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Identify Environmental Risks Affecting Financial Performance of Ports and Maritime Organization in Iran

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ABSTRACT

The purpose of this study is to identify and then manage the most important environmental risks affecting financial performance of Ports and Maritime Organization (PMO) in Iran. In this research, risks management of port equipment and facilities, operational, human resource, pollution, maritime transport, natural, security and rules has been considered as environmental risks management affecting financial performance of PMO. This research is a mixed data in terms of type, applied and developmental purpose, exploratory and descriptive research in terms of nature and a survey in terms of data collection method. The statistical population of the research is certified and experienced specialists in the field of financial management and health, safety and environment (HSE) of PMO in Iran, which the sample size of 70 was selected by purposeful sampling method. Structural equation modeling and Smart PLS software were used to analyze the research data. The results showed that to improve the financial performance of PMO from environmental risks management, human resource risk management, pollution risk management and operational risk management with path coefficients based on the research structural model of 0.948, 0.914 and 0.905 has been the highest, and rules risk management with path coefficient 0.629 has been the lowest effects. As a result, special attention should be paid to environmental risks management in order to improve the financial performance of PMO in Iran. Therefore, PMO can increase the level of their professional knowledge and skills by considering training programs for employees, and thus reduce human error.

1. Introduction

Ports always play a strategic role in the development of a country's domestic and international trade, whether it is developing or developed [1]. Ports are the main routes for transporting products around the world [2]. Ports play an important role because they are the vital links of land and sea, acting as gateways and linking transport corridors, thus enhancing trade and communication [3]. Sea ports facilitate the exchange of goods and help regional and national economy and social systems. Also, they include various goals such as economic benefits, environmental protection, improvement of quality of life, reduction of tax costs, facilitating trade, etc.

Ports, in addition to services they provide and the effect they have on economic growth and stability in their regions, can cause significant damage to country's environment. Pollution caused by port operations, in addition to disrupting the ecological balance of nature and urban environment, with the occurrence of climate changes in world, have led to an increase in the risk related to port operations [4]. The sea pollutants include oil pollution, waste disposal, sewage and ship pollution, among which oil spills from oil tankers being the most important and common sources of sea pollution. In such cases, a large amount of oil, which cannot be dissolved in seawater, enters the sea. For this reason, it creates worrying problems for marine wildlife. Petroleum hydrocarbons enter the sea through various ways. The highest level of pollution is related to oil wells, oil rigs and oil exploitation platforms. These oil pollutions impose the highest cost on PMO.

This organization spends a lot of money annually to prepare and deal with oil pollution in sea, which reduces the financial performance of organization and its profitability. Also, water pollution has always caused concern for governments and people, and in order to stop it, it is necessary for governments to take action and participate at the national and international level. The destruction of marine systems and surface waters has caused irreparable damages to the environment. Today, due to the high use of sea and variety and speed of polluting substances discharge into the sea, the self-purification ability of marine ecosystems has been reduced and they can hardly neutralize the effects caused by entry of such substances. Current waters and industries created along the coast cause a huge part of sea pollution. Another part of marine ecosystem pollution is related to bed drilling, marine transportation (shipping), natural oil spills, sky falls, direct contact of the water surface with the surrounding air, and intentional dumping of materials into the sea. Also, marine transportation, oil terminals, ship repair shops, fishing docks and ships lead to waste production that can potentially be considered a source of sea pollution. Collecting, recycling, cleaning, processing and proper disposal of these materials will have a significant effect on reducing sea pollution caused by sea transportation. The PMO which in charge of sea protection should provide equipment to deal with this pollution. Since providing this equipment imposes high costs on organization, it is necessary to take measures to manage these environmental risks to improve the organization's financial performance. Therefore, in this research, environmental risks affecting the financial performance of PMO in Iran were investigated.

2. Literature Review

By definition, risk is a combination of the severity and the probable frequency of the harm. Risk can be defined as the frequency of a possible event and the consequence of that event`s outcome. Projects are growingly challenged with complexity. In fact, project managers need to deal with several and different deeply interrelated parameters, inside and outside the project. Such complexity results in complex risk interactions and a decrease in the effectiveness of the tools that are normally used for risk management [5].

Some researchers have conducted research in the direction of environmental risk management and their effect on financial performance. Farzingohar et al., [6] conducted a research entitled "Fishing port pollution due to the vessel activities along Bandar Abbas Coast, Iran". The cluster results indicated that Ni and Zn entered the environment due to the activities of ship repairs and coastal construction. Pb, Cu and Cd sources were from oil spills of fishing boats. Moreover, due to the direction of prevailing wind in this region which is from south west, the floated oil spills on the water surface were transferred to the eastern coast of Bandar Abbas. The weathered spills are trapped within sand and increased the concentration of heavy metals in the coastal port sediment in this area.

Gholipour and Ebrahimi [7] conducted research entitled "Human resource risk management: mix method application". Human resources risks in this study are: Human capital risk (Risk of knowledge, skills and abilities of employees (Inadequacy of knowledge, skills, abilities or personality characteristics with job; Obsoleteness of job skills)), occupational health and safety risk, human resource related risk (Instability of senior management positions, importing senior management positions), operational risks of human resources such as performance management risks, risks of training and development (weakness of the training effectiveness measurement system, inadequacy of training with employees job needs), selection and employment risks, service compensation risks, individual risks of human resources specialists (risk of not having perceptive, human and technical skills (Lack of specialized knowledge, not updating specialized knowledge)). Nguyen et al., [8] conducted another research entitled "An operational risk analysis model for container shipping systems considering uncertainty quantification". The case study reveals the physical flow as the dominant origin of high-ranking risks with potential significant consequences such as piracy, dangerous cargoes, and maritime accidents. The risks identified in this study are: information flow risk (information incompletion or inaccuracy (misdeclaration of cargoes in containers), information and communication technology (ICT) technical failures (human-caused errors on the ICT systems)), physical flow (transportation delay (halts of port due to strike, unrest or war situation, acts of God), Loss/damage of goods/assets (inland transport deficiencies (e.g., accidents, congestion), hazardous events (HEs) caused by dangerous goods (e.g., leakage, fire, explosion), Failures in maintaining reefer containers' temperature, shipments being stolen or container being tampered, acts of piracy and terrorism in the maritime legs)), and payment flow. Azevêdo et al., [9] conducted a research entitled "Methodology for Maritime Risk Assessment in Ports due to Meteo-oceanographic Factors: The Case of the port of Suape, Brazil". The risks identified in this study are: Grounding in the external port access channel, Head-on collision with ship in the external port, Capsize of tugboat during berthing, Contact with machinery, Stern collision with berthed tanker. Aydin et al., [10] discussed the "Analyzing human error contributions to maritime environmental risk in oil/chemical tanker ship". The results of research showed that human error contributes the most to various types of maritime accidents. In this study, risks for chemical pollution due to leakage in oil/chemical tanker ship are the following:

cargo leakage in oil/chemical tanker ship, improper cargo handling, equipment's failure, operational error, human error for cargo handling, improper equipment maintenance, human error for maintenance, lack of knowledge, lack of situational awareness, insufficient training, failure to follow rules and regulations, equipment failure, lack of safety culture, lack of knowledge about maintenance, insufficient supervision, insufficient equipment resource, insufficient planning, using defective equipment, heating Cargo freezing in lines. Gunes et al., [11] studied "Cyber security risk assessment for seaports: A case study of a container port". In this research, three of potential vulnerabilities sources of port assets include: 1) operators, users and employees (external unauthorized access to the port information system, lack of training of operator and users, employees' failure to correctly implement security policies, procedures and processes, facility policies, processes and procedures are not updated against emerging risks, lack of service personnel to perform maintenance when necessary, lack of awareness of cyber security in employees, IT personnel not constantly controlling the system), 2) Physical infrastructures and IT equipment, 3) organization (leak of information, lack of qualified / sufficient personnel for emergency response, natural disasters). Nguyen et al., [12] conducted a study entitled "Container shipping operational risks: an overview of assessment and analysis ". The risks identified in this research include: Information (internal or within the organization factors such as lack of information, shortages of the necessary information about relevant entities such as containers cargoes, partners, markets and regulations, failures of the information or controlling system, or any of its components that occur due to internal technical or human errors, information security), External-Causal factors are external or in the connections with external entities (such as ICT system malfunction, failures of the information or controlling system, or any of its components that occur due to external factors such as natural disasters or acts of vandalism or sabotage), Physical ((Inland-physical security, failures in protecting the shipments, containers, and vehicles against physical intrusion scenarios such as being tampered, contraband, thief acts, or piracy and terrorism; transport accidents (Transport system inefficiencies, Failures in maintaining the timeliness of transportation services caused by factors such as road, inland waterway depth insufficiency, and congestions), Vehicle malfunction (Technical deficiencies of vehicles in the process of transportation, Cargo handling accidents, Physical damages to shipments, containers, and the vehicles in cargo handling tasks such as stuffing/unstuffing and loading/unloading), Cargo accidents (Physical damages to shipments, containers, and the vehicles caused by cargoes such as fire, explosion, leakage, erosion, and liquefaction; physical damages or degradation of the shipments inside containers caused by external factors such as water, humidity, and temperature; failures in maintaining the timeliness caused by factors such as severe weather or handling equipment break down), occupational accidents (Accidents actively involving human factors, causing casualties, injuries, as well as disruptions and damages such as physical damages, and delays of the flow), Shortage of supplies (Insufficiencies of necessary materials, service, or equipment such as containers, vehicles, electricity, slots, berths, cranes to support the continuousness of the flow), Port congestion (the situation in which vessels/trucks/wagons arriving at a port is unable to finish the operation and have to wait for infrastructure/service to become available), Unexpected terminal productivity (Lowered throughput capacity of terminal due to a range of potential causal factors such as accidents, infrastructure issues, or shortages of supplies), Act of God (involving natural hazards out human control, from extreme weather conditions such as heavy rain, fog, strong wind to disasters such as earthquake, tsunami, storm), Legal liabilities and detainments (Interventions of related authorities that delay or detain the physical flow. The detained subjects could be cargoes, containers, or vehicles), Political events (Delays or damages caused by political or social factors such as wars, strikes, blockage, martial law), Cargo rerouting (Failures in transporting the shipments or containers to the intended geographical locations)), Financial (Unexpected cargoes depreciation (Unexpected fiscal losses in the relative value of the shipments inside the containers in the process of transportation, usually caused by transportation delays or rescheduling), Limited financial ability, Unexpected cost fluctuation (Unexpected variations of operating costs before or after the freight agreement or contract such as fuel cost or surcharges)).

Tseng and Pilcher [13] discussed "Evaluating the key factors of green port policies in Taiwan through quantitative and qualitative approaches". In this research, the key factors and sub-criteria influencing implementation of green port policies include: International Legislation, Environmental policy and regulation (Supervision and management framework, Voluntary checking mechanism), Technical leverage (Port infrastructure and terminal, Ship structure and maintenance, Environmental monitoring technique), Economic leverage (Port operation efficiency, Penalty Port pricing strategies, Incentive Port pricing strategies), and Human (Environmental risk perception, Shipping operators support, Stakeholders management). The quantitative FAHP analysis found the key factors to be environmental policy and regulation, followed by economic leverage, human and technical leverage. Liu et al., [14] studied "A three-dimensional risk management model of port logistics

for hazardous goods". Ports are the distribution centers of hazardous goods in the global transportation system. Once hazardous goods accidents occur in ports, they may cause catastrophic losses to humans and the environment. To manage these risks, this research proposes a three-dimensional risk management model that includes human, governance and goods and provides a risk level identification framework for port hazardous goods logistics. In the hazardous goods logistics of ports, training, emergency plans and professional personnel are essential. Hazardous goods accidents in port logistics are partly caused by the following points: as the personnel are not knowledgeable enough or highly equipped with skills, the existing conditions could easily trigger large-scale accidents. In port logistics accidents, hazardous goods ships and oil tankers are the main types of ship. In the port logistics regarding the hazardous goods risks in China, the quality of the front-line staff is not sufficient. The whole system is more prone to accidents due to a lack of professional skill. In the analysis of the accidents and the port logistics risks of hazardous goods, personnel operational error was an important cause of frequent accidents.

Vilko et al., [15] conducted a research titled "Risk management abilities in multimodal maritime supply chains: Visibility and control perspectives". In this study, the exogenous risk sources in maritime supply chains are: Unpredictability of regulations, Border policies, Oil catastrophe, Storms, Military conflict, Fire, Old shipping lanes, Terrorism, Explosion of gas line, Infrastructure limitations, Customs formalities and unclarities, Political instability, Wind, Economical problems of countries, Regional epidemic, Lightning, Organized crime, Heavy rains, Floods, and Climate change. Sources of endogenous risk include: IT-system vulnerability, Problems with software, Insufficient knowledge, Unwillingness to share information, lack of human resources, Workers poor motivation, Irresponsibility, Shipment capacity, Lack of equipment, Chemicals, Explosives, other Hazardous materials, and Forwarding operator.

Chen and Rong-chang [16] studied "Current problems and risk analysis on high pollution risk operation of ship". The results indicate that there is a great risk of pollution during the process of typical operations, such as tank cleaning, liquid hazardous goods barging, tank dismantling and wreck salvage. When a shipwreck occurs, it will pose real or potential dangers to marine environmental protection, maritime navigation safety, and marine production operations in the vicinity of the wreck. The main risks are pollution caused by oil spills from ships and leakage of harmful cargo.

3. Materials and Methods

This research is a mixed data in terms of type, applied and developmental in terms of purpose, exploratory and descriptive research in terms of nature and a survey in terms of data collection method. The mixed approach of this research has been divided into two phases: qualitative (review of theoretical foundations and interviews) and quantitative (statistical analysis based on a researcher-made questionnaire). In the qualitative part, in order to identify the most important environmental risks affecting the financial performance of PMO in Iran, the theoretical foundations and research background were reviewed at the world level; then, the extracted items were evaluated and localized through semi-structured interviews and field visits using the Delphi method, and experts were requested to give their opinion about the identified risks (eight main environmental risk management components and 65 sub-components) and different degrees of importance according to Likert's classification in five classes of importance (very high to very low). The statistical population of the research is certified and experienced specialists in the field of financial management and HSE of PMO in Iran including 11 ports, Shahid Rajaei, Imam Khomeini, Amirabad, Bushehr, Nowshehr, Anzali, Shahid Beheshti, Khoramshahr, Lengeh, Shahid Bahonar, and Abadan, and by purposeful or judgmental sampling method, 70 of them were considered as a sample. Purposeful sampling is one of the frequently-used methods in qualitative studies. In purposeful sampling, subjects have been selected by the researcher. The subjects who were selected have rich and in-depth knowledge and experience of the concept under study and can provide a detailed insight into it [17]. Based on the research conceptual framework, the questionnaire was designed in two parts. The questionnaire validity was examined in two sections: content validity and construct validity. Questionnaire content validity was confirmed by consulting and advisor professors and experts of PMO in Iran after making the necessary corrections. Confirmatory factor analysis was used to ensure the structure validity. In this research, reliability of measuring instrument was checked through Cronbach's alpha and composite reliability coefficients. SPSS.22 and SmartPLS2 statistical software's were used to analyze research data.

4. Results and Discussion

4.1. Descriptive Statistics

Table 1 shows the demographic characteristics findings of certified and experienced specialists in the field of financial management and HSE of PMO in Iran.

Table 1. Demographic information of research experts

Demographic characteristics		Frequency	Percentage
Age	<40	4	5.7
	41-50	56	80.0
	51-60	10	14.3
Education	Bachelor	20	28.6
	Master	45	64.3

Demographic characteristics		Frequency	Percentage
	PhD	5	7.1
Experience	<10	17	24.3
	11-21	33	47.1
	21-30	16	22.9
	>30	4	5.7
Position (occupation) of people	General Director	4	5.7
	Marine Deputy	8	11.4
	Head of Vessel Registration and Inspection Department	5	7.1
	Head of Maritime Safety and Protection Department	14	20.0
	Deputy of Planning and Resource Development	5	7.1
	Head of Finance Department	10	14.3
	Head of Administrative Affairs	3	4.3
	Port Deputy	3	4.3
	Head of Port Affairs Department	3	4.3
	Technical and Engineering Deputy	4	5.7
	Head of Coastal and Port Engineering Department	6	8.6
	Head of Design and Supervision Department	1	1.4
	Head of Equipment Maintenance Department	1	1.4
	(pilot) Ship Guide	3	4.3

In Table 2, descriptive findings of research variables are presented.

Table 2. Descriptive findings of research variables

Variables	Number of items	Mean	Standard Deviation
Port equipment and facilities risk management	5	3.1171	0.7219
Operational risk management	7	3.1347	0.8477
Human resource risk management	11	2.6610	0.8598
Pollution risk management	20	2.6436	0.7562
Maritime transport risk management	4	3.0464	0.8234
Natural risk management	6	2.5500	0.9732
Security risk management	7	2.7918	1.0941
Rules risk management	5	2.1629	0.7654
Risk control	10	2.9157	0.8402

4.2. Inferential Statistics and Research Model Fit

In conducting this research, inferential statistics and Structural Equation Modeling (SEM) using Partial Least Squares (PLS) method were used to investigate the influence of environmental risks on financial performance and relationships between them. In SmartPLS.2 software, three types of fitting are performed in model: 1. Measurement model fit, 2. Structural model fit, and 3. General model fit [18].

4.3. Measurement Model Fit

Reliability is one of the measurement model criteria, which is done by four ways of examining factor load coefficients, Cronbach's alpha coefficients, combined reliability (CR) and communality. In this study, questionnaire factor validity test was done with help of confirmatory factor analysis and using PLS software. According to Fornell and Larcker (1981) criterion [19], factor loads of items should be greater than 0.5 and significant. But before performing the confirmatory factor analysis using "Kaiser-Meyer-Olkin (KMO)" and "Bartletts Test of Sphericity", the ability to evaluate confirmatory factor analysis for variable measurement should be evaluated. KMO value is always between 0 and 1. If the desired value is less than 0.5, the data will not be suitable for factor analysis, and if its value is between 0.5 and 0.69, factor analysis should be done more carefully. If this value is more

than 0.7, correlation between data will be suitable for data analysis. On the other hand, Bartlett's test should be used to ensure the suitability of data for factor analysis. Bartlett's test evaluates the hypothesis that observed correlation matrix belongs to a society with dependent variables. For a functional model to be useful and meaningful, variables must be correlated [20]. Table 3 shows the results.

Table 3. KMO and Bartlett Test results

Variables	Questions	KMO
Port equipment and facilities risk management	ER1-ER5	0.754
Operational risk management	ER6-ER12	0.899
Human resource risk management	ER13-ER23	0.866
Pollution risk management	ER24-ER43	0.835
Maritime transport risk management	ER44-ER47	0.746
Natural risk management	ER48-ER53	0.829
Security risk management	ER54-ER60	0.838
Rules risk management	ER61-ER65	0.845
Environmental risks management	ER1-ER65	0.823
Risk control	FP1-FP10	0.872
Cost control	FP11-FP18	0.915
Financial performance	FP1-FP18	0.875

Considering the possibility of using factor analysis to determine the instrument's validity, confirmatory factor analysis was used. After that, Cronbach's alpha and CR coefficients of constructs were investigated, which are presented in Table 4. According to Table 4, internal reliability of structures in measurement model is more than 0.7, which indicates the appropriate reliability of variables. The second criterion of measuring measurement models is convergent validity, which is desirable according to the results of convergent validity of variables.

Table 4. Cronbach's alpha, CR and Convergent Validity coefficients of variables

Variable	Cronbach's alpha	CR	Average variance extracted (AVE)	Communality
Port equipment and facilities risk management	0.790	0.845	0.539	0.539
Operational risk management	0.916	0.935	0.673	0.673
Human resource risk management	0.941	0.949	0.631	0.631
Pollution risk management	0.950	0.955	0.517	0.517
Maritime transport risk management	0.837	0.892	0.674	0.674
Natural risk management	0.934	0.948	0.755	0.755
Security risk management	0.949	0.959	0.769	0.769
Rules risk management	0.923	0.944	0.772	0.772
Environmental risks management	0.983	0.983	0.506	0.506
Risk control	0.947	0.956	0.688	0.688
Cost control	0.953	0.961	0.756	0.756
Financial performance	0.968	0.972	0.659	0.659

4.4. Structural Model Fit

In Figure 1, which shows the structural model analysis, R^2 value and standardized factor loading coefficients related to paths of each hypotheses are shown. According to this figure, the factor loading value of all items is higher than 0.5.

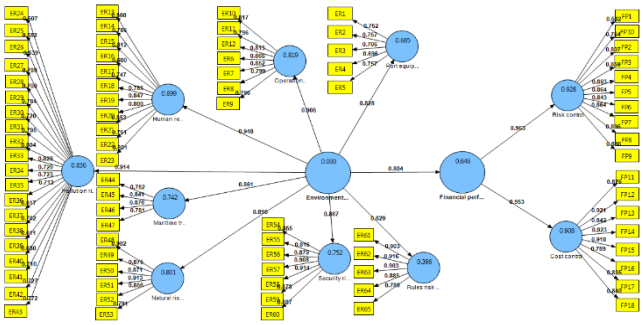

Figure 1. Standardized coefficients of factor loading

Figure 2 shows the model with Z significant coefficients.

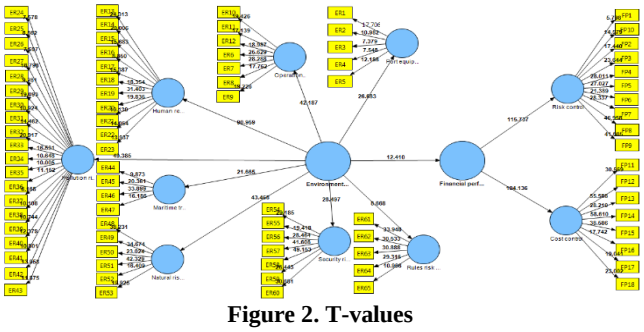

Figure 2. T-values

According to path coefficients and t-statistics extracted from Figures 1 and 2, the results of structural equation model showed that environmental risk management with a path coefficient of 0.804 and t-statistic value equal to 12.410 on financial performance of PMO in Iran has a positive (direct) and significant effect. Also, Port equipment and facilities risk management with a path coefficient of 0.828 and t-statistic value equal to 26.683, Operational risk management with a path coefficient of 0.905 and t-statistic value equal to 42.187, Human resources risk management with a path coefficient of 0.948 and t-statistic value equal to 90.959, Pollution risk management with a path coefficient of 0.914 and t-statistic value equal to 49.385 Maritime transport risk management with a path coefficient of 0.861 and t-statistic value equal to 21.665, Natural risk management with a path coefficient of 0.895 and t-statistic value equal to 43.468, Security risk management with a path coefficient of 0.867 and t-statistic value equal to 28.497 and Rules risk management with a path coefficient of 0.629 and t-statistic value equal to 8.668 have a positive (direct) and significant effect on financial performance of PMO in Iran. Therefore, to improve the financial performance of PMO in Iran, among the environmental risks management, human resources risk management has the highest effect with a coefficient of 0.948. Therefore, based on the factor load adopted for human resource risk management indicators, it is necessary for the managers of PMO's in Iran to focus on three main priority indicators, respectively: 1- Education risk management (educational needs assessment, fitness of education with job needs, organization managers' acceptance of training courses), 2- Risk management of knowledge, skills and specialized abilities of employees (fitness of knowledge, skills, ability or personality traits with job), and 3- Risk management of senior management positions instability. This finding is consistent with the findings of [7], [10], [11], [13], and [14]. Pollution risk management with a path coefficient of 0.914 became the second priority in improving the financial performance of PMO among environmental risks management. Therefore, based on the factor load adopted for pollution risk management indicators, it is necessary for the managers of PMO's to focus on three main priority indicators, respectively: 1- Pollution risk management due to the unloading and loading of petroleum products, 2- Pollution risk management resulting from the transportation of toxic liquid materials in bulk by ships and 3- Pollution risk management resulting from hazardous substances packed by ships. This finding is consistent with the findings of [10], [8], and [14]. Operational risk management with a path coefficient of 0.905 obtained the third priority in affecting financial performance of PMO in Iran among the environmental risks management. Therefore, based on the factor load adopted for operational risk management indicators, it is necessary for the managers of PMO's to focus on three main priority indicators, respectively: 1- risk management related to port infrastructure and terminals, 2- risk management related to technical issues in port design and logistics, and 3- Safety risk management related to weather conditions. This finding is consistent with the findings of [11], [12], [13], and [15].

4.5. General Model Fit

Goodness of Fit (GoF) criterion is used to check the overall model fit. GoF criterion is calculated according to formula 1. In this formula, $\overline{communalities}$ is the sign average communality values of each structure and $\overline{R^2}$, the average value of R Squares values of the model's endogenous structures. Wetzels et al., [21] have introduced three values of 0.01, 0.25 and 0.36 as weak, medium and strong values for GoF [18]. According to the introduced values for GoF, obtaining 0.719 for research model confirms the very strong fit of the overall model.

$$GoF = \sqrt{\overline{communalities} \times \overline{R^2}} = \sqrt{0.677 \times 0.764} = 0.719 \qquad (1)$$

5. Conclusions

The existence of oil and gas, maritime transport, tourism and recreation, aquatics are the most important economic values of national water, which emphasizes the need to pay attention to the marine environment. Since the ports are gateways for the exchange of various international commercial goods, identifying and managing the environmental risks of ports increases their safety and, as a result, the effectiveness of their financial performance. Therefore, managers of PMO need planning, serious attention and huge investment in important activities of this organization. In this way, by creating a safe port, efficiency can be increased by attracting customers. This organization can achieve suitable economic and social conditions and improve the country's power in the port and maritime field. Therefore, in this research, the environmental risks affecting financial performance of PMO in Iran were investigated and studied. According to results presented to the PMO in Iran, it is suggested that employee training programs are considered to increase the level of their skills and professional knowledge in order to reduce human errors. Training courses should be held in order to raise the awareness level of port employees, executive contractors, shipping representatives and ship captains regarding waste management. Pollution risk management caused by unloading and loading of oil derivatives should be done by applying rules on ships, ports, platforms and marine facilities. Appropriate safety measures should be taken during unloading to minimize the amount of cargo waste caused due to operation. In order to reduce waste leakage during load transfer operations, proper communication should be established between

employees. In case of accidental leakage of goods, necessary measures should be taken to prevent and spread the leaked material to other goods. In case of lack of sufficient receiving facilities in ports, the insufficiency of facilities should be reported. In ports, berths and oil terminals, the necessary equipment and facilities to receive balance water and oil waste from oil tankers, ships and vessels should be created and managed. Therefore, in order to manage the waste materials resulting from ships traffic in ports, suitable and sufficient facilities should be considered to receive the wastes of reluctant ships to port and receive all wastes in a correct and on time manner. In addition, reforming and regulating commercial waste management solutions in ports can significantly reduce the damages and losses caused to the marine environment and also costs of the organization. advanced techniques such as proper packaging, loading and unloading methods and proper transportation methods for hazardous goods should be applied. Many natural disasters occur in the marine industry, which lead to severe environmental damage and economic problems for companies and countries involved. Therefore, risk and safety assessment by organization can reduce severe environmental damage and economic problems to the organization.

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