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IMPORTANT FACTORS IN THE ESTABLISHMENT OF SHIP RECYCLING INDUSTRY BY USING AHP METHOD

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ABSTRACT

Life time of a ship is estimated that an average of 25 to 30 years, after that it is not safe to use of the ship for service delivery. It should be noted that around 95 percent of a ship is built by steel which is quite economical to be re-used or recycled.The researcher decided to consider the requirement of the domestic industries for melting steel of the old ships, increase number of employees of the relevant companies, to prevent of transporting the old ships for dismantling and so on.A part of this research is designated to look upon about the feasibility of establishment of a ship recycling company at the Arvand Free Zone in order to improve the Iranian economic; of

course by considering the environmental issues. Brainstorming as the main tools for data collection were used in this study, which includes a team of 15 senior managers of the respective organizations, sample size is formed.After four meetings with team members brainstorming and analysis data with AHP model in Expert Choice 11 inferencethat the most important factors in the establishment of ship recycling industry include: safety and environmental laws, employment, national income, access and hinterland, specialty staffing and flotation of drowned vesselwhich safety and environmentallawsfactor with degree of importance 0.496 between other factor denoted as the most important measure.

Keywords: Recycling of ship, marine pollution, development of economic, Hong Kong and the Basel Convention, Arvand Free Zone

1- INTRODUCTION

Iran has more than 1,800 km coastal line along the Persian Gulf and Sea of Oman and the ownership of one of the largest shipping fleets in the region has great potential to benefit from the economic aspect of the recycling industry and Iranian ships and even foreign securities (Darban, 2012). Now environmental reasons, a lack of scientific technology and other reasons, Iran has not the industry, and even Iranian ships owned by IRISL and NITC fleet to dismantle and recycle to Bangladesh, Pakistan and India are sold. This is in addition to the use of this potential because of the costs of accommodation and return ferry personnel to the country, often by air, are the costs for shipping companies (Khosravi et al., 2014).

Vessels being operated in the life time growing rate, especially old tanker and container ships which are normally removed from the marine transportation cycle in order to be dismantled (Majedpour, 2010). Increase the number of outdated fleet, the ships damaged during the Iran-Iraq war, a good market and ultimately increasing the number of ships that have recycled securities products are good economic justification for the development of ship recycling industry in the country. On the other hand, according to capacity and very good equipment and infrastructure in different areas of shipbuilding, repair and construction and installation of offshore structures Shipbuilding and Offshore Industries Complex Iran and the presence of potentially could be receptive to ship recycling industry (Masoumi and Akbarivakilabadi, 2011).

2- Ship recycling and needs for establishment of its industry

The Basel Action Network (BAN, 2012) is the world's only organization focused on confronting the global environmental injustice and economic inefficiency of toxic trade (toxic wastes, products and technologies) and its devastating impacts during recycling of different components and materials of the ships (Basel Action Network, 2012).In fact, the shipbuilding industries have been worked since many years in the past. If the age of a ship became more than thirty years old, therefore it's efficiency would reduce and she is unsafe to navigate further (Hesham and Kazem, 2013). At present time, running costs of the old ships are greater than to gain cargo freight or chartering the ships, therefore the owners prefers to recycle their ships.

The ship recycling process is performed in a range of land and coastal waters which may cause to create pollution in coastal ecosystem. As a result of that problem may affecting economic, social and safety for related industries of developing countriesThe problem that environmental degradation and pollution pressure if be done on the basis of environmental management, correct positioning, collection, disposal and principlerecycling of hazardous wastes and environmental assessment, be reduced to the minimum possible (IMO, 2009; Mikelis,

2010).Understanding this issue that in thisindustry and other similar industries, the role of human resources is very valuable and in the national capital. The importance of issues such as safety, health andtraining capitalthat main basis for infrastructure development of marine industry will be more specific.

Usually ships in the end of working life are sent to ship dismantling industry. This industry in the developing countries, along with job creation, a source of iron for the steel smelters is required. Steel is often used in ships sent for recycling to steel furnaces (Misra, 2009).Due to the limited natural resource that plays an important role in some countries. Sales of spare parts and machines in the second-hand markets, shows the another aspect of the market of this industry.

Since 95% of the weight of the ship beformed of metals such as iron and steel, the industry also help to supply the needs of the steel industry (Mikelis, 2007).However, thesouth and north of the country for the establishment of the industry's potential there.According to experts, employment and profitability of ship recycling industry cannot be ignored in any way, as countries such as China, India, Pakistan and Bangladesh with investments as well as utilizationof this industry and annually billions of dollars

utilization from ship recycling operations gain theforeign exchange.

In order to consider the attraction of the industry for the development of domestic industries, increasing the efficiency of employment, the provision of basic supplies steel industry as well as old ships already sent for recycling to other countries and the exchange out of the country or the vessels with bottom tonnage at the shipyards build and repair for recycling trafficking and no attention to environmental issues is not, the researcher seeks to Effective factors study of establishment ship recycling industry at the Arvand Free Zone.

3- Spatial and temporal scope of research

The Arvand Free Zone area iscase study in this research. This research is the study area Arvand Free Zone.

Arvand free trade area in the northwest of the Persian Gulf and the south-western province of Khuzestan, that include Abadan and Khorramshahr towns, with an area of over 173 square kilometers located at the confluence of Karoon and Arvand River and the border with Iraq and Kuwait. The master plan has been prepared on the basis of 3 main sections Industrial Parks Khorramshahr and Abadan, Minoo Island and Shalamcheh (Arvand Free Zone organization, 2015).

There is plenty of water and rivers Bahmanshir, Karoon and Arvand and other facilities such as transportation, road, rail, sea and air in and out of the country and Abadan airport and short distance to the neighboring countries of the merits of the Arvand Free Zone and after the Qeshm Free Zone is the largest commercial and industrial free zone in country.

The study on May 2014 to September 2015 lasted, it should be noted that this timeframe involved the scope of the research time.

4- MATERIALS AND METHODS

4-1- Brainstormingmethod

More than sixty years ago by Alex Osborne brainstorming methods to increase the quantity and quality of advertising ideas, designed and used so welcoming people and organizations in the West, which was part of their lives.Forseveral decades brainstorming to prepare the mind for decision-making, generating ideas and solving problems is used,therefore, for organizations and businesses that their employees are considered a miracle of creative people together to from the organization's problems, solutions and ideas out and thereby significantly contribute to organizational growth (Gholizadeh, 2013).

4-2- Analytic Hierarchy Process (AHP)

AHP is one of the types of decision-making with multiple criteria that may not be considered as this type of decision. The AHP first by an Iraqi man named Saaty was proposed in the 1970s (Saaty, 1980).This method such as the brain focuses on the issues to analysis. AHP decision makers enable that real-time and interaction effects of many complex and uncertain situations to determine. This technique is to solve many complex and simple issues in the fields of management, social sciences, urban planning, locating and engineering applications. AHP method based on a logical approach to examine complex issues and allows them to simply provide analysis. This technique is ideal for logical answers to a lot of things can be used daily (Momeni, 2014).

4-3- Tools and methods for data analysis

The study aims to identify effective factors in the establishment of ship recycling industry used of brainstorming method, which is a qualitative approach. In order to determine the weight of each criterion, analytic hierarchy process was used. At the end of stage, the paired comparisons matrix use of AHP approach be formed and determine the weights of effective factors in the establishment of ship recycling industry, a factor that has the highest degree of importance as the most important factor in

the establishment of this industry will be introduced. This approach programming in Expert Choice 11 software and after verification program decision-making matrix to analyze the data was entered. It is also worth noting that for simple calculations EXCEL 2010 and SPSS 22 software was used.

4-4- Validity and reliability of research

The validity of the scale and content or question in exactly the tool to measure variables and research subject, validity in this research by Supervisor, advisors, experts and specialists, were investigated.

Reliability that credibility, accuracy and reliability of the interpretation is, is that if a meter is variable and attribute measurement is made, in similar conditions and at the time and place to be used, similar results it is achieved. In questionnaires to compare the paired comparison criteria and paired comparison options have been used of the incompatibility rate. The incompatibility rate shows how much we can trust the data gathered from the perspective of each expert. Inconsistency rate in AHP technique is used to ensure the correct answer. This criterion states that if the inconsistency rate is greater than 0.1 is better than that paired comparisons be revised. So the reliability of the data, this value should be less than 0.1.

4-5- The statistical population and sample volume

Our study population included all of the senior managers of relevant organizations in Arvand Free Zone area, including PMO, Arvand Free Zone Authority, Department of Environment, Shahid Mousavi shipbuilding company, Islamic Republic of Iran Navy and other relevant agencies, is formed.

Given that in this study to identify and rank the effective factors in the establishment of ship recycling industry, brainstorming method is used and the appropriate number of members to form a team brainstorming between 14 and 20 specialists and experts in the article.Therefore, in this study, to form the brainstorming team, 22 experts in the field of ship recycling was invited and15 people respond to our invitation and during a several meeting the effective factors identified and ranked. The sample volume of this study comprises 15 experts.

5- RESULTS

5-1- Identify criteria on the establishment of ship recycling industry

This study stage is the first phase of the questionnaire.At the first meeting of brainstorming team demand'sof people that indicating important factors or criteria in the ship recycling industry, and each of the team from the angle of his thoughts on the factors

and criteria mentioned that totally 22 criteria were identified. After the end of the first meeting, by eliminating duplicates factors and classifies other criteria, 10 criteria were explained as follows (see table 1).

5-2- Identify and prioritize the most important criteria

At this stage of research cause of analysis of the 10 criteria for paired comparisons difficult and time-consuming, making questionnaire for determine importance of 10 criteria and distributed between team members as follows, and 6 superior criteria for the AHP analysis entrance to the next stages of the research.

It should be noted that the degree of importance of each criterion from 1 to 5 for quality and quantity stated as follows (see table 2):

Results of importance between above 10 criteria are as follows in Table 3.For selection and ranking of 6 Criteria that are more importantly once used of the Arithmetic mean and once again, Friedman test in SPSS 22 software because of more scientific this test, was used. Finally, both methods achieved the same results (see table 3 and figure 1).

This phase of the research is to determine the importance of Criteria by comparing two to two Criteria with respect to the target,to

determine which of the Criteria in the establishment of ship recycling industry is more important. As mentioned before, due to the time-consuming evaluation of 10 criteria, 6 criteria, which have the highest total, were selected and for paired comparisons between the Criteria were entrance in this phase of the questionnaire.

The following factors are the most important criteria for the establishment of ship recycling industry in the analyses of second phase of the decision-making brainstorming team was determined: 1. Safety and environmental laws, 2. Employment, 3. National income, 4. Access and Hinterland, 5. Human Resources Specialty and 6. Salvage ships Immersion. Then to determine the weight of each criterion was used of

Expert Choice 11 software. To obtain the weight of each criterion is calculated as the geometric mean of each row and then geometric mean of rows divided by the sum of each rows. Results are summarized in the table 4 along with the Inconsistency rate of paired comparison are shown.

Matrix results suggest that safety and environmental laws as the most important criterion in the establishment of ship recycling industry has recognized that its degree of importance equal0.496. Meaning that safety and compliance of recycling industry with environment should be placed on the agenda and seriously. That in order to ease the weight criteriashown by the chart below (see figure 2).

Table 1- identification criteria

Row	criteria	Explanations
1	Safety and environmental laws	1. Standards and safety issues related to Human Resources. 2. The implementation of national and international standards and rules regarding ship recycling industry 3. Prevention of sea and river pollution in the region.
2	Employment	1. The establishment of ship recycling industry to attract labor. 2. The establishment of this industry boost related local industries such as transport market, towage, crane and etc.
3	Modernization of fleet	1. Amortized-out vessels and replacing them with new vessels.
4	National income	1. The establishment of ship recycling industry is to attract capital and increase national income. 2. The industry as a supplier may be part of the steel industry and strengthening the supply chain. 3. Handling of waste and scrap pieces of the ship is covered by duty free zone.
5	Human Resources Specialty	1. Promote and increase the knowledge, expertise and skills of the labor force in the field of ship recycling.
6	Salvage ships Immersion	1. The establishment of the recycling industry is motivated to floation old and sunkenships. 2. Clean interior waterways of sunkenvessels for better access to ports byships.

7	**Access and Hinterland**	1. **Way of access to send the waste to the country iron and steel industry.** 2. **Geographical location of the Arvand Free Zone for the establishment of ship recycling industry.**
8	**Market adjustment**	1. **The establishment of ship recycling industry will adjust ship supply and demand market.** 2. **The establishment of ship recycling industry will adjust steel supply and demand market.**
9	**Rivals**	1. **No rival in the Persian Gulf area for ship recycling, encourages Iran's entrance into the industry.**
10	**Localization of Technology**	1. **The establishment of ship recycling industry is to localization technologies are associated with it.**

Source: Research findings

Table 2- The style of importance

degree of importance					
quantity	**1**	**2**	**3**	**4**	**5**
quality	**very low**	**low**	**medium**	**high**	**very high**

Source: Research findings

Table 3- Results of criteriaimportance

Results

Rank	Criteria	Arithmetic mean	Friedman test
1	**Safety and environmental laws**	**4.80**	**8.87**
2	**Employment**	**4.46**	**7.70**
3	**National income**	**3.86**	**5.83**
4	**Access and Hinterland**	**3.80**	**5.77**
5	**Human Resources Specialty**	**3.60**	**5.37**
6	**Salvage ships Immersion**	**3.53**	**4.93**
7	**Rivals**	**3.40**	**4.87**
8	**Modernization of fleet**	**3.20**	**4.40**
9	**Market adjustment**	**3.13**	**3.87**
10	**Localization of Technology**	**2.80**	**3.40**

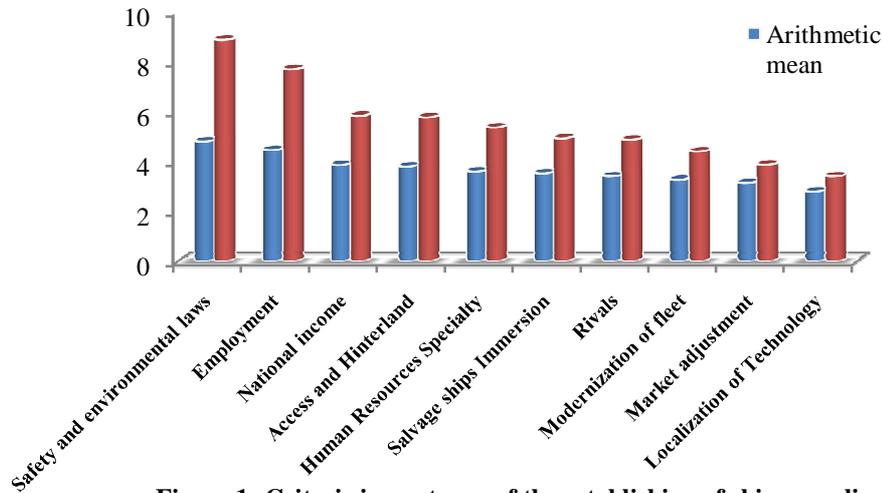**Source: Research findings**

Figure 1- Criteria importance of the establishing of ship recycling

Table 4- Results of criteria ofpaired comparison matrix

criteria	Safety and environmental laws	Employment	National income	Access and Hinterland	Human Resources Specialty	Salvage ships Immersion	Criteria weight
Safety and environmental laws	1	5.564	5.573	5.435	4.469	5.640	0.496
Employment		1	2.267	4.380	3.140	4.090	0.198
National income			1	3.966	2.780	3.108	0.135
Access and Hinterland				1	1.800	2.170	0.067
Human Resources Specialty					1	1.990	0.061
Salvage ships Immersion						1	0.042
Inconsistency rate							0.08

Source: Research findings

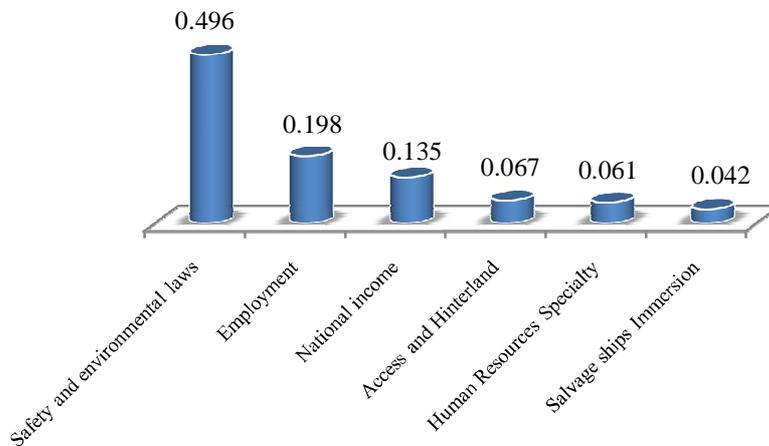## 5-3- Paired comparisons of criteria

Figure 2- Criteria importance

6- CONCLUSION

The ship recycling process has two main aspects that these two factors are always against each other,the economic importance and potential of this industry on the one hand and the human and environmental problems on the other hand,these two factors constantlyare in conflict as a problem affecting economic, social, environmental, safety in the industrial societies, especially in the developingcountries referred.Unless the establishment of this industry based on environmental management, correct positioning, rules and regulations in this regard, the executive necessity of Hong Kong and Basel conventions, collection, disposal and recycling of hazardous waste and environmental assessment to be done systematically.On the other hand, if the requirements of international organizations not used it, this industry will cause environmental problems.If I could follow all environmental requirements of the recycling industry can be viewed as a national project that is very important.By solving the environmental problems of the industry and its deployment in the context of environmental conventions and relevant laws, can referred to economic benefits of the industry, including: employment opportunities, increase government revenue

and national revenue, source for the needed steel and steel industries Steel mills, sale of parts and machinery in second hand markets, savings in foreign currency, boost domestic industries, attract foreign investment, active participation in economic growth, hundred percent recycling Hardware used in shipbuilding as the national capital and etc.

Finally, this study concluded that the most important factors in the establishment of ship recycling industry in Arvand Free Zone as the region this study include:safety and environmental laws, employment, national income, access and hinterland, human resources specialty, salvage ships immersion. Safety and environmental laws factor or other defining,standards and safety issues related to human resources, the implementation of national and international standards and rules regarding ship recycling industry and prevention of sea and river pollution in the region,in the ship recycling industry has such importance that almost half the weight of all factors (0.496) is formed.It appears that the ship recycling industry has been very profitable but it is a business that requires a high degree of safety, environmental awareness, environmental safety, health and welfare of workers, the application of the convention, and the provisions of international and national

regulations in this field, national support through an emphasis on maintaining the cleanliness of the environment, comply with international standard practices for disposal of waste from the ship, the dissemination of details of ship recycling guidelines for local shipyards ship recycling, environmental management skills and etc.

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