

## MODELLING SUSTAINABLE DEVELOPMENT OF OIL AND PETROCHEMICAL INDUSTRIES IN SOUTHWEST COASTAL ZONES OF IRAN

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**Ph.D**  
**7<sup>th</sup> Semester**

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Key words: Coastal zones, Sustainable development, Modeling, Oil and Petrochemical Industries

### **Introduction**

Pressure from human habitation and economic development are common in the coastal areas of the world. The growth rate of exploring new gas or petrol fields in Iran has been exorbitant high in recent decades. This has lead to rapid urban growth in petroleum zones. Today, companies are increasingly integrating aspects of the sustainable development concept into their management systems. In a systems view of sustainable development six essential subsystems can be distinguished. The six subsystems can be aggregated to three subsystems: human system, support system, natural system. All development activities cause some type of environmental impact and therefore all development projects should go through an environmental review process. In environmental management, risk assessment is the process by which the results of a risk analysis are used to make decisions through relative ranking of risk reduction strategies. Qualitative and quantitative analysis are two types of risk assessment are found in the industries. A risk assessment involves evaluating actual and perceived risks as the basis for decision-making.

### **ii. Objective**

The main objective is sustainable development model with Identifying Sustainability indicators for Environmental system and Industrial system also apply model of Environmental Risk Assessment for oil and petrochemical system in Iran.

### **Research Methodology**

Using the Delphi group and AHP methods for reliability and justifying Identification the sustainable development indicators in the environment and industries system, using AHP, William fine and FMEA method for evaluating and ranking risk assessment are methods to clear the sustainability and vulnerability of the systems. These indicators in environmental system contain the seven basic orientors: Existence, Effectiveness, Freedom of action, Security, Adaptability, Coexistence and Psychological needs. The scale from 0 to 10 is used to grade orientor impact. The scale can be given descriptors such as: very low, low, medium, high and very high sustainability condition.

For justifying the indicators, we prepared 50 questioner from 2 main groups, lecturers and experts in universities and department of environment and graduated or graduating student of environmental management, economic, science, and water resources, water and sewage, solid waste, air and HSE fields and ..., that most of them are local people or working in the area. In this questionnaire we are choosing the best indicators with comparing the sustainable development indicators of the World Watch 1996, Seattle – Washington, Upper Austria, New Zealand, Global region, UN CSD and Iran and selected factors. This system tested for the coastal area in southwest of Iran. The study area covers Shadegan Wetland, which is a Ramsar site. We will identify the indicators for three cities Abadan, Shadegan and Mahshahr that covers with area study separately. This area is very close to oil and petrochemical industries, fisheries and agriculture lands.

For the industrial systems, Identifying Sustainability indicators relate economic, social, environmental and health and safety performance indicators that influence system sustainability in petroleum industries development.

- The environmental Indicators such as spills, emissions, wastes and energy use, when expressed as absolute quantities provide a sense of magnitude or scale. Normalization of these quantities facilitates comparisons among organizations of different sizes, and can help express environmental performance in economic terms.
- The health and safety performance indicators described in this section are generally recognized as good indicators that may help companies manage operations and promote improvements in health and safety performance.
- As in other sections, indicators have been split into core and additional. Companies are encouraged to report all core indicators. Oil and gas companies can find themselves operating in challenging environments by nature of the location of oil and gas reserves.
- The economic dimension of sustainability reporting address the financial performance of the reporting company, also the company's effects on the economic circumstances of its stakeholders and on the local, national and global economic systems in which it operates. Economic performance, therefore, covers aspects of the company's economic interactions.

Many companies in the oil and gas industry employ management systems as a principal means to continually improve business performance. The efficiency of such systems is often discussed in sustainability or non-financial indicator reports. Reporting companies often describe and give evidence of how they are using a systematic approach in managing health, environment, safety and social issues. Identifying Sustainability indicators relate economic, social, environmental and health and safety performance indicators that influence system sustainability in petroleum industries development. The financial and economical indicators, that we use for identifying the economical and financial sustainability consist of tax expenses, transparency of payments, dividend paid plus share repurchases, payroll and benefits, capital expenditures, interest paid, information for using products, product with services net income (in million of euros or us\$), production (mboe/day), refinery throughput, crude oil input or distilling capacity (mb/d), total refined products sales (mb/d), total chemical sales (in millions euros and/or us\$) and..., the social indicators consist of political contribution, political lobbying and advocacy, non-discrimination and equal opportunity, employee satisfaction, training

and development, non-relation and grievance system, local employment opportunity, security and ..., environmental indicators consist of spills and discharges (hydrocarbon and control discharges to water), wastes and residual materials, emissions, resource use, environmental management systems and biodiversity, health and safety indicators consist of health & safety management systems, employee participation, workforce health, occupational injury and illness rates, and product-related health risks. We are using API, DOE and Iran Oil company standards and guidelines to identifying and ranking these sustainable indicators to achieve to sustainability of the all of the oil and petrochemical industries in area study.

Qualitative and quantitative analysis are two types of risk assessment are found in the industries. A risk assessment involves evaluating actual and perceived risks as the basis for decision-making as lead to rapid urban growth in petroleum zones. Environmental risk assessment is a proactive approach to risk minimization by quantifying the likelihood of certain outcomes and the consequences of those events. in this context, probabilistic risk assessment development involve six major steps: 1. system identification, 2. event identification, 3. frequency analysis, 4. consequences analysis, 5. risk estimation, 6. risk assessment. The William fine and FMEA are two methods that we can do for identifying and assessing the risk of the oil and petrochemical industries in study area. The scopes of this dissertation include ERA conceptual model development, geographic information system (GIS), data collection, consequences analysis and risk estimation.

17 units of oil and petrochemical industry in study area consist of: Abadan oil refinery, Abadan petrochemical industry, oil pipe line Abadan to mahshahr, Bandar Imam jetty's, Arvand (olfin 8 plan), Amir kabir (olfin 4 plan), Bo Ali (Aromatic 3 plan), Tondgoyan (PET/PTA plan), Khouzestan (Engineering polymers plan), Rejal (granol polipropilen), Shemi baft (MTBE plan), Ghadir (PVC/VCM plan), Fajr (Utility plan), Fan avaran (Metanol 3 plan), Karoon (Isosyanat plan) and Maroon (olfin 7 plan) petrochemical companies. We will identifying the sustainability of the industrial systems in these companies and we will find the vulnerability of these companies with doing the ERA. Modeling allows planners to apply information in finding out the environmental implications of various development scenarios. Spatial planning involves decision-making techniques that are associated with techniques such as Multi Decision Criteria Analysis (MCDA) Combining GIS with MCDA methods creates a powerful tool for spatial planning and Computer modeling can be used in building consensus between disciplines and between science, policy and the public.

### **Result & Discussion:**

The wetland area is under the jurisdictions of the shadeghan, Abadan and mahshahr towns. The main recent developments include oil and gas industries and oil transporting pipelines, petrochemical industries, irrigation developments, fish culturing, power plants and transmission lines, roads and rail ways and extension of towns and cities. Several other heavy industries such as the steel factory of ahvaz and the large sugar cane and fish culturing developments are also developing outside the catchment but in close proximity to the wetland. Sustainable development is a particular type of development that is characterized certain criteria. These criteria of sustainability and evolutionary development can be clearly specified. Following orientation theory, it has been argued here that the essential indicators are those that provide a complete description of the state

of satisfaction of the fundamental interests of each system, i.e. its basic orientors: existence, effectiveness, freedom of action, security, adaptability, coexistence and psychological needs (for humans and for systems with humans as components). This leads to the select of a comprehensive but minimum set of indicators. We applied the Rating method using percentages for the indicators .we identified the total, mean total and weight of subsystems and orientors. the weight for human system is 38%,support system 37% and for natural system is 25%.the result of the percentage ,it means that the human and support system are in the same range and better than the natural system.

As you know for the quality sustainability ranking, we ranked for the subsystems and Oriento's , based on the very high, high, medium, low and very low rank. Sustainable development is seen as a co evolutionary process of interacting systems in a common environment, where each system follows its own path of self-organization in response to the challenges of its particular environment. For justification and reliability of the selecting best factor, we are using Delphi group method .in this method the questioner will compare the indicators in the another areas that doing this method and we will select the best indicators with using the experience of the questioners .we collected the indicators of the another areas in the table and asked the questioner about the indicators, we filled 50 questioners, for the each human, support and natural system, we collected the suggested indicators. the roads in Delphi group software, was, filling the questioners', import the data to Delphi software, categorizing the orientor, categorizing the human, support and environmental system, importing the indicators for each systems, importing the 50 data questioner, collecting the summation and percent of each indicators. Table 1 shows the number of the indicators for each subsystem.

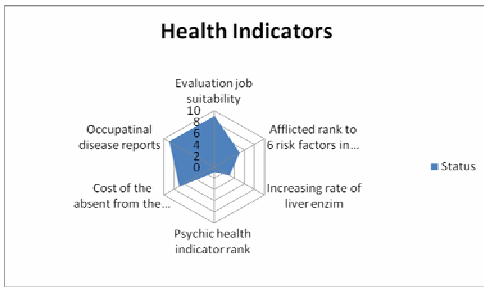
No.	Orienter	human	support	Natural
1	Existence	6	10	12
2	effectiveness	5	11	8
3	Freedom of action	11	10	12
4	security	5	13	12
5	adaptability	10	8	11
6	coexistence	12	11	11
7	Psychological needs	9	8	10

Table1.number of the suggested indicators for the each orientors.

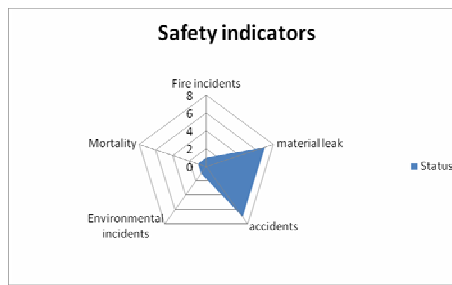
We are using the SPSS, for selecting the best indicators from the collected indicators. After the selecting the indicators, we will take the statistical report of the management and planning organization for the Abadan, Mahshar and Shadegan cities.

We are collecting data for all of the industries. For example in Fajr Petrochemical Company, we used the annual data of all of the indicators. For data that have daily, weekly, monthly data, we are using the mean of the data and mean other ranking data with comparing to the standards. the health system in fajr p.c. consist of evaluation job suitability, afflicted rank to six factors in the region, increasing rate of liver enzyme,

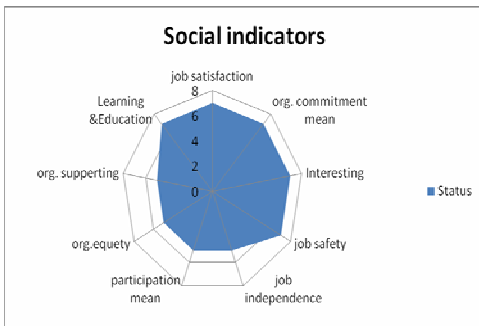
psychic health indicator rank, cost of the absent from the work and occupational disease reports. the ranking rate is from 0 to 10 in five level.0-2,2-4,4-6,6-8 and 8-10.the percent result of the health system is 56%.for the safety system, we evaluated the fire incident, environmental incident, accidents, mortality and material leak. the percent result of the safety system is 34%.for the social system we evaluated the job satisfaction, organization commitment, interesting, job safety, job independence, participation mean, organization equity, organization supporting and learning and education. The percent result of the social system is 58.51%.for the environmental system; we evaluated the air pollution, waste pollution, solid waste, environmental management system, environmental fine. The percent result of the environmental system is 60 %.the economical indicators, isn't ready until now.



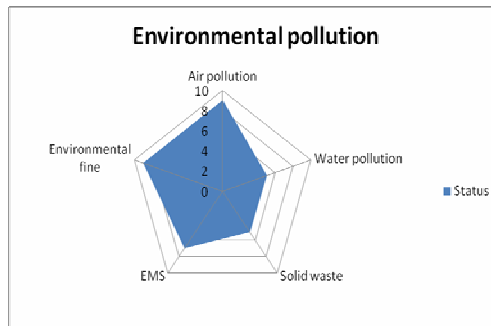
Health indicators of fajr p.c.



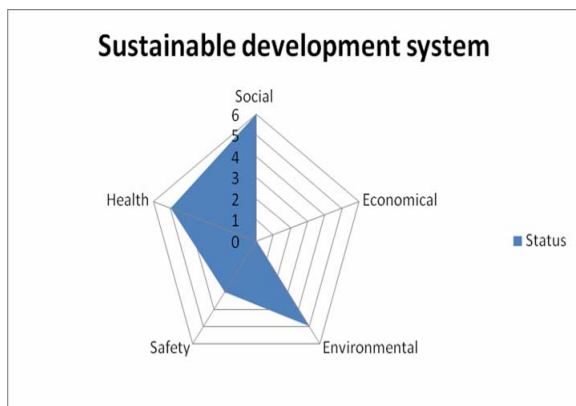
Safety indicators of fajr p.c.



Social indicators of fajr p.c.



Environmental indicators of fajr p.c.



Sustainable development system

With combining the social, economical, environmental, health and safety system, we take the result of the sustainable development rank of the fajr petrochemical industry the is 51.87. it is the medium range, the lowest system is safety system, that we should decrease the safety risk with upgrading the safety indicators. the rank of other system ,was in the same range. We are finding the rank of the sustainable development system for all of the 17 industries in area study.

The oil and gas industry recognizes that its operations have potential impacts on the environment. Some of the environmental impacts may have social and/or economic implications. Companies in the industry have made many commitments to manage and minimize negative environmental impacts. Often, these commitments go beyond regulatory obligations. Risk analysis basically involves the estimation of the frequency and consequences of a potential accident associated with an operation or equipment. Modeling, allows planners to apply information in finding out the environmental implications of various development scenarios. Spatial planning involves decision-making techniques that are associated with techniques such as Multi Decision Criteria Analysis (MCDA).

At this time, we prepared the GIS layers of the study area. All of the oil and petrochemical industries and the 3 cities pointed on the satellite maps with combining the AutoCad maps of the industries.

## V. Significance of Finding

In this study, we will try to define Sustainability indicators model in the study area, sustainable coastal development oil & petrochemical modeling in respect to environmental quality and patterns regard up potential impact, conceptual model of ERA to provide frame work of this model. Also define the sustainable development model based on environmental system, oil and petrochemical system and risk management model.

To achieve to this result, we need more considered to site visit, data collection and soft ware. Using an integrated evaluation method based on a sustainable indicator system of the coastal region, a fuller view of the coastal zone development process towards sustainability can be clearly achieved. The approach is effective, operational and

reasonable if the selected indicators appropriately reflect the status of the study region. Decision making information can be successfully derived in order to assist government policy making towards the sustainable development of the coastal zone. It should also be noted, however, that the effectiveness of the approach will be limited by the suitability of the sustainability indicators selected.