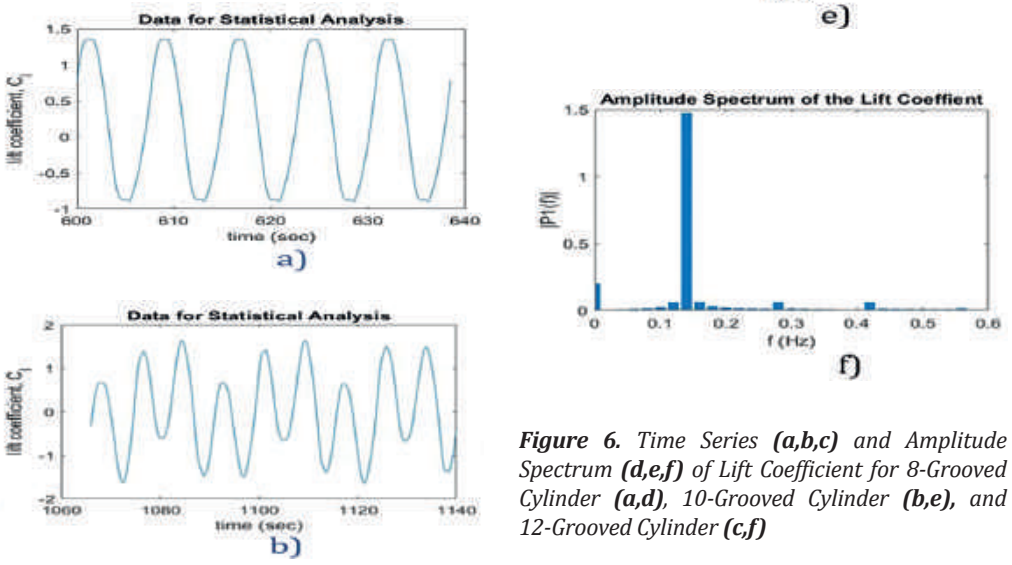


Figure 6. *Time Series* ***(a,b,c)*** *and Amplitude Spectrum* ***(d,e,f)*** *of Lift Coefficient for 8-Grooved Cylinder* ***(a,d)****, 10-Grooved Cylinder* ***(b,e),*** *and 12-Grooved Cylinder* ***(c,f)***

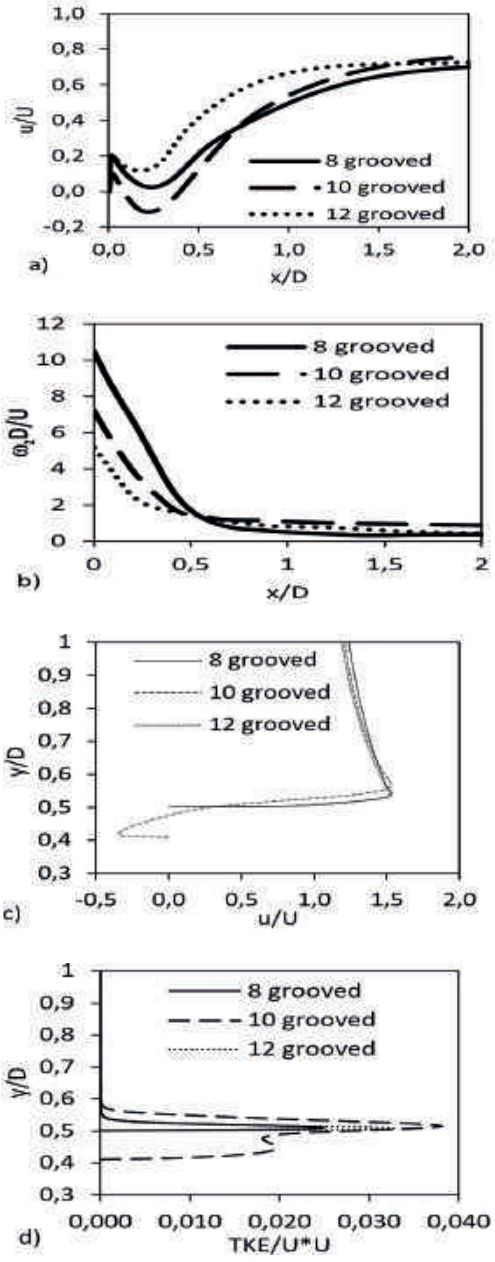


Figure 7. *Time-Averaged Line Plots based on 2D URANS Simulations* ***a)*** *Streamwise Velocity on the Wake Center Line* ***b)*** ω_z *along Horizontal Line at y/D = 0.52* ***c)*** *Velocity along Vertical Line on the Shoulder (x/D = -0.5)* ***d)*** *TKE along Vertical Line on the Shoulder (x/D = -0.5)*

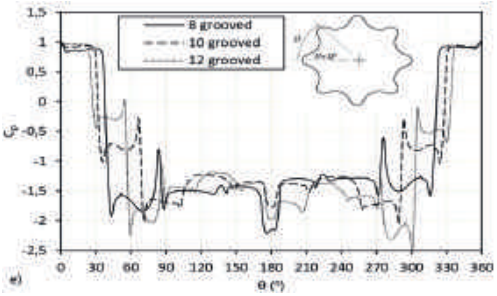


Figure 7. (continued) *Time-Averaged Line Plots based on 2D URANS Simulations e)* C_p *around the Cylinders*

4. Conclusion

In this study, the influence of the number of rounded grooves on cylinders is investigated employing 2D URANS computations. The first unsteady CFD analysis is performed on a smooth cylinder at Re = 10^5. While separation angle (θ_s) is predicted larger than the experimental, consistently, $C_{d\text{-mean}}$ and base suction coefficient ($-C_{pb}$) are estimated smaller compared to the experimental results. Rms of C_l is calculated larger because the flow is solved with 2D CFD analysis, which cannot consider spanwise flow and vortex dislocations in the wake field of the smooth cylinder.

The second CFD analysis is carried out on an 8-grooved cylinder at Re = 1.1×10^5. Although the backflow in the near wake cannot be predicted, recovered velocity magnitude is in close agreement with experiment. Mean shear and mean vorticity profiles in the shear layer computed by CFD show a good match with the literature experimental results.

The third CFD work is conducted on 8-,10-, and 12-grooved cylinders. While $C_{d\text{-mean}}$ of the 12-grooved cylinder is slightly smaller compared to the 8-grooved, its fluctuating drag (rms of C_d) is 29% smaller. Although rms of C_d of the 10-grooved increases by 44% compared to the 8-grooved, its dominant frequency of C_d decreases considerably by 69%. θ_s has been significantly improved from 92° of the 8-grooved to 120° of

the 12-grooved. Turbulence intensity contours reveal the immediate transition to turbulence after the first grooves. In this way, TKE increases by the number of grooves and this is followed by a rise in θ_s. On the other hand, rms of C_l of the 12-grooved increases by 24% compared with the 8-grooved. Closer vortex roll-up for the 12-grooved results in stronger downwash, in turn, more lift force arises with reference to conservation of momentum. Frequency of lift remains nearly the same for the grooved cylinders.

In summary, experimental time statistics of fluctuating forces are partially reproduced in 2D CFD for a smooth cylinder. Time-averaged vorticity and velocity profiles on the shear layer of the 8-grooved cylinder are fairly well predicted by 2D CFD comparing with experimental results. However, backflow in the immediate wake of the 8-grooved cannot be predicted.

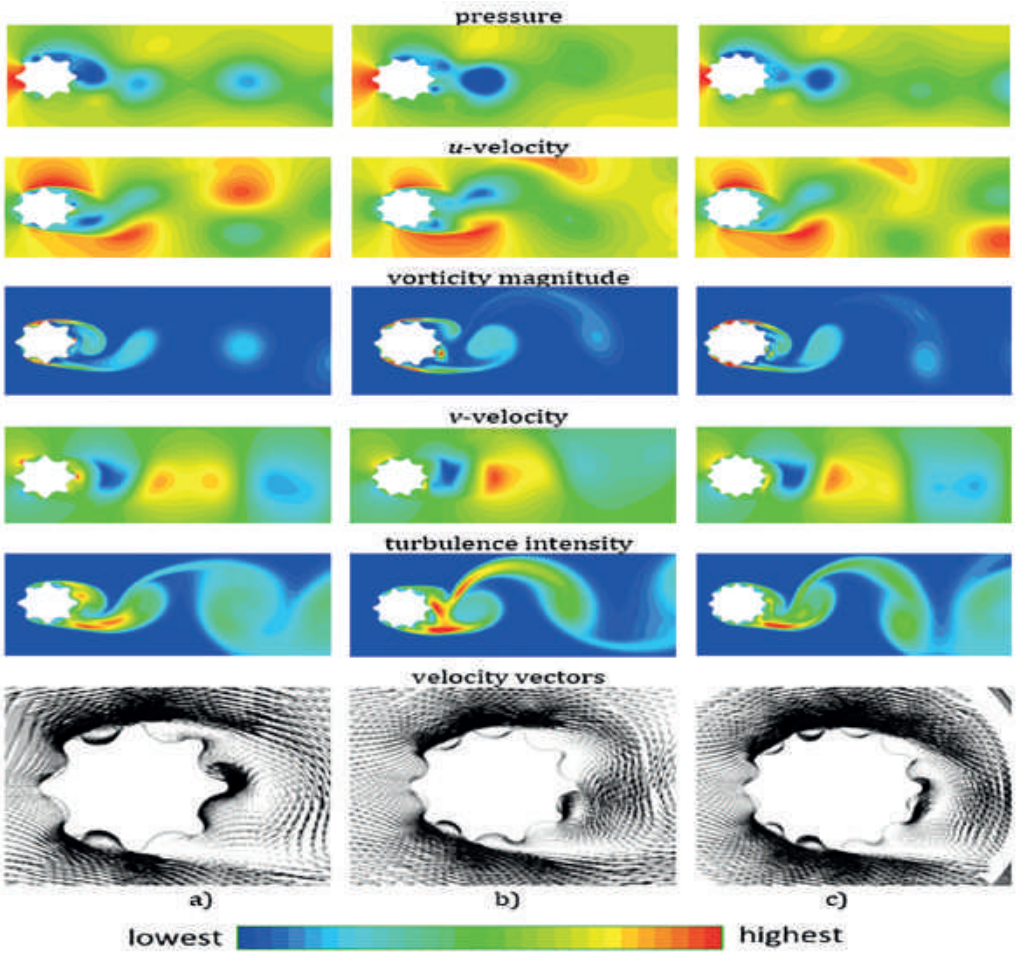


Figure 8. *Instantaneous Contours and Velocity Vector for Maximum Lift Force* ***a)*** *8-Grooved Cylinder (*C_l *= 1.34)* ***b)*** *10-Grooved Cylinder (*C_l *= 1.46)* ***c)*** *12-Grooved Cylinder (*C_l *= 1.59)*

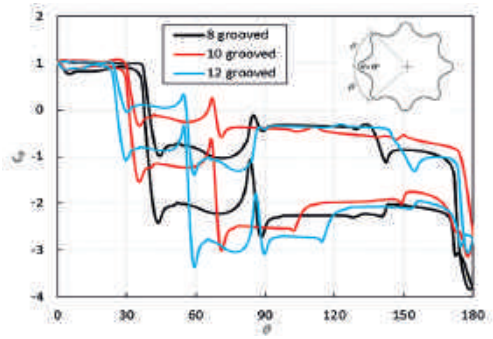


Figure 9. *Instantaneous Pressure Coefficient around the Cylinder for Maximum Lift Force*

TI level computed in 2D CFD is well below that of experiments possibly due to Reynolds averaging in RANS modelling. The ability of grooved cylinders to reduce the fluctuating lift force observed in experimental literature is not seen in 2D CFD analysis. Fluctuating lift force is overestimated due to inability of 2D CFD to take into account vortex dislocations. It is shown and discussed that the increased number of rounded grooves has the potential to improve the hydrodynamic drag characteristics of a cylindrical structure. Although 2D CFD results are consistent in itself, it is believed and partially seen that 2D CFD approach are deficient predicting highly complicated flow field around smooth and grooved cylinders. Therefore 3D CFD approach, which will be more proper choice of research tool, is essential to extend the research and investigate the benefits of grooves.

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Raising Awareness About Women in Turkish Maritime Industry

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ABSTRACT

The maritime sector is male-dominated. Women working in this sector face the challenges of not only working in a male-dominated working environment but also being at sea, far from their home and families for a long time. Moreover, they struggle with many misperceptions and prejudice against them. In this study, such negative feelings against women in the Turkish maritime sector are examined thoroughly, and the elimination ways of them are examined. The data in this research have collected by employing survey and structured interview methods. After evaluation, the main stakeholders who have a role in building career path of the women in maritime industry are determined as being the women themselves, their male colleagues, families, education institutions, and employers in the sector. In conclusion, the roles of these stakeholders in eliminating negative attitudes towards women are discussed.

Keywords

Maritime, Women, Misperception, Prejudice, Stakeholders.

1. Introduction

Research shows that women working in male-dominated sectors have some problems that are different from those of other working women [1]. Maritime is a male-dominated sector where women may face unique problems because they not only work in a male-dominated environment but also live there, and they are far from their families and home for extended periods. Therefore, it is commonly observed that they have some problems particular to this sector; however, these problems have been ignored for a long time. It was only when more maritime schools opened their doors to female students and more women began to be employed in the sector that researchers began to study what their problems are and how they can be solved. The number of female students in maritime-related departments is still considerably limited. That means female cadets go from male-dominated classrooms to male-dominated workplaces. In other words, they start to experience the challenges of male-dominated working environment as

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early as they start university education [2]. This situation may cause several problems, and something should be done to help them with their fight against all these potential problems like discrimination, bullying, or harassment. Thus they can actualize themselves and maritime industry can benefit from all they can contribute to the sector.

2. Literature Review

2.1. Global Approaches To Women

In 1988, the support of the International Maritime Organization's (IMO) strategy for the integration of women into the maritime industry, and the following year, the implementation of IMO Women in Development Program, accelerated the admittance of women to the maritime world [3]. In today's world, similar approaches still are performed by the IMO and international nongovernmental organizations such as United Nations, Global Fund for Women, and The Association for Women's Rights in Development. IMO Secretary-General Kitack Lim emphasizes the importance and urgency of the realization of the UN Sustainable Development Goal (SDG) 5: Gender equality in the shipping industry [4]. Within the scope of SDG 5, IMO keeps its commitment to achieve gender equality not only at sea but also onshore jobs by adopting "Achieve gender equality and empower all women and girls" [5].

Supporting women in the maritime industry and increasing women employment both working onboard as seafarers and onshore in managerial positions as maritime professionals shall only be provided by implementing new approaches to maritime sector dynamics. Encouragement of women can be sustained by discovering two pioneer aspects: 1) by enabling their attainment to the essential education and their participation to the labor force, and 2) by supporting them both at entry-level positions and any stage of their career [6]. Women have advanced analytical and multitasking skills which are demanded by shipping companies [7]. The preference of women employment in the maritime sector shows concrete results. According to the McKinsey Report (2018), the companies in the top-quartile in terms of gender diversity, which executive teams also consist of women were 21% more likely to outperform on profitability and 27% more likely to have superior value creation [8]. Therefore, the report's results showed that companies that had great performance on both profitability and diversity had more women in line (for example, income-generating) roles than in staff roles on their executive teams. In the maritime industry, if women are triggered and pulled to the maritime sector as part of a diverse maritime workforce, wider opportunities for women will be suitable both at leadership and managerial positions which is a benefit in a competitive market like maritime [9].

According to the International Labor Organization's Report (2019), share of women in managerial positions by region, between the years 1991–2018 is as following: world's average 27.1%, Americas 39 %, Europe and Central Asia 34.4 %, Asia and The Pacific 22.5 %, Africa 20.3 %, Arab States 11.1 % [10]. However, the number of women who are in managerial positions and in chair company boards is still limited. The share of women sitting on company boards, from 2010–2016 varies from 0 % in Germany to 4.6 % in the United States, which showed that glass disparity needs both in the international and national arena [11]. Since maritime women's contribution to the maritime sector has been underestimated, women at managerial positions haven't had a chance to confute. Therefore, raising awareness of the success of women in the maritime industry was not sufficient [12].

2.2. A Global View of Maritime Women in Recent Years

The obstacles for maritime women are not the same as they were sixty years ago. Thanks to the battle won by the first women seafarers in history, in today's world, maritime women can access to many maritime institutions. As stated in World Economic Forum's Global Gender Gap Report 2020, among Nordic countries, Sweden is holding the highest record, with 15.7% of female graduates from Science, Technology, Engineering and Mathematics (STEM) programs [13]. In order to create more awareness, it is important to promote and introduce maritime fields and ocean sciences (in the fields of science, technology, engineering, and mathematics (STEM)) to more women and girls in their early ages [14]. In recent years, regardless of their sex, maritime students (especially studying deck and engine departments) have had serious problems with finding internships onboard both in the world and in Turkey. According to the survey held by Ghosh & Bowles (2013) among Australian Maritime Education and Training (MET) Institutions, the results reconfirmed these struggles on finding suitable cadetship onboard [15]. The struggle starts from their studentship cadet program onboard.

From an industrial perspective, it is an undeniable fact that struggles, problems, and bad experiences that maritime companies encounter in terms of women seafarers and women holding managerial positions have a butterfly effect on the approach of maritime entities [16]. The prejudices of ship owners and maritime companies set a big challenge for young ladies which make them feel discriminated at the beginning of their professional life.

In the transport sector, as well as in the maritime sector, women are considered incapable and weak both physically and mentally. Stereotypes about women in the transport sector may end up with low demand of female community. Therefore; employment and training problems become more difficult for female students and women in Science, Technology, Engineering and Mathematics (STEM) fields [17]. It is a crucial fact that ship owners should be encouraged to giving equal opportunities to accept female cadets onboard considering the importance of this process in having experience in the field . Some maritime companies have already started to support maritime women and give them fair chances to show their skills and abilities . These companies cooperate with maritime education and training (MET) institutions to employ current cadets meaning future officers [18].

2.3. The Admission of Women to Maritime Colleges

Until the late 1970s, many women seafarers were facing barriers in acceptance to the maritime institutions, and maritime schools' criteria, mostly aimed at supporting men. However, the acceptance of women to the maritime faculties and maritime education and training institutions dates back to the 1970's in the world [19]. Some examples of women admission dates to the colleges are as following: 1920's in Russia, 1950's in China, 1970's in the USA, Sweden, Portugal, Ghana [19]; 1990's in Turkey [20] and Chile [21]. For the first time in Turkey's history, in the academic year of 1991/1992, Istanbul University, Faculty of Engineering, Department of Maritime Transport Management Engineering started to accept female students (total quota of 26 students). After this, in order to provide academic proficiency of maritime women, in 1997 Dokuz Eylul University, School of Maritime Business and Management, in 1999 Istanbul Technical University Maritime Faculty and Near East University Maritime Faculty, and in 2001 Karadeniz Technical University Surmene Faculty of Marine Sciences followed this approach for women

seafarers. Henceforth, as trickle-down effect, manymaritime schools in Turkey have opened its doors to female students [20]. Thanks to these successful initiatives, in the process of time, the ambition inside the first women officers made them warriors of the oceans and helped them to become the first women Master Mariners in Turkey. The path to success was not easy. This struggle for existence in their career was to refute against bias [21].

3. Method

The aim of this study is to determine the factors preventing awareness of women's contribution to the Turkish maritime sector and to discuss the ways to improve them.

To this end, two methods were used to obtain the data. Firstly, a 11-statement survey aiming to question the awareness for women's contribution to the maritime sector was prepared and given to all the stakeholders, such as both men and women seafarers, employers, ship owners, people working in maritime companies, and maritime entrepreneurs in the sector. The first two statements in the survey were questions while the rest nine statements were propositions. The first question of the survey was a demographic question to learn the gender of the respondents while the others were those prepared to see their perceptions of women in the sector, to learn the problems women face and to study the ways to solve them. The survey was responded by 657 people from the maritime sector. Since the first question, which asked the gender of the respondents, was left blank by some respondents, it was not possible to say how many women and how many men participated in the survey. This is a limitation of the research. However, the gender distribution of the respondents can roughly be estimated taking the percentage of those who responded to the first question into consideration. Among 657 people who joined the survey, 185 people answered the first question. 38,4% of these respondents were women (71) and 61,6% of them were men (114). The survey was given in Survey Monkey and the choices were categorized as "Yes", "No" and "Maybe".

The second method used in the research was the structured interview method which was conducted with 48 people, 22 of whom are women. The interviewees were from different positions in the sector. Most of them were seafarers. Some of the rest were employers while some were just company workers at different positions. All male interviewers had some experience of working with women. Each interview took approximately 20 minutes since 11 questions were asked and some detailed responses were expected. Some interviewees gave short answers while some of them gave detailed answers which included their own experiences. We took notes during the interviews, and after all the interviews were finished, we used the data we obtained in the comments and explanation parts of each question. It is also used to support the findings part of this paper. The questions were clear and easy to understand and answer, so the interviewees didn't come up with some issues which may stir ethical concerns. During the interviews, which were face to face, we observed that some of the interviewees were hesitant to clearly express their opinion for fear of offending the interviewers, who are women. This was another limitation that we tried to overcome by assuring them that their names wouldn't be revealed in the study and that this was scientific research which required correct answers. The interviewers were from different positions in the sector. Most of them were seafarers. Some were employers while some were just company workers at different positions. All male interviewers had some experience of working with women. Each interview took about 20 minutes on average since 10 questions were asked and some

detailed responses were expected. Some interviewees gave short answers while some of them gave detailed answers which included their own experiences. We took notes during the interviews, and after all the interviews were finished, we used the data obtained through the comments and explanation parts of each question. It is also used to support the findings part of this study. The questions were clear easy to understand and answer, so issues, which might stir ethical concerns, were not emerged by interviewees.

4. Findings

In the following part, each question in the survey, the number of its respondents, and the percentages of the options chosen are given together with the responses in the structured interview.

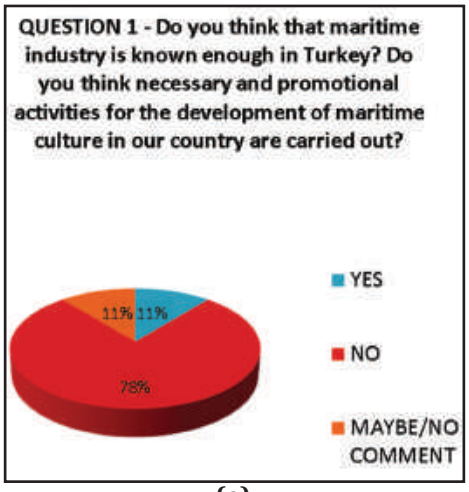
1. Do you think that the maritime industry is known enough in Turkey? Do you think necessary and promotional activities for the development of maritime culture in our country are carried out?

78% percent of 651 respondents who answered this question gave a negative answer while only 11% replied positively. 11% of the respondents had either no idea or did not want to comment on this. That result indicates that many of the respondents think that maritime industry is not well-known sector in Turkey. Interviews made on this subject indicate that the participants think that Turkey has a big potential in the maritime sector, but cannot make use of it much enough and the promotion of the maritime sector is made by the maritime schools only. They also express that the cadets who prefer to go to these schools usually come from the coastal areas. Besides the respondents who say there is a slight increase in the number of people prefer to work in the maritime sector despite very limited promotion activities, there are those who claim maritime culture is getting lost day by day. Moreover, some respondents think the maritime sector is under the control of the wealthy people only. One of the interviewees said, "Only the rich people can take part in sea-going activities. Since it requires a lot of money, the poor people cannot participate in these, even if they want to. It is too expensive." Consequently, it is seen that the vast majority of respondents think the maritime sector is not well-known in Turkey and promotional activities for the development of maritime culture in our country are not carried out.

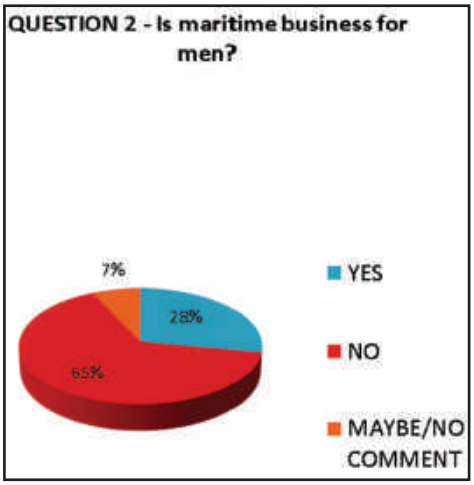
2. Is maritime business specific to men?

28% of the respondents gave a positive answer to this question contrary to the 65% who gave a negative answer. 7% of them were indecisive. These figures show that maritime is not seen as a men's job. However, the fact that there are a lot more men in the sector than women shows that women don't prefer this job. Statistics show that the percentage of women in the sector is about 1-2% [22].

The data obtained from interviews prove that there is a negative perception for women in the sector. Although the success of women in the sector is an important factor to eliminate this perception, there are not many good role models since there are not many women in the sector. Those who claim that maritime is specific to men say that technological developments eliminate the differences deriving from gender, but actually, they do not prove useful because they do not change the fact that women are more vulnerable than men, but some interviewees have pointed on something that can be changed. They said "It may be hard at the beginning, but the women who really want to work in this sector will be persistent and she will be able to do most things that she could not do at the beginning because of not being as strong as men. Exercise and hard work will help women to have a strong and enduring body." Another interviewee said "The effects of menstrual



(a)



(b)

Figure 1. *Percentage of replies for questions 1(a) and 2 (b)*

cycle on the physical working capacity of women are clear. Some men use this as an excuse not to employ women onboard. They know this is a temporary situation, but they do not want to accept this." Another one advised, "On-the-job training emphasizing the benefits of women onboard may be helpful for men to accept women as equal colleagues onboard." Despite all these negative perceptions, the statement that the maritime sector is not under the control of men is accepted by a majority as high as 65%, which is a good sign for the existence of women in the sector.

3. Due to the physiological structure of women, that is because of the physical aspects of them, it is difficult to work at sea and onboard for her.

15% of the participants have no idea about this topic. Half of the rest agree with the statement above while the other half don't. Maritime, which has long been thought to be more suitable for men [23], has started to get rid of this prejudice by digitalization and technological developments [24]. That the percentages of the respondents who agree and do not agree with this statement are close to each other can be seen as an improvement. On the evaluation of the comments made by the interviewees on this statement, it is seen that the success and efficiency of the women working on board will definitely eliminate the prejudices. One of the interviewees who is a captain said that "I worked with a lot of female onboard and witnessed that they created a positive awareness to a great extent". The statement proves that if people have a chance to work with women they will appreciate their positive contributions to life onboard. On the other hand, there are those who say that prejudice against women is very hard to break down and there are still some jobs that require physical strength despite the improvements on the technical field. The biggest handicaps for women about this are the pregnancy and child-bearing. Women are away from the ship during these periods and cannot go far away from their children because of maternal obligations. For a woman with children waiting for her at home, going back onboard ship and working as enthusiastically as before are very hard, if not impossible.

4. In the maritime profession, which is male-dominated, it is difficult for women to exist both onshore and onboard.

52% of the respondents agree with this

statement while 40 % think the opposite. The maritime sector is hard to work in. Seafarers are far away not only from their families and beloved ones for a long time but also from the land and normal working conditions that a workplace on land can offer to them. Therefore, working at sea is hard for anyone, whether men or women. When interviewees' comments on the statements are taken into consideration, it is seen that there is not a big discrepancy between those who accept that working on the land is as hard as working at sea for women and those who don't accept this. Some of the respondents say that women should work on the land, not at sea. However, most of them think that women face hardness both at sea and on land and they can overcome all the hardness when they are supported in a good way. As one of the interviewees puts it, "It is hard to work onboard, but not too hard for women to overcome". On the other hand, in maritime, like with all the men-dominated jobs, there is a misperception and negative prejudice against women. What should be done is that men should be informed about the positive contributions women can make to the sector and accept the equality of the two genders. Another comment made by the interviewees is that women who choose to work onboard are those who have self-confidence and who believe that they can succeed as much as men can. Women with these characteristics face no problems in coping with the hardships and they can be role models for the others. It seems that most people have firm ideas on the existence of women in the maritime sector since only 8% of the respondents expressed they did not have any ideas.

5. In the maritime sector, efforts should be made to ensure that the number of women employed in management companies and onboard ships could be higher than men in maritime companies. Actions requiring affirmative action, such as a certain quota for women and a 10% increase in salaries, are necessary to increase women's awareness in the maritime sector.

40% of the respondents gave a positive answer, and 43% said "no" while 17% did not have an idea on this statement. It is seen that the number of those, who think positively about this, are almost the same as those who think negatively. Although it may seem right that women should be given a certain quota because of the hardships they face for employment in the maritime sector, it is more logical to take away the hardships preventing them from achieving the positions they deserve rather than to give them a certain quota. When the comments from the interviewees are reviewed, it is seen that allocating a quota to women and, especially, giving a higher salary to women are reacted very severely not only by men but also by women. Besides those who defend that such discrimination will shadow the struggle of women for equality, some claim that it will get a negative reaction from men. Interviewees say that women who really want to work onboard and who are ready to do this properly are appreciated by their colleagues, but there are those who want to abuse the privileges they may get as there may be in every society. Interviewees also express that even treating women fairly, let alone positively, will lead to positive developments. However, the increase in the salary is one point that gets the worst reaction, and there are even those who claim that such a behavior can be called “labor theft”.

6. Maritime departments such as Maritime Business Administration, Maritime Transportation and Management Engineering, Naval Engineering, Marine Engineering, etc. can be introduced with the participation of the Academic Staff of Maritime Faculties in high schools.

The vast majority of the participants, that is 80% of them, approved the idea that this statement conveys. The number of

people who did not agree with the statement was as low as 5% while 15% of them did not have any ideas. The fact that there are more "YES" answers signals that jobs in the maritime industry should be introduced better to the people. When the comments from the interviewees are taken into consideration, it is seen that the promotion of these jobs should be made realistically. That is why cadet candidates should be informed about these schools by those who have experience at sea, and, because of this, who can reveal the negative sides of the job as much as positive sides. Another thing that is pointed out is that the maritime sector should be promoted to the people when they are young and ready to learn and practice new things. As it was stated by an interviewee "The earlier is the better. Even the children at primary school should learn about maritime". This will help them make an informed choice for their future career.

7. Reasons such as marriage and pregnancy cause women to leave the maritime profession early.

Duties like pregnancy and child care, which women undertake because of their physical structure, cause an interruption in their work-life not only in maritime but also in all sectors. Only 12% of the respondents do not agree with this idea while 63 % of them think women leave from their jobs because of these maternal duties, as Figure 2 (b) shows. As for the comments from the interviewees, they show that there is a dissidence on this subject. While some of them indicate that this is a natural period that can be experienced with all the jobs, some others say that this subject has something to do with the choices and priorities of women and those who want to go on with their career can do that even when the pregnancy period is over and the children are grown-up enough to start school. One of them says, "Both parents have equal responsibility for children. Male seafarers don't leave their job because they have to look after their children. It should be the same for the female who should go back to their job onboard after the children are grown up enough to be taken care of one of the parents." What's more, they express that sometimes family life and having children can also affect men and cause them to leave their careers as seafarers.

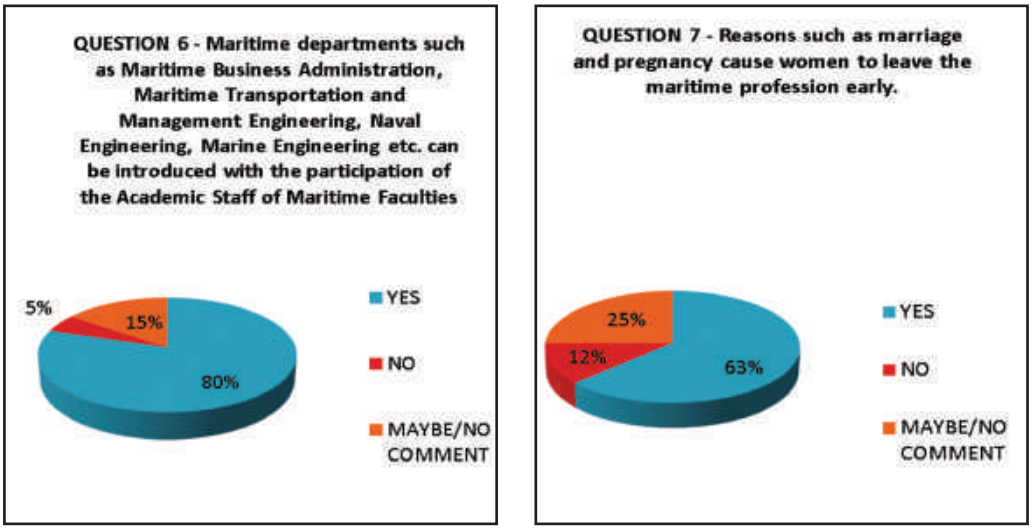


Figure 2. *Percentage of replies for questions 6 (a) and 7 (b)*

8. Women's analytical and organizational skills are better than men.

Responses given to this statement show that the participants have the perception that the dominancy of some characteristics changes by gender, and they think that women have better analytic and organizational abilities. On the other hand, interviewees emphasize that such kind of characteristics do not have anything to do with the gender but with the social and educational background, with the way a person is raised, or with whether or not he has practical intelligence. Despite this, if the facts that the survey was taken by the people in the maritime sector and responses are based on their own experiences and observations are taken into consideration, it can be said that the idea which the statement conveys is correct to a limited degree. Another point signaling this is the discrepancy between positive and negative responses, which are 45% and 27% respectively. On the other hand, 28% of the respondents say that they have no idea. This is a portion which is close to the portion of those who think that women are not better than men regarding those skills. Based on this, it is possible to say that most people in the sector think that women in the maritime sector have better analytical and organizational skills than men.

9. Working in the maritime sector as a ship owner, port, shipyard, broker, freight forwarder is easier for women than working at sea.

A vast majority of the respondents, that is 69%, agree with this idea. 12% of them do not agree while 19% express that they do not have an idea. Those with no idea on this statement are more than those who don't think the statement is right. Interviewees believe that working in these fields is easy not only for women but also for men. Some of them comment on the statement by bearing the fact in mind that every job has its own hardships and responsibilities and they express that the field to work in is a matter of preference and because people do what they like easily, working at sea, that is doing the work they like, is not hard for them. One of them says, "It may change from culture to culture, but in our culture, women should be at home early in the evening for a peaceful life at home", emphasizing the fact that cultural values may be effective for the career of women.

10. Negative experiences of women sailors on board (such as accidents, psychological pressure, mobbing, emotional intimacy, extreme emotionality etc.) have a negative effect on ship owners' prejudice regarding female seafarers' employment and the employment of female seafarers on board.

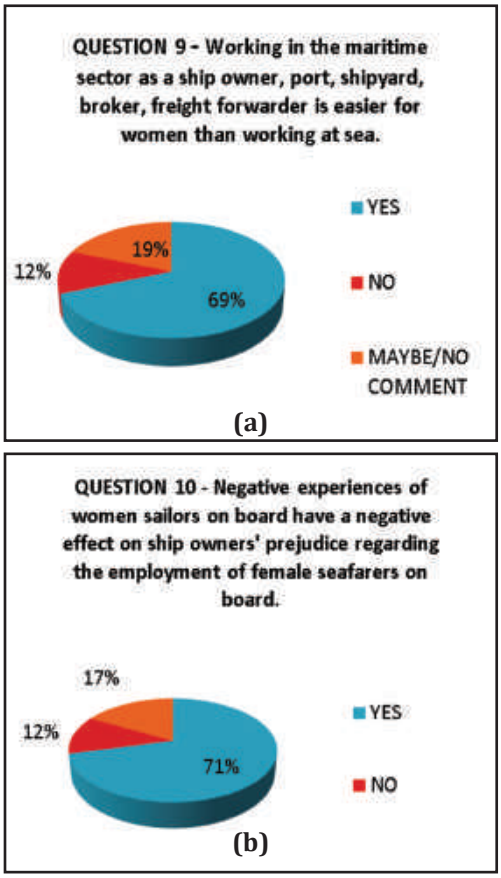


Figure 3. *Percentage of replies for questions 9 (a) and 10 (b)*

As Figure 3 (b) shows, the percentage of the respondents who agreed with this statement is strikingly high (71%). This signals the fact that women face a great amount of prejudice and there is a long way to go in the maritime sector to break down this. It is seen that not only women but also men agree with the idea this statement conveys and they think such behaviors prevent women from being assigned in maritime jobs. But some comments from the interviewees show that the hardships in question are experienced by not only women but also men and these are valid not only in maritime but also in other jobs. While women claim that people push them around on purpose and men are preferred by the employers especially for seagoing jobs, men claim that is not the case. They say women do not work at sea just because they don't want to and they shouldn't look for someone responsible for this.

Analysis of Findings

Data obtained from the survey and interviews prove that there is a problem of perception towards women in maritime sector. This paper looks at this problem from the viewpoints of the stakeholders and states what can be done by each of them to eradicate it.

As a result of the research, it is found that although women seafarers like their job and they want to work at sea, prejudice in society and misperceptions of stakeholders about women in the sector prevent them from reaching their goal. To prevent this and to help women in achieving their goal, all the stakeholders, who are the women themselves, the men working with them, families which are the basic building blocks of society, maritime education institutions, and employers in the sector, are expected to do something. By using the data obtained through the survey and the interviews, what the stakeholders are anticipated to do in the process of eliminating misperceptions and prejudice for women are studied and the result is given in the following paragraphs:

Women seafarers are those who choose this job bearing the risks it brings in mind. They are aware of the fact that there is a misperception towards them in the sector and they fight to beat this. They organize meetings, conferences, seminars, and establish networking to strengthen solidarity among them. Since the misperception towards women is commonplace in the sector, IMO decided the theme of World Maritime Day 2019 as "Empowering Women in the Maritime Community" and organized several activities on that day [25]. The activities, which bring all the stakeholders together on this issue, reveal that the prejudice women experience in the sector is the prejudice the women in the maritime sector can face more or less in the same way as in everywhere in the world. It is also understood that these problems stem not only from the misperceptions but also from social and cultural backgrounds and expectations in different countries. Because of these radical reasons, it is not expected that these problems can easily be solved, but there may be some solutions to these such as mentoring and networking, the effects of which can be realized in the long run. On the other hand, despite the hardships women experience in the sector, they refuse to be given some privileges and state that all they want is fair treatment. The only exception to this is the maternity period. In case women want to go back to serve on board after some divine roles and responsibilities they are given by nature such as motherhood or childcare, it will be helpful to give them some privileges such as being assigned at ashore units till the children grow up to a certain age or being given some help for child care. This will be beneficial for both increasing the number of women in the sector and satisfying the need for efficient personnel that the sector needs.

On the other hand, some interviewees believe that women should end their duty onboard and work at ashore units for good family life.

Men should do their share to help women with their fight against the misperceptions and bias they face in the sector and judge them with the moral and intellectual values which they obtained by working together with women not with those which belong to other people. What is expected from men is not to generalize some bad examples that can be found at every society to all the women in maritime and appreciate those women who do their work well. Women are more emotional and vulnerable by nature compared with men. Men should not take these traits as weakness and instead of going for jugular only because women want to work at a men-dominated sector, which is traditionally their own field, in their opinion, they should try to make use of their strength.

Families which are the basic units of social life are among the important stakeholders who have a role to give the place women deserve in maritime. The character of the people is shaped when they are young. If the families pass down negative feelings and prejudice about women to their children, to the boys, this will influence them during their life. That is why the families must plant the idea of gender equality into their children's minds and support their daughters as well as their sons if they want to go to maritime schools and work onboard ships. It should not be forgotten that education starts in the family.

Maritime schools can take important steps to promote both the sector and schools correctly and to make the human capital stronger in the sector. Those who are interested in sea are people with ties with the sea and those who make use of sea both to make their living and as a hobby. Unfortunately, although our country is surrounded by sea on three sides, only the people living at the seaside are familiar with sea and that's why only the children who have grown up at the seaside want to be seafarers. Therefore, if the promotion of maritime schools is made in a way to reach the remotest parts of the country, more people will be aware of maritime as a job field, and more students, that is more female students, will know about it. An important point here is that those who promote the maritime sector should introduce not only the good sides of it to make more people interested in it, but they should also include the hard sides of it not to make these people disappointed later. That is how people who do not know much about hardships in maritime can be prevented to attend maritime schools and to be a burden on the school's first and then on the sector since they may, sooner or later, realize the fact that they are not suitable to work onboard, so they will want to work onshore or neglect their duties because they don't like them.

Employers are also among the stakeholders who can take some steps to help women for a better career in the maritime. Interventions such as applying a quota for women and making it possible for women to be represented with a certain fraction in the sector are among the ones implied in the survey, but the responses given to the statements about these and the interviews made in the frame of the study show that such interventions are found damaging by both men and women. They indicated that instead of such affirmative actions, there shouldn't be any interventions, neither for men nor for women, which means the negative one should also be erased. When this is possible, the vacant positions will be given to those who deserve them, and women will not be denied some jobs just because they are women. Providing such equality will be profitable for both women and employers, that is, women will find a job to work for

while employers will have the chance to make use of their skills and abilities. Another thing expressed by interviewees is that employers should do something to eliminate the glass ceiling barrier for women. If there are enough support for pregnancy and early child care periods for women, they will not be prevented from climbing the career ladder in the maritime.

The last thing the interviewees have emphasized is that all these stakeholders should support each other and they need to be in cooperation continuously and closely with each other to eliminate the barriers for women in the maritime sector (Figure 4). Today, technological developments made it easy not only for women but also for men to work onboard. Regarding this, cooperation for the prevention of misperceptions and prejudice against women should be made and more women should be supported to work onboard. This will be beneficial for women to actualize themselves and will have positive effects on the sector, the economy, and the welfare of the country, which will make use of their skills and abilities.

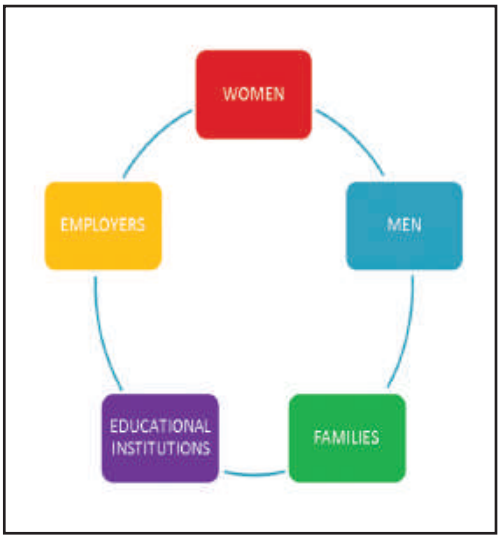


Figure 4. *Stakeholders to have a role to eliminate prejudice and misperceptions about women in maritime*

As is seen in Figure 4, stakeholders who have the most important roles in changing the misperception and prejudice about women in the maritime sector are women themselves, men who work with women, the families of the stakeholders in the maritime sector, educational institutions where maritime sector employees are trained and educated, and employers in the sector. The sustaining the women employment in the sector, their happiness, job satisfaction, and productivity heavily depend on their relations with these stakeholders as well as the relations among themselves. It is also very important that all these, except for women themselves, should have positive thoughts about women in the sector free of prejudice and misperceptions.

5. Discussion and Conclusion

Since the maritime is a male-dominated and demanding sector, it is not easy for a well-educated, qualified woman who wants to work in this sector to find a job as she likes. Even if she finds one, she may have to leave it early because of some negative attitudes towards her. Maritime women, who are well aware of this, have been struggling to cope with the hardships, bias, and misperceptions they face [1, 26, 27].

There have been many studies and activities to support the struggle of women in getting the place they deserve in the maritime sector. For example, achieving gender equality and empowering all women and girls have been the goals of IMO's Gender Program [5] and employment of women in the maritime sector is supported in the International Women's Conference, 2019 [14]. In addition, the participation of women in maritime jobs is encouraged by various organizations such as IMO. As Tansey [3] points out, they were first accepted to maritime schools over 30 years ago. Since then many conferences, seminars and meetings have been conducted to increase the awareness of people about

the women in maritime. Unfortunately, none of them have resulted in a significant rise in the awareness for the existence of women in the maritime sector, as Kitada [12] indicates. Their chance to be employed is little in this sector, and to be promoted to the managerial positions, similar to many other sectors, is next to nothing as indicated in the report by International Labour Organization (ILO) [10].

Theoretically, they are given a number of rights, so they are supposed to face less and less obstacles each passing year, but, in practice, as Ghosh & Bowles [15] and Kitada & Harada [17] point out they still have difficulty in finding internships as students and finding jobs as seafarers. Although gender equality which is stated in has been made a SDG by IMO, the progress is slow and it seems that it will take decades for women to attain the place they deserve in the maritime sector. Eliminating the barriers is not easy for women, because it is seen that there are a lot of misperceptions and prejudice against women which stem from the social and cultural structure of the society. Instead of accepting women as they are, the belief that women cannot succeed in maritime jobs and the belittlement of their skills and abilities cause irreparable harm to the women as well as to the sector. women state that they want to be accepted as they are, that they don't expect positive discrimination in the employment process but want to be treated equally. Men are expected to treat women the same as they treat other men. They should neither bully women to cause them to leave their job nor protect them just because they are women. The elimination of prejudice that has been created by all kinds of events throughout centuries and coping with the devastating effects of the misperceptions caused by them are not easy, but the struggle to give the women the place they deserve should start from somewhere and all stakeholders should do what is expected from them during this struggle. It should not be forgotten that the most important actors in raising the awareness women's equality in society are families and education and training institutions. For this reason, equal treatment for women and men is not limiting the job choices of women, and not keeping them away from any opportunities just because they are girls should start in the family. Maritime schools should do their share and emphasize that maritime, which is traditionally known as the realm of men, offers career choices for women, too, and women have a voice in maritime, too. Last but not least, employers in the sector should be fair in the employment process and should not refuse candidates only because they are women or hire candidates only because they are men.

As is seen, maritime women have both a glass ceiling above them and glass bulkheads around them which are made of misperceptions and prejudice. These glass bulkheads together with the glass ceiling cause women in the maritime to have a harder career path and a harder self-actualization process in comparison with their colleagues in other sectors. To clear the way women will take in maritime is not so simple as to be achieved by a few stakeholders in a short time, on the contrary, it is a demanding long-term process that requires cooperation by all stakeholders. If all the stakeholders in the maritime sector do their share properly, the maritime will be a preferable and peaceful sector for women. Opening doors to maritime to women, being fair to both genders, supporting women to reach the places they deserve in maritime and making use of the skills and abilities women can bring to the sector will both boost the efficiency and morale of the people, improve internal communication and productivity, and make both men and women committed to their job, which will all benefit the maritime sector. These may be the steps to be taken to give the women

a space they deserve in the sector. uture research may be about what can be done to realize these, that is, which measures can be taken in the short and long run to help women advance in their career, work productively and make most of themselves in the maritime sector.

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Appendix: SURVEY

Awareness of Maritime Women in Turkish Maritime Industry

1. Your Gender
   Woman ( ) Man ( )

2. Do you think that maritime industry is known enough in Turkey? Do you think necessary and promotional activities for the development of maritime culture in our country are carried out?
   Yes ( ) No ( ) Maybe ( )

3. Is maritime business for men?
   Yes ( ) No ( ) Maybe ( )

4. Due to the physiological structure of a woman it is difficult to work at sea and on board for her.
   Yes ( ) No ( ) Maybe ( )

5. The maritime profession, which is a male-dominated profession, is difficult for women to exist both on shore and and on board.
   Yes ( ) No ( ) Maybe ( )

6. Maritime departments such as Maritime Business Administration, Maritime Transportation and Management Engineering, Naval Engineering, Marine Engineering etc. can be introduced with the participation of the Academic Staff of Maritime Faculties in high schools.
   Yes ( ) No ( ) Maybe ( )

7. In the maritime sector, efforts should be made to ensure that the number of women employed in management companies and on board could be higher than men in maritime companies. Actions requiring positive discrimination, such as a certain quota for women and 10% increase in salaries, are necessary to increase women's awareness in the Maritime sector.
   Yes ( ) No ( ) Maybe ( )

8. Reasons such as marriage and pregnancy cause women to leave the maritime profession early.
   Yes ( ) No ( ) Maybe ( )

9. Women's analytical and organizational skills are better than men.
   Yes ( ) No ( ) Maybe ( )

10. Working in the maritime sector as a shipowner, port, shipyard, broker, freight forwarder is easier for women than working at sea.
    Yes ( ) No ( ) Maybe ( )

11. Negative experiences of women sailors on board (such as sea accidents, psychological pressure, mobbing, emotional intimacy, extreme emotionality etc.) have a negative effect on shipowners 'prejudice regarding female seafarers' employment and the employment of female seafarers on board.
    Yes ( ) No ( ) Maybe ( )

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Antarctic Research Strategy of Turkey

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Nearly 95% of Antarctica, the Earth's fifth-largest continent, is covered with ice. One of the unique characteristics of this amazing continent is that it is both the coldest and the highest region on Earth. The continent, with lots of mysteries and wonders yet to be discovered, has been home to many scientific studies throughout the world. The unknown facts of the continent are among the key points of the global climate change on our planet.

With a declaration of policy in 1957, The International Council of Scientific Unions has aimed to increase scientific research in the Antarctic region. Also known as the continent of science and peace, Antarctica is a region where scientific studies can be carried out freely, as well as transnational scientific cooperation boosts.

The Antarctic Treaty was signed in Washington in 1959 by 12 countries whose scientists had been active in and around Antarctica during the International Geophysical Year of 1957-1958. It entered into force in 1961 and has since been acceded to by many other nations. The total number of Parties to the Treaty is now 54. 29 of these countries are Consultative Parties, and 25 of them are Non-Consultative Parties. Turkey acceded to the Antarctic Treaty in 1995 and has been one of the Non-Consultative Parties to the Treaty since then. Consultative Parties are the ones with the right to vote at the meetings organized to make decisions about Antarctic issues.

Many scientists from various disciplines have travelled to the continent to conduct research activities for many years. The first Turkish scientist to visit Antarctica is Dr. Atok Karaali, who went there in 1959 and carried out some research on ionospheric physics. After that, Prof. Dr. Ümran İnan carried out studies on the upper atmosphere of Antarctica, and Prof. Dr. Serap Tilav carried out scientific studies in the continent in 1980 and 1991, respectively. Due to the contributions of these pioneering Turkish scientists to science in Antarctica, some geographical regions in the continent were named Karaali Rocks, Inan Peak and Tilav Cirque. It is also known that many other Turkish scientists have gone to the continent for scientific studies later on. Antarctic studies in Turkey continued with Turkey's 1st National Scientific Expedition to Antarctica, organized under the auspices of the Presidency of the Republic of Turkey in 2017. These expeditions have been carried out regularly since then and were named Turkish Antarctic Expedition (TAE) I, II, III, and IV, during which a total of more than 80 scientific projects from different subject areas were carried out. Setting out to contribute to earth science, Turkey has incorporated many international scientists into its expeditions as part of the National Polar Science Program teamed up in 2018. The outcomes of these expeditions have been presented to the scientific world in both scientific articles and project results to contribute to science in Antarctica in various disciplines.

In order to maintain the sustainability of the scientific studies carried out in Antarctica by ensuring their continuity, Turkey has initiated actions to establish the Turkish Scientific

Research Base. With the TAE I and TAE II expeditions in 2017 and 2018, appropriate regions where Turkey could establish bases in Antarctica were determined through investigations. During the TAE II expedition in 2018, the first temporary science camp was established on Robert Island, and scientists consisting of 9 people carried out their studies on this island. In the TAE III expedition in 2019, a temporary Science Camp was established on Horseshoe Island, where the Science Base would be established. The actions to establish a Turkish Scientific Research Base in this region in the following years continued with the TAE IV expedition performed in 2020. Turkey still continues actions to establish bases with many studies in different areas. Turkey has also established a weather station on Horseshoe Island and the surrounding islands, including 3 Global Navigation Satellite System (GNSS) stations. Instant data are obtained from some of these stations, and these data are shared with scientists from other countries.

Antarctica, where studies in different disciplines are carried out, attracts scientists' attention. Turkey collaborates with scientists from other countries by increasing scientific research and bilateral cooperation in the continent. Turkey also gives importance to establishing a permanent scientific base in Antarctica by increasing the scientific studies and science expeditions made regularly every year. In parallel with these studies, it is about to have a say in the continent's future by moving from the position of Non-Consultative Parties to Consultative Parties in Antarctica.

Considering the international policies that Turkey has developed recently, it is seen that Poles are in the centre of interest. The factors that emphasize the importance of polar studies are new perspectives on climate change, energy policy, and scientific studies.

Prof. Dr. Ersan BAŞAR

Mr. Başar works as a Professor in the Department of Maritime Transportation and Management Engineering at Karadeniz Technical University. In 2003, he defended his doctoral dissertation titled "Temporal and Spatial Distribution of Oil Spill after Tanker Accidents in the İstanbul Strait." After this study, he carried out studies on ship accidents and subsequent marine pollution in the Black Sea and the Turkish Straits System. He has many scientific publications on risk determination in ship accidents, oil pollution, and emergency management. Besides, he did post-doctoral studies at British Columbia University in Canada in 2005, where he carried out research on oil-spill and emergency response methods at sea.

Mr. Başar participated in Turkish Antarctic Expeditions I, II, III, and IV organized in 2017-2020, during when he carried out scientific projects on marine pollution. In addition, he served as the camp leader in the TAE II expedition and as the expedition leader in the TAE IV expedition. He has been to the Antarctic continent four times as well as an expedition to the Arctic. He carried out scientific projects during those expeditions.

Mr. Başar, who has broad experiences on life and survival in nature, has been the Head of the Turkish Mountaineering Federation since 2016 and speaks English and Russian.

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