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Presenting a model for analyzing the status of the petrochemical industry value chain (case study: Shastan commercial investment company)

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Abstract

This study presents a model for analysing the status of the petrochemical industry value chain (case study: Shastan Commercial Investment Company). This research is applied in terms of purpose and is of a descriptive-analytical type. The research method is of a mixed type and has been carried out in two parts: quantitative and qualitative. The statistical population of this research in the qualitative part is academic experts and managers of Shastan Investment Company, who were selected using the purposive sampling method and the theoretical saturation point, 20 people. The tool for collecting information in the qualitative part is a semi-structured interview based on theoretical foundations. The method of analysis in this part is the content analysis method. The results of the qualitative part of the research were explained in the form of eight organizing categories and 47 basic categories. In the quantitative part of the research, a researcher-made questionnaire tool derived from the qualitative research model was distributed after confirming the validity and reliability in the statistical population, which was estimated to be 213 people. Confirmatory factor analysis confirmed the paths and causal relationships between external and internal structures in the structural model. The path coefficients were greater than 0.3, and the corresponding t was greater than 1.96; therefore, all paths were examined and confirmed.

Keywords: situation analysis, value chain, strategy, Shastan
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1 Introduction

Organizations cannot achieve sustainable competitive advantage simply by introducing tangible and obvious benefits. This issue becomes more important in the case of service organizations due to the intangible nature of services. As organizations move toward globalization, an opportunity has been created for organizations in developing countries to enter the global economy system and earn more sustainable income, profit, and social value by upgrading their value chain [4]. However, taking advantage of these new conditions requires the use of models that also consider the new business environment. One of these tools is value chain analysis. A value chain is a set of interconnected activities through which a good or service is produced and delivered to customers. In fact, it is a set of loops of activities and operations that are carried out within the organization, including internal purchases and transportation, operations,

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external distribution and transportation, sales and marketing, services, and finally profit. This chain serves as a framework for identifying and analyzing all the activities of the company and how they affect each other. So, the chain also shows the costs and value provided to its buyers [9]. In their value chain model, Kramer and Porter [10] divided the company's activities into core and support activities. These core activities begin with the entry of raw materials into the organization and end with the provision of services to customers. These activities are supported by support activities. By analyzing the economic value chain, organizations can identify the components of their subsystems that generate production and economic value [21].

The value chain in the petrochemical industry is basically an economically justified concept that includes a set of actions and activities on feeds and manufactured products at different stages until they finally reach their destination, and the continuation of the stages is either not possible or does not have economic justification (for various reasons).

The petrochemical industry is the most profitable and at the same time one of the most capital-intensive economic sectors of the country and, as one of the country's strategic industries, it plays a prominent role in the economy, especially in realizing the resistance economy, so that paragraphs 13, 14, 15 and 18 of the general policies of the resistance economy are dedicated to this industry. The easiest way to earn income in the country is to allocate oil fields to various international companies and sell this valuable raw material. But there are other ways to earn more income from this divine blessing. In fact, every country has two ways to develop its oil and gas industry to increase its added value; using it as fuel and using it as a raw material for the production of petrochemicals, although these two paths have been merged together in the form of petrochemical units for several years, and separating them from each other downstream in the value chain seems far from reality. Iran is far ahead of the petrochemical industry in the quantitative development of the refining industry due to its significant demand for fuel. As a result, less than 5% of its high refining capacity is allocated to petrochemical complexes. Gas petrochemicals have also grown well in the country, but the problem with this sector is the quality of the products produced, which do not add much value to the country. In addition, their domestic consumption is less than their production, which means that the downstream petrochemical industries and the transformation of the value chain in the country have not been developed properly and balanced. Therefore, the lack of liquid feed petrochemical complexes to produce diverse products and the lack of completion of the value chains of gaseous and liquid petrochemicals should be considered by the planners of the country's downstream industries in order to increase the added value of oil and gas. Therefore, although Iran has huge oil and gas reserves, it has not yet been able to develop its upstream and downstream oil and gas industries in a desirable and balanced manner in proportion to its huge reserves. While different countries have pursued various competitive and non-rent-based strategies and rational models for developing the oil and gas industry value chain according to domestic conditions and requirements, to realize the policy of developing the oil and gas value chain, in addition to choosing the right and optimal strategy and model for a country, it is essential to pay attention to the political and executive requirements of developing the oil and gas value chain that must be examined.

In the petrochemical industry, the issue of market efficiency is of great importance because oil price fluctuations affect other variables through different channels and to different degrees, or affect other variables and sectors. FAMA [6] states that in an efficient market, all available and relevant information affects market prices completely and instantly, and there is no possibility of obtaining special profits by using this information. In this situation, the market price is the best estimate of the value of that commodity, and the valuation process will be equal to the market price [11].

Any fluctuation in global oil prices disrupts the budget (Iran) and subsequently its development plans because the budget's susceptibility to fluctuations and disruptions in global oil prices can cause problems for the economic and social structure in the long term, and based on this, it can be concluded that the global oil price plays a very important role in macro-decision-making and economic planning in Iran [14]. Given that Iran is one of the world's leading producers of crude oil, in order to access international markets, like other oil-producing countries, it is subject to the policies governing these markets, especially the Organization of the Petroleum Exporting Countries (OPEC), which is one of the most crowded daily markets in the world, and changes in this market also have a direct impact on other goods, including oil products. On the other hand, the National Oil Company is always looking for solutions that will increase Iran's share in global oil markets.

For this reason, it is necessary to examine and research various solutions that will lead to an increase in the volume of production and expansion of oil and gas sales at the global level or at least to maintain a quota in the market. The methods of producing and selling oil and gas are different from the methods of producing and selling consumer products. Also, in the marketing and selling of these products, issues such as political issues between countries, the specific characteristics of exported crude oil, the type of applicants, etc. have many effects; for example, as mentioned, nuclear sanctions in recent years have had a severe negative impact on the sale of Iranian crude oil in global markets, so that in addition to the reduction in oil exports due to banking sanctions, the income from oil sales has not returned to the country. In addition, optimal marketing and sales management is also of great importance [16]. In order to create

maximum added value and benefit from competitive advantages in global markets, and to confront sanctions and limit Iran's crude oil sales market share, as well as to expand market share and gain new markets, it is necessary for the National Iranian Oil Company to pay more attention to the factors affecting the expansion of crude oil and natural gas production and sales with the approach of examining the global demand for these strategic and vital products. On the other hand, it is necessary to look and observe intelligently the supply and demand situation of crude oil and natural gas at the global level, the developments in the field of international economy, the shifting equations and balance of economic and emerging powers at the global level, and the fundamental and vital need of all parties of this balance for energy, especially crude oil, in parallel with these developments, and to adopt comprehensive policies and strategies from now on with the aim of achieving a proportionate market share, and to design and establish refining systems and types of consumable feedstock with a more favorable and beneficial approach to the country's export situation [2]. Since the crude oil of countries such as Iraq, Kuwait, the UAE, Saudi Arabia, Russia, and the United States has replaced the country's crude oil due to the oil sanctions imposed on Iran, the negative consequences of the country's reduced foreign exchange earnings and the increase in security threats have made effective measures and the adoption of appropriate approaches very necessary and inevitable. Therefore, increasing the market share of Iranian crude oil types, which results in increased national security, can be one of the leading measures in achieving fundamental policies of a resilient economy for sustainability against future imposed external shocks [12].

To overcome these obstacles and challenges facing Iran's petrochemical industry, we need a series of requirements and requirements that will enable the full implementation of the value chain, from the extraction stages to the completion of the process. The main issues are having the technical knowledge (technology and licenses) to carry out the task, along with the appropriate equipment in the field of machinery and tools required, and skilled manpower along with the necessary resources (financial) to carry out the task. As discussed earlier, unfortunately, due to the oppressive sanctions, most countries with knowledge and technology are not willing to cooperate, and we are practically forced to use technical knowledge in plants built before the sanctions without obtaining approval from the technology owner. Meanwhile, other problems and obstacles in this industry, which are in some way in conflict with the demands and are considered part of the requirements, are the inability of the foreign sector to enter and invest in this field.

The main reason for this issue is also in some way derived from the prevailing political conditions and the sanctions imposed, which have severely limited and stopped income and the creation of resources for domestic investment. Ultimately, what has helped us on this path and helped us survive and earn foreign exchange in this industry is paying attention to analyzing the current situation of the country. Naturally, the existence of strategic and rich oil and gas reserves, as the main option in this field, which is necessary for any action, is considered one of the main assets of the country of Iran. On the other hand, the imposition of sanctions and the problems that have arisen, despite all the obstacles and problems mentioned, have been considered an opportunity to use the conditions of the resistance economy with careful consideration and timely action to strengthen and benefit from them and ultimately create conditions for exiting the sanctions.

Therefore, in this research, the main issue is to present a model for analyzing the status and strategic position of the petrochemical industry value chain in Shastan Commercial Investment Company, which we will examine in detail each component.

2 Theoretical and empirical foundations of the research

2.1 Common models of value chain analysis

There are many common methods in value chain analysis and its development among governments and international development institutions, and in this section we will examine only a few that have enjoyed greater acceptance in the scientific community.

1. International Labor Organization (ILO) model: The International Labor Organization offers a value chain analysis tool that discusses value chain analysis in the context of "promotion". Value chain analysis is seen as an increase in economic competition between companies and the occupation of new positions in a global value chain or the provision of new markets. In this context, the International Labor Organization, considering its mission, considers value chain analysis as an important tool for promotion, focusing on good working conditions, employment and job security, environment, cleanliness, workforce training, etc. The ILO provides a model for value chain analysis for professionals working in the ILO and other organizations and consultants working in developing countries and engaged in project development. The ILO foresees five stages in value chain analysis: (1) defining areas of interest, (2) identifying entry points for value chain analysis, (3) planning detailed maps in specific parts of the value chain, (4) conducting field surveys at three levels: global buyers, local producers and suppliers, and (5) evaluating findings [22].

2. The UN International Trade Centre Model: The UN International Trade Centre provides a participatory tool for value chain development that emphasizes the development of business and operational strategies. The model emphasizes analyzing the market and business environment from an exporter's perspective and identifying areas that support trade. A tool from the United Nations International Trade Centre, designed to help stakeholders or small groups of exporters identify opportunities, identify performance issues, trade, develop strategies to improve competitiveness, and organize their operations. The tool consists of three modules: (1) Form, which involves developing comprehensive trade strategies and organizing their implementation. Its outputs include: value chain performance identification, strategic vision, market options, objectives, implementation plans, progress indicators, resource requirements, and evaluation criteria. (2) Discovery, which involves a value chain diagnostic and training tool for analyzing and planning for the organization's business and trade support. The outputs include a market needs assessment, value chain performance identification, and an operational plan. (3) Competition involves helping companies operating in a sector to identify market success factors, reach new markets, develop a desirable value chain, create a business plan, and organize operational operations [3].
3. The Swiss Value Chain Analysts' Model of Organizational Resources and Capacities: The Swiss Value Chain Analysts' Model of Organizational Resources and Capacities for Professional Work in Rural and Agricultural Development and the Swiss Cooperative Development Organization have published Participatory Approaches to Value Chain Development [18]. Their analysis emphasizes the challenges of information availability and reliability, as well as the costs and time required to access information. They distinguish between speed and depth of analysis. Therefore, any value chain analysis should be carried out in a chain of external and rapid methods in a participatory and deep manner. This method led to the development of a new approach called market development for the poor, with an emphasis on developing capacity among poor producers in developing countries by identifying and acting on market conditions and marketing opportunities.
4. The Netherlands Development Agency (SNV) model: The Netherlands Development Agency analyses the value chain with an income and employment approach and emphasizes pro-poor development. This method consists of six steps: (1) participatory value chain selection, (2) pro-poor value chain analysis, (3) identification of opportunities for market-based solutions, (4) solution assessment, and (5) identification and selection of interventions and customer capacity. This method was first successfully tested in Asia in the countries of Vietnam, Laos, Nepal, and Bhutan by applying a number of principles for value chain analysis with a focus on the interests of the poor and taking into account the needs of the poor and market opportunities [8].
5. The United States Agency for International Development (USAID) Model presents value chain analysis as a tool for identifying the systemic factors and conditions under which a value chain and firms can achieve higher levels of performance, with a particular emphasis on end-market opportunities. The focus of this approach is on business development and. Greater growth and poverty reduction are expected when the value chain becomes more competitive and includes a large number of small-scale marketing firms. The results of the analysis provide industry stakeholders with a perspective on the competitive value chain and provide the basis for developing a competitive strategy. Value chain analysis in the value chain development process consists of five stages: value chain selection (stage 1), value chain analysis (stage 2), development of a competitive strategy (stage 3), design and implementation (stage 4), and monitoring and evaluating impacts (stage 5) [17].
6. The United Nations Industrial Development Organization Model for Value Chain Analysis
In recent years, the United Nations Industrial Development Organization has increased its efforts to put various value chain activities into convergent projects for value chain development. In 2006, a working group presented a paper entitled "Business Connectivity and Value Chains". This paper, emphasizing the importance of value added as a key concept in value chain analysis, distinguished between a producer-centric and a buyer-centric approach to managing global value chains. This paper concluded that value chain analysis is a promising tool for technical assistance and advisory services in the United Nations Industrial Development Organization, which can increase the efficiency of the organization with technical assistance by providing an integrated value chain framework [5].
7. Porter's Value Chain Model: Kramer and Porter defined the value chain as a representation of the value-added activities of the company based on its pricing strategy and cost structure. This model has 9 different parts, which are divided into two categories: primary and supporting activities [10]. One of the models used to evaluate and determine business areas in different organizations is the Porter Value Chain Model. In this model, important business areas in the firm are identified and classified. Although Kramer and Porter, initially proposed this model for manufacturing and competitive institutions and companies, the concepts proposed in this model can be used to categorize the tasks of organizations in different business areas.
8. Gabriel's Service Value Chain Model: Gabriel stated that although Porter's value chain is useful in all cases, due to the different services, another value chain should be designed. The form of the service value chain designed by Gabriel is similar to Porter's value chain, and its difference is in the components that make up the model.

The designed value chain has five main characteristics and four supporting characteristics. The use of the word characteristic is intentional because the components of the service value chain may not be activities [7].

2.2 Research background

Sahranvard et al. [19] in their article "Analysis of the Distribution of Sustainable Planning and Management Indicators Based on the Futures Research Approach in Industry" showed that the sustainable human resources planning and management model based on the futures research approach consists of four main dimensions including (input, organization, process, output) and 15 components and 53 indicators. These findings were obtained in three stages of expert questionnaires, the first-stage Delphi technique, and the second-stage Delphi technique. The results of the research indicate that in designing a sustainable human resources management model in the Iranian petrochemical industry based on the futures research approach, attention should be paid to the four dimensions of input, organization, process, and output of sustainable human resources management.

Qazvini et al. [15] in their article "Determining the Doctrine from the Mapping Between Organizational Values and Environmental Attitudes (Case Study: Determining the Doctrine for Petrochemical Industry Equipment Inspection)" showed that by describing the stages of developing the doctrine, a coherent and integrated framework for extracting the doctrine of organizational values and environmental attitudes in the field of inspection of machinery and equipment in the construction phase of petrochemical industries has been presented as follows: Strengthening company performance, inspecting equipment in the oil, gas and petrochemical industries, and economic growth along with creating opportunities, reducing inflation rates, unemployment and improving the process, must be achieved by using the localization of the inspection process and updating technology along with promoting the training of domestic specialists with full support for this industry and by observing ecological and environmental requirements.

Abdoli et al. [1] in their article "Validation of the Developed Model of the Petrochemical Industries Observatory at the Macro Level (Case Study: Persian Gulf Petrochemical Industries Company)" showed that the Petrochemical Industries Observatory model was presented in the form of 7 main concepts, 21 central concepts, and 127 propositions. The validity of the developed model was assessed, and in this regard, the dimensions and components of the observatory model are confirmed. The extracted dimensions and the importance coefficient of each of them were determined to include political issues (0.791), economic issues (0.952), environmental issues (0.596), social issues (0.402), technological issues (0.720), legal issues (0.842), and international issues (0.682). Accordingly, monitoring the identified dimensions and related components as input data and information leads to the acquisition and dissemination of more knowledge and wisdom in this area and helps company managers make better decisions and foresight.

Pan et al. [13] conducted a study entitled "Research on Petrochemical Supply Chain Risk Management Based on the Dynamic Network Evolution Model". In this study, in combination with the characteristics of the petrochemical supply chain network, a supply chain risk propagation model based on the cascade failure process is proposed, and a risk propagation simulation experiment is conducted to investigate different model parameters and different risk source companies on the connections. Process. According to the experimental results, this paper provides targeted preventive measures to achieve supply chain risk prevention and control, which has important guiding significance for the orderly operation of the petrochemical supply chain.

Shinkevich et al. [20] conducted a study titled "Computer-based analysis of energy and resource efficiency in the context of petrochemical supply chain transformation". The results of the study indicate that promising directions are identified for reducing energy-intensive production and improving energy-efficient supply chains of petrochemical products.

Ziyae et al. [23] in an article titled "Innovative Scenarios for Planning Petrochemical Enterprises in Iranian Society" acknowledged: Research studies in the field of futures have recently attracted significant attention to create a desirable future based on environmental changes. Futures studies seek to discover, invent, present, test, and evolve possible, feasible, and desirable futures. The findings show four scenarios in the petrochemical industry, including investment attraction, private sector presence, public capital attraction, and sustainable development of the petrochemical industry.

3 Research methodology

This research is applied in terms of purpose and is of a descriptive-analytical type. The research method is of a mixed type and was conducted in two qualitative and quantitative parts. With the sampling method in the qualitative part of the interview in a purposeful and snowball manner, 20 people in this research were invited to interview experts and university professors in the field of industrial engineering, project management and experienced executive

managers of Shastan. The qualitative part of the data collection tool is a semi-structured interview derived from theoretical foundations. The method of analysis of this part is using content analysis. In this quantitative part of the research, the statistical population selected is managers of the petrochemical industry. The sampling method is purposeful. In this part, according to the structural equations approach in the quantitative part, at least 200 samples are randomly examined. In this research, the statistical sample was 213 people. In this research, in the first stage, the data collection tool is a library method. In the second stage, when the research enters the field stage, interviews are used as a data collection tool, which is used to collect the required data according to the subject variables and the relationship between the research components. In the third stage, a researcher-made questionnaire with items based on statistical categories was developed from the questionnaire to collect the required data regarding the evaluation of the qualitative research model. The questionnaire consists of two main parts, the first part of which includes demographic variables (gender, age, educational degree, field) and the second part includes items related to the main subject of the research. In order to ensure the validity and reliability of the questionnaire and the internal consistency of the questions, the questionnaire was randomly administered to a preliminary sample of 20 experts from Shastan. After implementing and examining the Cronbach's alpha coefficients calculated using SPSS statistical software for the preliminary sample, the alpha value in all indicators was above 70 percent, so the reliability and trustworthiness of the instrument was confirmed, and since it is closer to one, it can be said that the questionnaire has high validity. To confirm the validity of the questionnaire, it was approved by professors and experts and was formally approved. Data analysis in the quantitative section was carried out using the structural equation approach.

The structural equation model is one of the new statistical methods and one of the most powerful multivariate analysis methods, and its main application is in multivariate subjects. Multivariate analysis refers to a series of analysis methods whose main feature is the simultaneous analysis of several independent variables with several dependent variables. Structural equations are from the multivariate regression family, which allows researchers to test a set of regression equations simultaneously.

$$n_t = \beta_1 + \beta_2 m_t + \beta_3 g_t + \varepsilon_{1t} \tag{3.1}$$

The model should be named according to the number of parameters of the model and the parameters should be entered into the model:

$$n_t = \beta_{11} + \beta_{12} m_t + \beta_{13} p_t + \varepsilon_{2t} \tag{3.2}$$

$$n_t = \frac{\{(\beta_1\beta_{13} - \beta_{11}\beta_3) + \beta_{13}\beta_2 g t^{-} \beta_3\beta_{12} m_t - \beta_3\beta_{14} n_{t-1} + (\beta_{13}\varepsilon_{1t} - \beta_3\varepsilon_{2t})\}}{\beta_{13} - \beta_3} \tag{3.3}$$

$$p_t = \frac{\{(\beta_1 - \beta_{11}) + \beta_2 g t^{-} \beta_{12}\beta_{12} m_t - \beta_{14} n_{t-1} + (\varepsilon_{1t} - \varepsilon_{2t})\}}{\beta_{13} - \beta_3} \tag{3.4}$$

$$(X) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt.$$
$$n = (n_1, n_2) \tag{3.5}$$

where:

$$n_1 = \left\lceil 50\left(\frac{j}{k}\right)^2 - 450\left(\frac{j}{k}\right) + 1100 \right\rceil$$
$$n_2 = \left\lceil \frac{2}{2H}\left(A\left(\frac{\pi}{6} - B + D\right) + H + \sqrt{\left(A\left(\frac{\pi}{6} - B + D\right) + H\right)^2 + 4AH\left(\frac{\pi}{6} + \sqrt{A} + 2B - C - 2D\right)}\right) \right. \tag{3.6}$$

where:

$$A = 1 - p^2$$
$$B = parcsin\left(\frac{p}{2}\right)$$
$$C = parcsin(p)$$
$$D = \left(\frac{\delta}{z_1 - \alpha/2 - z_1 - \beta}\right)^2$$

where j is the number of observed variables, k is the number of latent variables, ρ is the estimated Gini correlation for a normal random vector of variables, δ is the predicted effect size, α is the corrected type I error rate, β is the type II error rate, and z is a standard score.

$$F(x\mu\sigma^2) = \frac{1}{2}\left[1 + erf\left(\frac{x-\mu}{\sigma\sqrt{2}}\right)\right] \tag{3.7}$$

where μ is the mean, σ is the standard deviation, and erf is the error function. Now, the same steps can be done using the software.

- Goodness of model fit tests

  As their name suggests, goodness-of-fit tests are used to determine whether a particular distribution is well-fitted. Calculating goodness-of-fit statistics also helps to rank the fitted distributions according to how well they fit the data.

- The first index- RMESA

$$RMESA = \frac{\sqrt{(\chi^2 - df)}}{\sqrt{[df(N-1)]}} \tag{3.8}$$

- The second index- GFI

$$GFI = 1 - \frac{F(S, \sum(\theta))}{F(S, \sum(\cdot))} \tag{3.9}$$

- The third index – AGFI

$$AGFI = 1 - \frac{k(k+1)}{2d}(1 - GFI) \tag{3.10}$$

4 Research findings

4.1 Qualitative section

In this section, the interviewees are classified based on their level of education, work experience, and gender, and the frequency of each category is displayed along with its percentage. Based on the experts' demographics, most interviewees are male (85%) and the lowest percentage is female (15%). Also, according to the work experience of 5-10 years, 5%, 35%, 11-20 years, and 60% of 20 years and above, and based on education, 35% are bachelor's degree holders, 15% are doctorate holders, and 50% are master's degree holders.

4.1.1 Presentation of the network of themes

In this stage of the research, the concepts and key points obtained regarding the presentation of a structural model influenced by the presentation of a model for analyzing the status and strategic position of the petrochemical industry value chain in Shastan Commercial Investment Company were listed from within the interview process. For this purpose, the phrases, concepts, and items extracted from the interviews were harmonized (choosing more correct words, eliminating common concepts) with detailed analysis, and 368 items were obtained in this section. The themes obtained were arranged in the form of a checklist for conducting interviews, and some of the items obtained were removed and modified by conducting interviews with experts.

In the second stage, the identified themes were divided into eight main categories, including basic, organizing, and comprehensive themes, according to the table below. Unrelated themes were removed and some related themes were merged, and finally 47 basic themes were finalized.

In the third stage, the method of data analysis and extraction of basic, organizing and overarching themes from the raw data obtained from the interviews is shown in the table above. After the interviews were conducted, quotes that explicitly or implicitly addressed the research questions were selected, and then basic, organizing and overarching themes were extracted from them. The theme network consists of 47 basic themes that are arranged in the form of eight main organizing themes that were clear from the beginning.

Table 1: Presentation of themes

Comprehensive Category	Organizing Category	Basic category
Analysis Model of the Strategic Position and Status of the Petrochemical Industry Value Chain in Shastan Commercial Investment Company	Strategic Factors and Variables of the Value Chain of Shastan Holding Currently	Market and competitor analysis
		Human resource management
		Research and development
		Supply chain management
		Marketing and sales
		Financial management
	Strategic Factors and Variables of the Value Chain in the Petrochemical Industry	Raw material supply
		Production processes
		Research and development
		Marketing and sales
		Supply chain management
		Human resources
		Financial management
		Compliance with regulations and laws
		Risk management
		Sustainability and social responsibility
		Strategic planning model in the petrochemical industry
	Strategic Factors and Variables of the Value Chain in the Petrochemical Market Currently	Raw material supply
		Production processes
		Research and development
		Marketing and sales
		Supply chain management and logistics
		Human resources
		Financial management
		Laws and regulations
		Sustainability and social responsibility
	Value Chain of All Loops Within the System in the Future of Shastan	Porter's five forces (1. Intensity of competition between existing companies 2. Threat of new companies 17 3. Bargaining power of suppliers 4. Bargaining power of customers 5. Threat of substitute products).
		Porter's Diamond Model (1. Internal factors 2. Demand conditions 3. Supporting and related industries 4. Strategy, structure and competition)
	Drivers of the Petrochemical Industry Value Chain Model in the Future of Shastan	Technology and innovation
		Market and demand
		Human resources and management
		Environment and sustainability
		Infrastructure and logistics
	Requirements (Strategies) of the Petrochemical Industry Value Chain Model in the Future of Shastan	Technology development and innovation
		Product and market diversity
		Human resource management
		Sustainability and social responsibility
		Improvement of infrastructure and logistics
		Economy and finance
		Laws and regulations
		Stakeholder relations
	Consequences of the Petrochemical Industry Value Chain Model in the Future of Shastan	Economic consequences
		Social consequences
		Environmental consequences
		Technological consequences
	Factors Affecting the Value Chain of All Loops Within the System in the Interactive Environment and the Operational Environment in the Future of Shastan	Interactive environment factors
		Operational environment factors

4.1.2 Confirmatory factor analysis of data

First, to enter the structural equations, the research instruments must be subjected to confirmatory analysis to determine the validity of the construct. Confirmatory factor analysis was used to confirm each of the variables and the items related to each of them.

1. Confirmatory factor analysis of the variables of the first category (strategic factors and variables of the current value chain of Shastan Holding)
   Confirmatory factor analysis was used to determine the validity of the variables of the first category. The output of the IMOS software shows that all factor loadings are higher than 0.6. According to the IMOS output, the

calculated χ^2/df value is 1.73, and the presence of χ^2/df less than 5 indicates a proper fit of the model. Also, the root mean square error of approximation (RMSEA) should be less than 0.08, which in the presented model is 0.045. The amount of GFI, AGFI, CFI and NFI indices should also be greater than 0.9, which in the model under study is higher than the determined amount, respectively. Therefore, the data of this study fit well with the factor structure of this scale, which indicates the alignment of the questions with the variables of the first category.

Table 2: Fit indices of the variables of the first category

Indexes	**Index name**	**Abbreviation**	**Acceptable fit**	**Research Index Value**
Absolute fit	Degrees of freedom	DF	–	212
	Significance level	P	Less than 0.05	0.000
	Ratio of chi-square to degrees of freedom	CMIN/DF	Between 1 and 5	1.73
	Chi-square coverage area	Chi-Square	Greater than 5%	0.4
	Goodness of fit	CFI	Greater than 0.9	0.934
	Adjusted goodness of fit	AGFI	Greater than 0.9	0.940
Comparative fit	Non-normalized fit	NNFI	Greater than 0.9	0.92
	Normalized fit	NFI	Close to 1	0.93
	Adaptive fit	CFI	Greater than 0.9	0.934
	Relative fit	RFI	Greater than 5.0	0.64
	Incremental fit	IFI	0-1	0.6
Private fit	Normalized parsimonious fit	PNFI	Greater than 0.5	0.75
	Normalized parsimonious fit	PGFI	Greater than 0.5	0.911
	Root mean square error of estimation	RMSEA	Less than 1.0	0.045
	Normalized chi-square	CMIN	Some bin 1 to 3	2.2

2. Confirmatory factor analysis of the variables of the second category (strategic factors and variables of the value chain in the petrochemical industry)
   Confirmatory factor analysis was used to determine the validity of the second category. All factor loadings are higher than 0.6. According to the Amos output in Table 3, the calculated χ^2/df value is 1.58, the presence of χ^2/df less than 5 indicates a proper fit of the model. Also, the root mean square error of approximation (RMSEA) should be less than 0.08, which in the presented model is 0.055. The amount of GFI, AGFI, CFI and NFI indices should also be more than 0.9, which in the model under study are higher than the determined amount, respectively. Therefore, the data of this study have a proper fit with the factor structure of this scale, and this indicates the alignment of the questions with the variables of the second category.

Table 3: Fit indices of the second category

Indexes	**Index name**	**Abbreviation**	**Acceptable fit**	**Research Index Value**
Absolute fit	Degrees of freedom	DF	–	212
	Significance level	P	Less than 0.05	0.000
	Ratio of chi-square to degrees of freedom	CMIN/DF	Between 1 and 5	1.58
	Chi-square coverage area	Chi-Square	Greater than 5%	0.39
	Goodness of fit	CFI	Greater than 0.9	0.981
	Adjusted goodness of fit	AGFI	Greater than 0.9	0.941
Comparative fit	Non-normalized fit	NNFI	Greater than 0.9	0.9
	Normalized fit	NFI	Close to 1	0.92
	Adaptive fit	CFI	Greater than 0.9	0.981
	Relative fit	RFI	Greater than 5.0	0.58
	Incremental fit	IFI	0-1	0.74
Private fit	Normalized parsimonious fit	PNFI	Greater than 0.5	0.9
	Normalized parsimonious fit	PGFI	Greater than 0.5	0.941
	Root mean square error of estimation	RMSEA	Less than 1.0	0.055
	Normalized chi-square	CMIN	Some bin 1 to 3	1.8

3. Confirmatory factor analysis of the third category variables (factors and strategic variables of the value chain in the current petrochemical market)
   The numbers on the paths are factor loadings. All factor loadings are higher than 0.6. According to the Amos output in Table 4, the calculated χ^2/df value is 2.96, the presence of χ^2/df less than 5 indicates a good fit of the model. Also, the root mean square error of approximation (RMSEA) should be less than 0.08, which in the presented model is 0.069. The GFI, AGFI, CFI and NFI indices should also be more than 0.9, which in the model under study are higher than the determined values, respectively. Therefore, the data of this study have a good fit with the factor structure of this scale, and this indicates the alignment of the questions with the variables of the third category.

Table 4: Fit indices of the third category variables

Indexes	Index name	Abbreviation	Acceptable fit	Research Index Value
Absolute fit	Degrees of freedom	DF	–	212
	Significance level	P	Less than 0.05	0.000
	Ratio of chi-square to degrees of freedom	CMIN/DF	Between 1 and 5	2.96
	Chi-square coverage area	Chi-Square	Greater than 5%	0.14
	Goodness of fit	CFI	Greater than 0.9	0.955
	Adjusted goodness of fit	AGFI	Greater than 0.9	0.941
Comparative fit	Non-normalized fit	NNFI	Greater than 0.9	0.9
	Normalized fit	NFI	Close to 1	0.99
	Adaptive fit	CFI	Greater than 0.9	0.955
	Relative fit	RFI	Greater than 5.0	0.64
	Incremental fit	IFI	0-1	0.59
Private fit	Normalized parsimonious fit	PNFI	Greater than 0.5	0.99
	Normalized parsimonious fit	PGFI	Greater than 0.5	0.901
	Root mean square error of estimation	RMSEA	Less than 1.0	0.069
	Normalized chi-square	CMIN	Some bin 1 to 3	1.9

4. Confirmatory factor analysis of the fourth category (the chain of values of all links within the system in the future of Shastan)
   Confirmatory factor analysis was used to determine the validity of the fourth category. The numbers on the paths are factor loadings. All factor loadings are higher than 0.6. The findings related to the fit indices of the interfering factors in Table 5 indicate that the CFI, GFI, NFI, RMR and RMSEA indices have an acceptable level and these goodness of fit characteristics indicate that the data of this study have a good fit with the factor structure of this scale and this indicates the alignment of the questions with the structure of the fourth category.

Table 5: Fit indices of the fourth category

Indexes	Index name	Abbreviation	Acceptable fit	Research Index Value
Absolute fit	Degrees of freedom	DF	–	212
	Significance level	P	Less than 0.05	0.000
	Ratio of chi-square to degrees of freedom	CMIN/DF	Between 1 and 5	1.91
	Chi-square coverage area	Chi-Square	Greater than 5%	0.46
	Goodness of fit	CFI	Greater than 0.9	0.930
	Adjusted goodness of fit	AGFI	Greater than 0.9	0.947
Comparative fit	Non-normalized fit	NNFI	Greater than 0.9	0.94
	Normalized fit	NFI	Close to 1	0.933
	Adaptive fit	CFI	Greater than 0.9	0.918
	Relative fit	RFI	Greater than 5.0	0.74
	Incremental fit	IFI	0-1	0.62
Private fit	Normalized parsimonious fit	PNFI	Greater than 0.5	0.96
	Normalized parsimonious fit	PGFI	Greater than 0.5	0.930
	Root mean square error of estimation	RMSEA	Less than 1.0	0.71
	Normalized chi-square	CMIN	Some bin 1 to 3	2.3

5. Confirmatory factor analysis of the fifth category (Drivers of the petrochemical industry value chain model in the future of Shastan): Confirmatory factor analysis was used to determine the validity of the fifth category. All factor loadings are higher than 0.6. The findings related to the outcome fit indices in Table 6 indicate that the CFI, GFI, NFI, RMR and RMSEA indices have an acceptable level and these goodness of fit characteristics indicate that the data of this study have a good fit with the factor structure of this scale and this indicates the alignment of the questions with the structures of the fifth category.
6. Confirmatory factor analysis of the sixth category (strategies of the petrochemical industry value chain model in the future of Shastan): Confirmatory factor analysis was used to determine the validity of the sixth category. All factor loadings are higher than 0.6. The findings related to the fit indices of the axial factors in Table 7 indicate that the CFI, GFI, NFI, RMR and RMSEA indices have an acceptable level and these goodness of fit characteristics indicate that the data of this study have a good fit with the factor structure of this scale and this indicates the alignment of the questions with the structures of the sixth category.
7. Confirmatory factor analysis of the seventh category (consequences of the petrochemical industry value chain model in the future of Shastan): Confirmatory factor analysis was used to determine the validity of the seventh category. All factor loadings are higher than 0.6. The findings related to the outcome fit indices in Table 8 indicate that the CFI, GFI, NFI, RMR and RMSEA indices have an acceptable level and these goodness of fit characteristics show that the data of this study have a good fit with the factor structure of this scale and this indicates the alignment of the questions with the structures of the seventh category.

Table 6: Fit indices of the fifth category

Indexes	Index name	Abbreviation	Acceptable fit	Research Index Value
Absolute fit	Degrees of freedom	DF	–	212
	Significance level	P	Less than 0.05	0.000
	Ratio of chi-square to degrees of freedom	CMIN/DF	Between 1 and 5	1.91
	Chi-square coverage area	Chi-Square	Greater than 5%	0.13
	Goodness of fit	CFI	Greater than 0.9	0.918
	Adjusted goodness of fit	AGFI	Greater than 0.9	0.947
Comparative fit	Non-normalized fit	NNFI	Greater than 0.9	0.91
	Normalized fit	NFI	Close to 1	0.933
	Adaptive fit	CFI	Greater than 0.9	0.918
	Relative fit	RFI	Greater than 5.0	0.59
	Incremental fit	IFI	0-1	0.61
Private fit	Normalized parsimonious fit	PNFI	Greater than 0.5	0.96
	Normalized parsimonious fit	PGFI	Greater than 0.5	0.930
	Root mean square error of estimation	RMSEA	Less than 1.0	0.071
	Normalized chi-square	CMIN	Some bin 1 to 3	2.5

Table 7: Fit indices of the sixth category model

Indexes	Index name	Abbreviation	Acceptable fit	Research Index Value
Absolute fit	Degrees of freedom	DF	–	212
	Significance level	P	Less than 0.05	0.000
	Ratio of chi-square to degrees of freedom	CMIN/DF	Between 1 and 5	2.58
	Chi-square coverage area	Chi-Square	Greater than 5%	0.13
	Goodness of fit	CFI	Greater than 0.9	0.989
	Adjusted goodness of fit	AGFI	Greater than 0.9	0.912
Comparative fit	Non-normalized fit	NNFI	Greater than 0.9	0.92
	Normalized fit	NFI	Close to 1	0.935
	Adaptive fit	CFI	Greater than 0.9	0.901
	Relative fit	RFI	Greater than 5.0	0.69
	Incremental fit	IFI	0-1	0.65
Private fit	Normalized parsimonious fit	PNFI	Greater than 0.5	0.94
	Normalized parsimonious fit	PGFI	Greater than 0.5	0.989
	Root mean square error of estimation	RMSEA	Less than 1.0	0.07
	Normalized chi-square	CMIN	Some bin 1 to 3	2.1

Table 8: Fit indices of the seventh category

Indexes	Index name	Abbreviation	Acceptable fit	Research Index Value
Absolute fit	Degrees of freedom	DF	–	212
	Significance level	P	Less than 0.05	0.000
	Ratio of chi-square to degrees of freedom	CMIN/DF	Between 1 and 5	2.5
	Chi-square coverage area	Chi-Square	Greater than 5%	0.24
	Goodness of fit	CFI	Greater than 0.9	0.919
	Adjusted goodness of fit	AGFI	Greater than 0.9	0.950
Comparative fit	Non-normalized fit	NNFI	Greater than 0.9	0.921
	Normalized fit	NFI	Close to 1	0.949
	Adaptive fit	CFI	Greater than 0.9	0.915
	Relative fit	RFI	Greater than 5.0	0.61
	Incremental fit	IFI	0-1	0.75
Private fit	Normalized parsimonious fit	PNFI	Greater than 0.5	0.85
	Normalized parsimonious fit	PGFI	Greater than 0.5	0.69
	Root mean square error of estimation	RMSEA	Less than 1.0	0.036
	Normalized chi-square	CMIN	Some bin 1 to 3	1.7

8. Confirmatory factor analysis of the eighth category (value chain of all intrasystem links in the interactive environment and operational environment in the future of Shastan)
Confirmatory factor analysis method was used to determine the validity of the eighth category. All factor loadings are higher than 0.6. The findings related to the fit indices of the axial factors in Table 9 indicate that the CFI, GFI, NFI, RMR and RMSEA indices have an acceptable level and these goodness of fit characteristics show that the data of this study have a good fit with the factor structure of this scale and this indicates the alignment of the questions with the constructs of the eighth category.

Table 9: Fit indices of the eighth category model

Indexes	Index name	Abbreviation	Acceptable fit	Research Index Value
Absolute fit	Degrees of freedom	DF	–	212
	Significance level	P	Less than 0.05	0.002
	Ratio of chi-square to degrees of freedom	CMIN/DF	Between 1 and 5	3.4
	Chi-square coverage area	Chi-Square	Greater than 5%	0.26
	Goodness of fit	CFI	Greater than 0.9	0.911
	Adjusted goodness of fit	AGFI	Greater than 0.9	0.969
Comparative fit	Non-normalized fit	NNFI	Greater than 0.9	0.41
	Normalized fit	NFI	Close to 1	0.961
	Adaptive fit	CFI	Greater than 0.9	0.936
	Relative fit	RFI	Greater than 5.0	0.79
	Incremental fit	IFI	0-1	0.69
Private fit	Normalized parsimonious fit	PNFI	Greater than 0.5	0.85
	Normalized parsimonious fit	PGFI	Greater than 0.5	0.79
	Root mean square error of estimation	RMSEA	Less than 1.0	0.02
	Normalized chi-square	CMIN	Some bin 1 to 3	1.9

4.2 Model analysis and examination of the fit of the proposed research model

Regarding the level of significant coefficients, since in order to reject or confirm the relationships, the CR value (critical ratio) must be greater than 1.96 or less than -1.96, the parameter value between the two domains in the model is not considered important, and the values between these two values indicate that there is no significant difference. The calculated value for the regression weights has a value of zero at the 95 percent level. The results of the model test are presented in Table 10.

Table 10: Results of implementing the structural model of the analysis model of the strategic position and status of the petrochemical industry value chain in Shastan Commercial Investment Company ($^*P \leq 0.05$)

Relationships	Standard estimate	Standard error	Critical ratio	P-value
Category One → Model for analyzing the status and strategic position of the petrochemical industry value chain in Shastan Commercial Investment Company	0.420	0.056	4.018	0.000*
Category Two → Model for analyzing the status and strategic position of the petrochemical industry value chain in Shastan Commercial Investment Company	0.26	0.077	2.798	0.010*
Category Three → Model for analyzing the status and strategic position of the petrochemical industry value chain in Shastan Commercial Investment Company	0.68	0.045	3.813	0.000*
Category Four → Model for analyzing the status and strategic position of the petrochemical industry value chain in Shastan Commercial Investment Company	0.44	0.042	2.958	0.000*
Category Five → Model for analyzing the status and strategic position of the petrochemical industry value chain in Shastan Commercial Investment Company	0.11	0.033	2.362	0.000*
Category Six → Model for analyzing the status and strategic position of the petrochemical industry value chain in Shastan Commercial Investment Company	0.23	0.041	4.113	0.000*
Category Seven → Model for analyzing the status and strategic position of the petrochemical industry value chain in Shastan Commercial Investment Company	0.31	0.045	6.69	0.000*
Category Eight → Model for analyzing the status and strategic position of the petrochemical industry value chain in Shastan Commercial Investment Company	0.26	0.044	12.45	0.000*

Accordingly, the research model was finally evaluated using Amos software and, as can be seen, all relationships are confirmed at a 95% confidence level, considering the value of the path coefficients. The pattern related to causal relationships in the model of analyzing the strategic position and status of the petrochemical industry value chain in Shastan Commercial Investment Company is presented in the table above. Based on the results obtained, the first to eighth categories were influential in the final research model.

5 Conclusion

The present research was conducted in two qualitative and quantitative sections, and the results of the present research include 47 organizing themes that have been arranged in the form of eight main overarching themes that were

clear from the beginning. In the quantitative section, the internal relationships between the structures were examined and confirmed, and the qualitative model was validated with conventional methods.

It is worth noting that the existence of huge potential and reserves of oil and gas in the beloved land of Iran has led to the study and extraction of these reserves for the past several hundred years in order to use these resources as a major part of the country's foreign exchange earnings. In this regard, Iran's natural gas reserves, which exceed 1,200 trillion cubic feet (33 trillion cubic meters) and are the second country in the world in this regard with a 17% global share allocated to it, are also of particular importance. The plan to develop fields and extract natural gas, especially with a priority for shared fields, has always been at the forefront of all internal policies of the system, the government, and of course the Ministry of Oil and all investors. Certainly, what will maximize the value of this divine blessing will be the completion of the value chain from the extraction stage to conversion to downstream industries for use in industry and production.

In this regard, and based on the announced policies, preventing raw sales has led to the necessary measures to develop this principle being put on the agenda, but considering the policies governing the country and international relations, doing this has faced challenges, and in the present study, we have sought to respond to these challenges. To achieve this, strategies and requirements have been needed that allow for the complete implementation, from the extraction stages to the completion of the value chain, the main issues of which are having technical knowledge (technology and licenses) to carry out the issue along with appropriate equipment in the field of machinery and tools required and skilled manpower along with the necessary resources (financial) to carry it out. Unfortunately, we have also been stuck due to cruel sanctions from countries with knowledge and technology. Naturally, the existence of strategic and rich oil and gas reserves, as the most important item in this area that is necessary for any action, is considered one of Iran's main assets. On the other hand, the sanctions and the problems that have arisen, despite all the obstacles and problems mentioned, have been considered an opportunity that comes from these sanctions. However, this issue requires special attention to key points and analysis that, with careful consideration and timely action, can strengthen and benefit from the possibility and ultimately create the conditions for exiting the sanctions. Considering the challenges raised, in order to achieve a higher level of the value chain in the petrochemical industry, the following suggestions are made:

- Paying attention to the private sector and using domestic power, since the distant past, the issue of investment in this industry has always been on the agenda of the government sector and in a way, the National Petrochemical Company (NPC) has been responsible for all responsibilities. Over time, and based on the policies of the Fifth and Sixth Economic Development Plans and also advancing Article 44 of the Constitution on the implementation of the privatization policy, domestic investors and those working in various industries have also entered the petrochemical sector, and today we are witnessing the presence of many of these sectors in this industry.
- Using reliable and strategic countries and business partners to advance goals and support trade and investment transactions, subject to observing 30 national interests and investor interests in a fair and beneficial manner, such as China.
- Implementing policies related to the value chain in advanced countries in the discussion of technological breakthroughs.
- Soft development through the establishment of relevant incentives and supports to guide investment.
- Planning the petrochemical value chain based on market, industry and transnational studies.
- Possibility of participation of foreign companies in the construction and operation of petrochemical units.
- Creating the potential for implementing investment projects within the Shastan complex instead of outsourcing or partnering or purchasing shares of projects.
- Providing appropriate financial resources and obtaining assistance from the National Development Fund to complete projects and remove some organizational constraints and shorten bureaucratic administrative paths.

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