

Identifying the Development Drivers of Iran's Petrochemical Industry and Drawing Future Scenarios

Hossein Shirazi* 

Assistant Professor, Faculty of Management, Islamic Azad University, Qom branch, Qom, Iran.
Hossein.Shirazi63@gmail.com

Kaveh Alba 

PhD student of Technology Management, Islamic Azad University, Central Tehran Branch, Tehran,
Iran. Kaveh.Alba@yahoo.com

Abstract

Purpose: The current research was conducted with the aim of identifying the drivers affecting the development of the petrochemical industry in Iran. In terms of practical purpose, this research is a combined method that includes two main stages of library studies and validation by experts, at the exploratory level and based on the future research and scenario planning approach.

Method: In the present study, propellants were identified using library studies, and after identification, they were approved by experts. The target community of the research was academic researchers and experts and senior managers of the petrochemical industry who had scientific and practical experiences in the field of futurology. The snowball sampling method was also used for sampling. The critical drivers were identified with Mic Mac software based on the method of cross-effects analysis. Next, the future of the petrochemical industry in Iran was drawn in the form of 16 scenarios based on the Scenario Wizard software, based on the slope method.

Findings: The results of the research indicate that 40 drivers affecting the development of the petrochemical industry were identified. Finally, based on the key drivers, 16 believable scenarios were investigated and their degree of importance was determined.

Conclusion: The scenarios that have more weight are: sustainable development, adoption of new technologies, digital transformation, development of emerging markets and climate change and its effects. At the end, suggestions and solutions have been proposed to face the challenges and take advantage of the future opportunities of the petrochemical industry.

Key Words: Futures Studies, Petrochemical Industry, Technological Developments, Micmac, Scenario wizard.

Cite this article: Shirazi, Hossein . Alba, Kaveh (2024) Effective drivers on the development of the petrochemical industry with the approach of future research and scenario planning ,Volume 9, NO.1 Spring & Summer 2024, 238-269

DOI: 10.30479/jfs.2024.20721.1567

Received on: 7 August 2024 **Accepted on:** 12 November 2024

Copyright© 2023, The Author(s). 

Publisher: Imam Khomeini International University

Corresponding Author/ E-mail: Hossein Shirazi Hossein.Shirazi63@gmail.com

Introduction

Iran's petrochemical industry is currently facing complex challenges and issues that must be investigated for its sustainable and effective development. The main problem of the current research is to identify and analyze the drivers affecting the future of this industry and how they affect the development process. Considering the changes in global markets and the need to compete internationally, this industry must be able to adapt to new trends. Changes in demand for petrochemical products, increased sensitivity to environmental issues and changes in trade policies are among the challenges that must be considered. Due to the increasing concerns about the environmental impacts of the petrochemical industry, it is of great importance to create and implement sustainable policies to reduce these impacts and follow global standards. This will not only help to improve the environment, but will also be effective in enhancing Iran's international reputation in this industry (Khodadadi, 2023).

The final goal of the research is to draw different scenarios for the future of the Iranian petrochemical industry using the identified propellants. These scenarios can help decision makers make better plans to face challenges and take advantage of upcoming opportunities. Finally, this research helps policymakers, industry managers and other stakeholders to adopt more appropriate strategies for the development of the petrochemical industry with a better understanding of the drivers of development and to take advantage of future opportunities and challenges. Therefore, this article tries to answer the following questions:

- 1) What are the driving forces affecting the development of the petrochemical industry in Iran?
- 2) What are the different scenarios regarding the future of the petrochemical industry in Iran?
- 3) Provide effective solutions to face the challenges and take advantage of the future opportunities of the petrochemical industry.

Methodology

In the present study, drivers were identified using library studies and after identification, they were approved by experts. The temporal scope of the research included the last 3 years and the spatial scope was such that the drivers of the development of the petrochemical industry at the global level were first identified, and then it was extended to the country of Iran with the opinion of experts and considering the current conditions. Micmac and Scenario Wizard software were used as well as strategic management and future research approaches. Micmac software is designed to perform interaction matrix calculations and facilitate structural analysis. This name is an abbreviation of the French phrase "matrix of coefficients of cross-sectional effect analysis for the purpose of classification". In

this software, first the variables and components related to the research field are identified and then they are entered in a matrix such as the impact analysis matrix. Experts have identified the degree of connection between the variables and the relevant field, and the variables in the rows affect other variables (Zali et al., 2018). In this way, the total data of the rows show the degree of influence and the total data of the columns show the degree of influence. The degree of connection of numbers is measured from zero to three; So that "zero" means no effect, "one" indicates weak effect, "two" indicates moderate effect, and "three" indicates high effect. As a result, if the number of identified variables is x , an $x \times x$ matrix is obtained (Taqvai and Hosseinihah, 2016).

Result and Discussion

1. **Analysis of key trends:** To predict the future of the petrochemical industry, it is necessary to analyze key trends. These trends include developments in new technologies, changes in environmental laws and changes in consumption patterns. For example, advances in nanotechnology and biotechnology can lead to the development of new products and sustainable processes (Schmidt, 2017). Also, changes in environmental laws, such as reducing greenhouse gases, can lead to changes in production methods and petrochemical products (Wang and Zhang, 2020).
2. **Identifying drivers:** Identifying the main drivers of the petrochemical industry includes new technologies, new markets, and economic and environmental changes. Technology drivers such as artificial intelligence, machine learning, and composite materials can help improve efficiency and reduce costs (Huang et al., 2018). Also, economic and environmental drivers include changes in oil prices, increased demand for sustainable products, and changes in trade policies (Lee, 2019).
3. **Scenario evaluation:** Scenario analysis simulates different futures based on identified drivers and trends. These scenarios can include positive, negative and moderate scenarios. Positive scenarios may include sustainable growth and technological innovations, while negative scenarios can lead to environmental and economic crises (Gerdon et al., 2021). Evaluating these scenarios helps decision makers design appropriate strategies to face challenges and take advantage of opportunities (Schwartz, 2018).

By analyzing the key indicators and the required data, the dimensions of the matrix are 40 x 40 with Mic Mac software and the method of cross-effects analysis, the degree of filling of the matrix is 97.5%, which indicates that the selected factors match each other in 97.5% of cases. have influenced Out of a total of 1600 evaluable matrix relations, 372 relations equal to 23.25% have cross effects 3, which means that the indicators have influenced each other or have influenced each other. 409 relationships equivalent to 25.57% had cross effects of 2, that is, they had a reinforcing role. 779 relationships equal to 48.68% have cross effects of 1, which means they have more influence on other indicators. 40 relationships equivalent to 2.5% of the cross effects neither influenced each other nor influenced each other.

In the following, we will identify possible scenarios in the petrochemical industry. These scenarios are considered based on the key drivers identified in the previous step.

- | | |
|--------------------------------------|---|
| [1] Sustainable development | [9] Emerging technologies |
| [2] Digital transformation | [10] Changes in the geography of production |
| [3] Reducing dependence on oil | [11] Increasing the use of biopolymers |
| [4] Green innovation | [12] Development of emerging markets |
| [5] Rapid growth in demand | [13] Reducing carbon emissions |
| [6] Circular economy | [14] Product diversification |
| [7] Strict environmental regulations | [15] Acceptance of new technologies |
| [8] Intense competition | [16] Climate change and its effects |

According to the outputs of the scenario wizard software, the impact score of the scenarios of rapid demand growth, increased use of biopolymers, intense competition, product diversity, geographical production changes, climate change and its effects have been higher. The impact score indicates the overall impact of each scenario on various criteria. Scenarios with a higher impact score are considered top priorities because they have greater impacts on key drivers. Also, the scenarios that have more weight are: sustainable development, adoption of new technologies, digital transformation, development of emerging markets and climate change and its effects.

Conclusion

The petrochemical industry is facing many challenges and opportunities that will affect its future. The use of new technologies, the adoption of sustainable approaches and the development of new markets and products turn these challenges into opportunities for growth and development. Success in this direction requires careful planning, appropriate investment and adaptation to rapid changes in the environment and global market. This industry is facing many changes and developments in the future; Sustainable development, innovation and new technologies, globalization, digitization, use of renewable raw materials, climate changes and environmental regulations, economic challenges and sanctions are among the most important trends and future macro trends of this industry.

Future research helps companies to prepare to face different futures by analyzing these trends and formulating appropriate strategies. The future of the petrochemical industry will be very dynamic and complex under the influence of these scenarios. Due to technological developments, environmental regulations,

market changes and demand, petrochemical companies will need to innovate, adapt to new conditions and be more productive. Paying attention to sustainability, reducing carbon emissions and using alternative sources can help improve the performance of the industry and its public image. On the other hand, fierce competition and the need for product variety can bring new opportunities and challenges.

References

- Ahmed, A., Zhao, H., & Patel, M. (2023). Innovations in Renewable Feedstocks for Petrochemical Production. *Chemical Engineering Journal*, Vol. 450, Article 138702. <https://www.elsevier.com/locate/cej>.
- Anderson, K. (2022). Nanotechnology Advances in Petrochemical Catalysts. *Journal of Nano Engineering*. <https://www.jnanoengineering.org>.
- Bagheri, M. (2023). Title: Government Policies and the Impact of Sanctions on Iran's Petrochemical Industry. *Journal of Energy Policy*, 60(4), 320-340. (in Persian)
- British Petroleum. (2022). Statistical Review of World Energy 2022. BP. <https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html>.
- Brown, R. (2023). *Green Chemistry and Sustainable Production*. Academic Press. <https://www.academicpress.com>.
- Brown, T. (2022). Composite Materials in Petrochemical Products. *Materials Science Journal*. <https://www.materialssciencejournal.com>.
- Brown, T. (2022). Organizational Changes. *Management Journal*. <https://www.managementjournal.org>.
- Brown, T. (2022). Packaging Material Market. *Packaging Journal*. <https://www.packagingjournal.org>.
- Brown, T. (2022). Renewable Energy Integration in Petrochemicals. *Materials Science Journal*. <https://www.materialssciencejournal.com>.
- Clark, D. (2023). Bio-based Processes in Petrochemicals. *Advanced Materials*. <https://www.advancedmaterials.com>.
- Clark, D. (2023). Consumer Habits Changes. *Consumer Behavior Journal*. <https://www.consumerbehaviorjournal.com>.
- Clark, D. (2023). Cooling Technologies in Petrochemicals. *Technology Journal*. <https://www.technologyjournal.org>.
- Clark, D. (2023). Demand for Sustainable Petrochemical Products. *Advanced Materials*. <https://www.advancedmaterials.com>.
- Clark, D. (2023). Waste Management Technologies. *Waste Management Journal*. <https://www.wastemanagementjournal.org>.