

Islamic Republic of Iran
Organization for investment economic and technical assistance of Iran

"Summary of technical-economical prefeasible study"

The name:

Fero-silicomanganese Production

Sector: Industrial, Mineral & Metal Industries Sub sector: Pig Iron and Steel
isic code: 2710412302

The owner of:

Industry, Mine and Trade

Counselor plan:

Razi University

The Address:

Kermanshah, Iran.

Date of P.F.S:

2024/10/22

Manager of Iran Investment Opportunities
SHAHRIG Engineering Company

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1- Abstract:

PROJECT PROFILE - SUMMARY SHEET

Project Introduction	
1- Project title: Fero-silicomanganese Production	
2- Sector: Industrial, Mineral & Metal Industries	Sub sector: Pig Iron and Steel
3- Products / Services: The project's target product falls under the basic metal industries (ISIC code 27), specifically the iron and steel basic industries (ISIC code 2710), and is classified as silicomanganese (HS code 2710412302).	
4- location (address): Ravansar Industrial Estate, Ravansar County, Kermanshah Province Free Zone <input type="checkbox"/> Economic Special Zone <input type="checkbox"/> Industrial Estate <input checked="" type="checkbox"/> Main Land <input type="checkbox"/>	

5- Project description:

This project is designed with an annual capacity of 50,000 tons and will commence construction and obtain an operational license upon acquiring the necessary permits. Subsequently, the project will commence operations, generating sufficient revenue from the sale of ferrosilicon manganese to cover its operational costs and yield an annual profit.

According to existing standards, a 50,000-ton ferrosilicon manganese production facility requires a land area of 10,000 square meters. Out of this, 4,500 square meters will be used for covered spaces, 4,500 square meters for uncovered areas, and the remaining area for the industrial unit's open space. The project is planned on a 10,000 square meter land plot, with the excess land allocated to green spaces and open areas.

The necessary power and transformer for this complex have been allocated and will be supplied from the Ravansar Industrial Estate. Water supply for the complex will be sourced from the Ravansar Industrial Estates. The internal piping within the factory buildings and other areas will be carried out by a qualified contractor.

The required equipment and machinery for the project include: vibrating feeder, jaw crusher, conveyor belt, vibrating screen, hammer mill, and electric arc furnace.

The primary raw materials and intermediate components include manganese ore, silicon, coke, and sponge iron.

A total of 60 skilled workers, 84 unskilled workers, and 122 technical personnel will be directly employed for this project.

Project Status

6- Local / internal raw material access: 100%

7- Sale:

- Anticipated local market: 50%

- Anticipated export market: 50%

8 – Project total time (from start of activities to start of commercial operation in years):

22 months and 20 years for implementation and operation

Schedule

Start of activities:

Start of works at site

End of Works:

Start of commercial operation:

9- Project status :

- Feasibility study available? Yes
- Required land provided? Yes
- Legal permissions (establishment license, foreign currency quota, environment, etc) taken? No
- Partnership agreement concluding with local /foreign investor? No
- Financing agreement concluding? No
- Agreement with local /foreign contractor(s) concluding? No
- Infrastructural utilities (electricity water supply, telecommunication, fuel, road, etc) procured? Yes
- List of know- how, machinery, equipment, as well as seller /builder companies defined? Yes
- Purchases agreement machinery, equipment and know-how concluded? No

Financial Table**10- Financial structure :**

Descriptions	Local Currency Required			Foreign Currency Required Million Euro	Total Million Euro
	Million Rials	Rate	Equivalent in Million Euro		
Fix Capital	20946150	600	13.7	21.2	34.9
Current Capital	4634500	600	7.7	0	7.7
Total Investment	25580650	600	21.4	21.2	42.6

- Value of foreign equipment / machinery 21.2 Million Euro
- Value of local equipment / machinery 0.7 Million Euro
- Value of foreign technical know-how..... Million Euro
- Value of local technical know-how..... Million Euro
- Net present value (NPV): 21.6 Million Euro
- Internal Rate of Return (IRR): 36 %
- Capital Rate of Return: 38.4 %
- Payback Period 4 years and 4 months

General Information**11 - Project type : Establishment ■****Expansion and completion □****12- Company Profile**

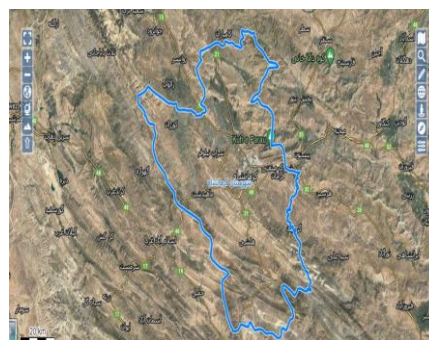
- Name (Legal/Natural persons): 1. Dr. Nader Naderi 2. Dr. Somayeh Azami
- Company's current activities: Razi University
- Address: Razi University, Taq-e Bostan, Kermanshah, Iran.
- Tel: +988334277605-6 Fax: +988334277605-6
- E-mail: info@razi.ac.ir Web Site: <https://en.razi.ac.ir>
- Company's legal structure :
- Government ■ Non-Governmental □ Public non-governmental □

2- Plan Location:

2-1. Province:

Kermanshah Province, spanning 25,009 square kilometers and centered around the city of Kermanshah, ranks as Iran's 17th largest province. Situated in western Iran, it lies between latitudes $33^{\circ}40'$ to $35^{\circ}18'$ N and longitudes $45^{\circ}24'$ to $48^{\circ}7'$ E. It borders Kurdistan Province to the north, Lorestan and Ilam Provinces to the south, Hamadan Province to the east, and shares a 371-kilometer border with Iraq to the west. The average elevation is approximately 1,200 meters above sea level. Kermanshah Province covers 1.5% of Iran's total area. According to current administrative divisions, Kermanshah includes 14 counties, 31 cities, 86 rural districts, and 2,793 inhabited villages. The 2016 Census by Iran's Statistical Center recorded a population of 1,952,434, with a density of 78 people per square kilometer across 25,009 square kilometers. The largest city, Kermanshah, serves as the provincial capital with a population of 946,651. In terms of road infrastructure, Kermanshah ranks 11th nationwide in total road length (excluding rural roads), 17th in highway and freeway length per 1,000 kilometers, and 18th in main roads. The city of Kermanshah holds the highest proportion of roadways due to its substantial area within the province.

Map Showing the Location of Province in Iran



With its extensive network of intercity and rural roads, Kermanshah Province is well-positioned to undertake ambitious road development projects, aiming to upgrade a significant portion of its road network to expressway standards. With six official border crossings (Khosravi, Parviz Khan, Sumar, Shushmi, Sheikh Saleh, and Tileh Koh) and substantial tourism potential, Kermanshah Province is well-positioned to significantly contribute to the country's foreign exchange revenue and national income. A key strategy to realize this potential is to invest in the development of its road infrastructure and transportation fleet. The Kermanshah International Airport is currently one of Iran's leading airports by flight volume, and the planned railway plan will link it to the international Khosravi border and Iraq.

Kermanshah is predominantly mountainous, with 70.8% of its area classified as mountainous terrain. The remaining 22.1% consists of plains, while 7.1% is categorized as foothills. In terms of altitudinal classification, 76.5% of the province is situated within the 1000-2200 meter elevation range, with the 1400-1800 meter band being the most prevalent. If we divide Kermanshah Province into two primary elevation categories—below and above 1400 meters—approximately 58.2% of the province's area falls within the higher elevation

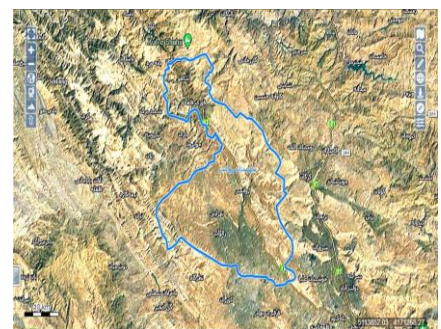
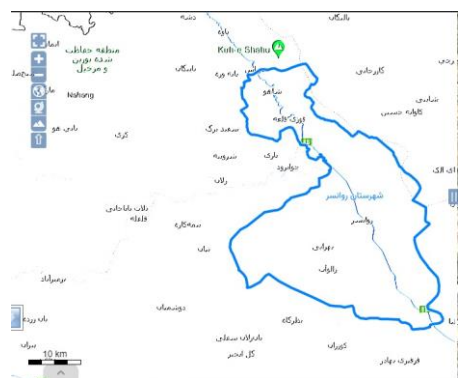
category, while the remaining 41.8% is at elevations below 1400 meters. Therefore, in addition to being a mountainous region, Kermanshah Province also has significant elevations. Kermanshah Province has a temperate mountainous climate. In the 4th century AD, this province, which was a pleasant village at the time, was chosen as the second royal residence of the Sassanian Empire. Extensive gardens were built in this area during the Sassanian period, providing a serene retreat for Sassanian monarchs for centuries. Throughout the Islamic period, Kermanshah was renowned for its pleasant climate, flowing waters, lush vegetation, and affordable goods. Writing in 290 AH, the geographer Ibn Faqih describes Kermanshah in his work 'Al-Buldan':

"From Madain to the Balkh River, Qabad traversed vast lands, yet nowhere did he find a region as enchanting as Kermanshah and the Hamdan-Asadabad pass. The purity of its air, the sweetness of its water, and the delight of its breeze compelled him to construct Qarmasin." Kermanshah experiences a maximum of 2999 hours of sunshine annually, with the highest solar radiation occurring in July and August, and the lowest in December and January. The climatic and ecological conditions of Kermanshah, characterized by moderate annual rainfall and relative humidity,

give rise to a landscape predominantly covered in forests and pastures. The region also features arable lands that are both irrigated and rain-fed. The annual average temperature in Kermanshah Province is approximately 14 degrees Celsius, and the average annual precipitation is 456.8 millimeters.

The primary inhabitants of Kermanshah are Kurds. Kermanshah Province is the ancestral homeland of numerous prominent Kurdish tribes, including the Zangeneh, Kalehor, Guran, Jaaf, Sanjabi, Qalakhany, Kelyayi, Bajlan, Zoleh, Jamir, as well as Laki tribes such as Jalalvand, Kakavand, Osmanvand, Payravand, and Balavand. Despite the official classification of Laks as a Kurdish subgroup, Kermanshah exhibits linguistic diversity, with Turkish-speaking communities, particularly the Sonqori Turks, residing alongside the Kilyayi Kurds in the city of Sanqor and Kelyai. The Sanqori dialect is a variety of Azerbaijani Turkish that is often described as a transitional form between Azerbaijani Turkish and Khorasan Turkish. Additionally, a community of Lors resides in Kangavar County, speaking the Luri-e-Salasi dialect. Over the past two centuries, migrants from other provinces, particularly Hamadan, Markazi, Isfahan, and Semnan, have settled in Kermanshah. Some non-Kurdish families, such as the Al-Aqa, Nojumi, Meybodi,

Map Showing the Location of the County in Kermanshah



Feyz Mahdavi, Shahrastani, Soduqi, Muhammadi Eraghi, Kazazi, Jaberi, and Dezfuli families, migrated to Kermanshah due to religious motivations to promote Shia Islam. These migrations have contributed to the distinctive Kermanshahi Persian dialect.

2-2. County:

Ravansar County is situated in the northwestern part of the province. As the gateway to the Oraman region, this county is geographically bounded by Kamyaran County in Kurdistan Province to the north, Kermanshah County to the east, Paveh County to the northwest, Kermanshah and Dalahu Counties to the south, and Javanrud and Salas-e Babajani Counties to the west.

Ravansar County, with the city of Ravansar as its administrative center, is located at an average elevation of 1,360 meters above sea level and covers an area of 1,140 square kilometers. Its geographical coordinates are approximately 46°40' longitude and 34°43' latitude, placing it in the northwestern part of Kermanshah Province, about 60 kilometers from the provincial capital. The county lies at the foothills of Mount Shahho, which significantly influences its topography and climate. Ravansar is located in a foothill region, situated at the base of the northern Zagros mountain range. To the north, Yelevar Mountain rises to an altitude

of 2000 meters. Three kilometers southeast of Yelevar, Mah Zard Mountain reaches a height of 2100 meters. The county is further characterized by the mountains of Anjireh, Taque Sefid, Chal Abad Shor, and Taque Chrami, which are the sources of various rivers and contribute to the region's cool and humid climatic conditions. The region experiences a mean annual precipitation of 600 millimeters. The region's botanical composition features wild pistachio, wild almond, wild fig, hawthorn, wild pear, mulberry, oak, and juniper.

2-3. Project Location:

Based on the initial phase of feasibility studies conducted in all counties of Kermanshah Province, there is potential for project implementation. Taking into account crucial factors such as raw material procurement, infrastructure, transportation accessibility, workforce availability, environmental aspects, government incentives, and competitive landscape, industrial parks in Ravansar have been identified as potential location for the plan. Ravansar Industrial Park is situated in Ravansar County, which is part of Kermanshah Province. The total area of the industrial park is 25 hectares, and the industrial area is 16 hectares. It is located 55 kilometers away from the provincial capital and just 5 kilometers from the nearest city.

Project Location Map



Ravansar Industrial Park



2-4. Infrastructure Accessibility:

Row	Required infrastructure	Distance to the Project	Infrastructure Supply Source
1	Water	0	Ravansar Industrial Estate
2	Electricity	0	Ravansar Industrial Estate
3	Gas	0	Ravansar Industrial Estate
4	Telecommunications	0	Ravansar Industrial Estate
5	Main Road	0	-
6	Secondary Road	0	-
7	Airport	70 km	-
8	Port	70 km	-
9	Railway Station	70 km	-

3- Plan Technical Specifications:

3-1- Product:

The plan's target product falls under the basic metal industries group (27), specifically the Pig Iron and Steel production subgroup (2710), and more precisely, Ferrosilicon Manganese (2710412302).

The plan's products are classified under the customs tariff subheading (7202), which pertains to "Iron alloys (ferro-alloys)", and are specifically under the subheading 72023000 for customs purposes.

(Product/Sample Image)



3-2. Plan Requirements:

3-2-1. Required Space and Infrastructure:

The project is designed to produce 50,000 tons of product annually. Once all the required permits are secured, construction will begin and, upon completion, an operating license will be issued. The facility will then be operational. The annual income derived from the sale of Ferrosilicon Manganese will be sufficient to cover all operational expenses and generate a yearly profit. Based on current standards, a Ferrosilicon Manganese production facility with an capacity of 50,000 tons necessitates a 10,000 square meter land parcel. This includes 4,500 square meters of built-up area, 4,500 square meters of open-air space, and the remaining area for the plant's outdoor facilities. A 10,000 square meter land parcel has been allocated for implementing the plan. Any remaining land will be used for green spaces and open areas. The facility has been provisioned with transformers and substations of the required capacity, and will be supplied with power from the Ravansar industrial park grid. Furthermore, the facility has received a sanctioned water allocation from the water supply networks of Ravansar industrial parks. Plumbing installation throughout the industrial complex, including the industrial sheds and various production units, will be executed by a qualified contractor, adhering to all relevant industry standards.

Plan Investment in Land, Site Development, and Buildings

Row	Description/Building Name	Specifications	Plan Capital Requirements		Total Cost (Million IRR)
			Quantity/Area Required	Unit Purchase/Construction Price (IRR)	
1	Land	7000 square meters of Ravansar Industrial Park land	10,000	15,000,000	150,000
2	Site Development	As per	10,000	2,990,000	29,900

	Operations	detailed specifications			
3	Construction	Warehouse	4000	117,475,000	469,900
		Administrative Building	250	180,000,000	45,000
		Other Buildings	250	180,000,000	45,000
Total			-	-	542,340

3-2-2. Equipment and Machinery:

Required Main Machinery and Equipment

Row	Description	Quantity	Unit Cost (IRR)	Total Cost (Million IRR)
1	Vibrating Feeder	1	67,220	67,220
2	Jaw Crusher	2	44,540	89,080
3	Conveyor Belt	2	26,750	53,500
4	Vibrating Screen	2	58,000	116,000
5	Hammer Mill	3	15,000	45,000
6	Electric Arc Furnace	3	4,250,000	12,750,000
Total				13,120,800

Ancillary Machinery and Equipment

Row	Items	Description	Total Cost (Million IRR)
1	Power Supply	5 MW power branch and the cost of purchasing panels and other related equipment, and cabling	50,000
2	Heating System	Heating system for ancillary and production buildings	3,000
4	Cooling System	Cooling system for ancillary and production buildings	2,000
5	Air Ventilation Exhaust Fan	Air ventilation for the production building	3,000

6	Ventilation Fan and Installation and Setup	Air ventilation for the ancillary building	500
7	F.B. Implementation	Ancillary and production buildings	100
8	Compressed air distribution for the production building	Compressed air distribution for the production building	2,000
9	Telephone Line Purchase and Installation	-	100
10	Water Branch Right and Piping	-	5,500
11	Water Treatment and Softening Equipment Purchase and Installation	-	1,500
12	Fire Extinguishing System	Including central system, fire extinguishers, fireproof clothing, etc.	2,000
13	Forklift	Two 5-ton forklifts	60,000
14	Light Truck	Two light trucks	50,000
15	Spare Parts Cost (Equivalent to 5% of Machinery Cost)	-	656,040
Total			835,740

3-2-3. Raw materials and intermediate products:

Raw Material Consumption Costs

Row	Description	Unit	Purchase Cost (IRR)	Annual Consumption Quantity	Annual Cost (Million IRR)
1	Manganese Ore	Tonne (t)	54,500,000	32,500	1,771.250
2	Silicon	Tonne (t)	14,500,000	14,000	203.000
3	Coke	Tonne (t)	90,000,000	2,000	180.000
4	Sponge Iron	Tonne	50,000,000	1,500	75.000

		(t)			
5	Other Elements (Lime, Dolomite, etc.)	-	-	-	15.750
Total Cost					2,245.000

3-2-4. Management and Human Resources:

Row	Skill Level	Quantity	Base Salary (IRR)
1	Specialist	60	180.000
2	Skilled	84	150.000
3	Unskilled	122	125.000

- **Direct Skilled Labor Required: 60 Individuals**
- **Direct Unskilled Labor Required: 84 Individuals**
- **Direct Specialist Labor Required: 122 Individuals**

4- Ownership and Legal Licenses:

4-1- Land Ownership:

In the Ravansar Industrial Park, a title deed is issued to the investor, and the usufruct rights of the property are realized through the title deed in this industrial park. Under the Law Governing the Transfer of Ownership and Management of Industrial Parks, an industrial park is a legally defined area created pursuant to the Iranian Industrial Parks Company Act. Industrial zones, subject to the same law, comprise organized collections of industrial, research, technological, and support service units, equipped with necessary infrastructure. Ownership in industrial parks and zones encompasses both individual ownership of specific plots and shared ownership of common areas. The aforementioned common areas in this law refer to portions of the industrial park that are accessible to all owners of units located within the estate and are not exclusive to one or more specific units. In general, any portion of an industrial park that has not been designated for exclusive use or is not specifically identified as the private property of one or more owners in property records shall be considered a common area. The rights of each owner in their exclusive portion and their share in the common areas are inseparable. Consequently, any transfer of the exclusive portion shall automatically entail the transfer of rights and obligations pertaining to the common areas.

4-2- Intellectual Property and Incentives:

In order to produce ferrosilicon manganese, there is no need to use high technical knowledge and the technical knowledge in question is available in the country. Typically, ferrosilicon manganese is produced in three-phase (three-electrode) electric arc furnaces. Electric arc furnaces are a modern and efficient method for producing steel. In this method, an electric arc is used to generate heat, which leads to the melting of raw materials. The use of electric arc furnaces in steel production as an advanced and efficient process is increasing

globally and different countries are seeking to maximize the use of this technology.

4-3- Legal Licenses:

Pursuant to the added Clause 5 of Paragraph (A), Article 3 of the Law on the Implementation of the General Policies of Article 44 of the Constitution, the issuance of permits for industrial parks/zones is the responsibility of companies affiliated with the Small Industries Organization. Furthermore, according to Paragraph (H) of Article 1 of the Implementing Regulations of the amended Clause 5 of Paragraph (A), Article 3 of the Law on the Implementation of the General Policies of Article 44 of the Constitution, the qualification of applicants for obtaining a permit to establish a non-governmental industrial park/zone is verified by the Small Industries and Industrial Parks Organization of Iran. In this regard, applicants are required to submit their applications and upload the necessary documents through the National Licensing Portal. Following this, the provincial Industrial Parks Company will assess the applicant's financial and economic qualifications, identity, and technical competence. Upon approval, the documents will be forwarded to the organization's Board of Directors, specifically to the department overseeing non-governmental industrial parks and service companies. Upon approval by the organization's Board of Directors, the provincial Industrial Parks Company will initiate 31 inquiries. Once all inquiries have been positively resolved, the provincial Industrial Parks Company will issue the establishment permit for the non-governmental industrial park/zone.

Upon the completion of the requisite infrastructure, the holder of a non-governmental industrial park/zone establishment permit must submit an application for an operational permit for the non-governmental industrial park/zone. Following the approval of the operational permit, the permit holder is authorized to lease portions of land within the established non-governmental industrial park/zone to applicants who possess valid establishment licenses from

the relevant authorities. This leasing process must adhere to the stipulations outlined in the standard contract booklet provided by the governing organization.

The requirements for obtaining a license to start the production of ferrosilicon manganese are as follows:

- The required property must be at least 1000 square meters in size.
- A minimum of 12 square meters of the property must be dedicated to a sales office.
- The enclosed space within the unit must be no less than 300 square meters.
- Compliance with all health, safety, and technical regulations is mandatory.

Additionally, considering that the type and extent of industrial pollution vary depending on the type of raw materials and products used, as well as the processing stages, meaning that different processes are susceptible to pollution in three stages: raw material collection, intermediate material production and conversion, and collection and storage of produced materials, environmental activities such as obtaining certifications like ISO 14000 from reputable institutions approved by the Environmental Protection Organization and the Institute of Standards are recommended through the following activities:

1- Industrial and Sanitary Wastewater Treatment:

Accurate identification of wastewater and quantitative and qualitative measurement of pollutants in all units, and installation of wastewater treatment systems.

2- Efforts to Prevent Air Pollution:

To mitigate air pollution resulting from industrial activities, quantitative and qualitative pollutant assessment studies have been conducted, and necessary measures will be implemented for their control. These measures include the

installation of advanced atmospheric pollutant measurement devices and closed-circuit cameras that perform daily and online (real-time) pollutant measurement.

3- 3. Solid Waste Management:

4- Conducting Environmental Research: These activities focus on process optimization, waste reduction, water and wastewater treatment, air pollution control, and waste recycling.

5. Green Space Development: Integrating industry with green spaces as a primary objective for both upstream and downstream industries. According to environmental standards, ten percent of the industrial area should be dedicated to green spaces. In this complex, a significantly higher percentage has been allocated to green spaces. (Irrigation of these green spaces is carried out using treated industrial effluents, which substantially reduces fresh water consumption.)

6- Utilization of Modern Technology and Avoidance of Inefficient Technology: When a new environmental standard is established, due to environmental pressures, significant costs and human resources are required to eliminate existing pollution and reduce pollution levels. Calculations have shown that if new technology implemented in the relevant industry complies with the required standards, in addition to reducing pollution, it will also increase production due to its high efficiency. In this regard, the company, considering the up-to-date nature of its technology and possessing all global environmental and quality standards, can prove this point. Environmental protection can also facilitate technology advancement. This method has been implemented in European countries, and technologies that have reached the end of their life cycle and do not comply with the mentioned standards are collected. However, sometimes these technologies are sent to developing countries, and

Iran has not been exempt from this. Environmental experts believe that if our industry does not have the capability to produce products while maintaining environmental standards and, at the same time, does not see the ability to access appropriate technology, it should not pursue the production of those products. Because in some units, due to the use of obsolete and outdated technologies, so much raw material and energy are wasted that the argument of economic efficiency taking precedence over environmental protection becomes meaningless. If the costs that must be paid to obtain more expensive but up-to-date technology are compared with the costs that are wasted due to the use of inappropriate technology in raw material and energy consumption and environmental restoration, it can be concluded that these cases are much more cost-effective and also more beneficial in terms of technology development and industrial growth.

5- Market Analysis and Competition:

Silicomanganese, also known as ferrosilicon manganese, is a ferroalloy used in the steel industry. As the name suggests, this ferroalloy is a combination of silicon and manganese, typically containing 12 to 16% silicon and 50 to 70% manganese. Silicomanganese is used in steelmaking for deoxidation, desulfurization, and improving the mechanical properties of steel through the addition of alloying elements. The trend towards using silicomanganese instead of a combination of ferrosilicon and ferromanganese in steelmaking has been driven by cost-effectiveness and the ability to maintain a consistent melt composition. Based on recent data from the U.S. Geological Survey, silicomanganese holds the second-largest share of global ferroalloy production, following ferrochrome. Given the dependence on raw materials and the impact of energy costs, many countries rely on imports to meet their demand for

silicomanganese, as is the case with other ferroalloys. In terms of regional trade, 48% of the world's silicomanganese exports came from Europe. Significantly, Europe is the biggest importer of silicomanganese globally.

Other applications of ferrosilicon manganese include:

- Alloying
- Adjusting the manganese and silicon content in steel and iron
- Reducing carbon solubility in produced steels and manganese alloys
- Decreasing sulfur
- Decreasing sulfur, nitrogen, and phosphorus impurities
- Increasing the hardenability of steel
- Deoxidation in steelmaking processes

Fe-Mn grades include high carbon (HC), medium carbon (MC), low carbon (LC), and very low carbon (VLC) grades, whereas Si-Mn grades encompass medium carbon (MC) and low carbon (LC) grades. The steel industry is the primary consumer of these alloys. Given that the typical manganese consumption per ton of steel is around 7 kilograms, the demand for these ferroalloys is significant, necessitating substantial production volumes.

To meet the requirements for manganese, silicon, and carbon, steelmakers can select a combination of HC Fe-Mn, Si-Mn, and Fe-Si, which can be adjusted based on the desired carbon, silicon, and manganese specifications. Traditionally, a blend of high-carbon ferro-manganese (HC Fe-Mn) and ferrosilicon (Fe-Si) was the preferred choice. Nevertheless, there is a shift in industry practice towards greater reliance on silicomanganese, primarily driven by the comparatively higher costs of HC Fe-Mn and Fe-Si.

Silicomanganese is manufactured in a range of grades and particle sizes. It finds its primary application in bulk quantities within the steelmaking process, serving as a source of silicon, carbon, and manganese for alloying and deoxidation.

Manganese, a ubiquitous element in steel, is employed to desulfurize and deoxidize the molten steel, thereby improving its mechanical properties. Through desulfurization, manganese enhances the ductility of steel, preventing hot cracking during the rolling process. Manganese also contributes to improved mechanical properties of steel, including increased strength and hardness. By acting as a deoxidizer, silicon improves the homogeneity of steel's chemical and mechanical properties.

Ferrosilicon manganese typically contains 65% to 68% manganese and approximately 17% silicon. Standards at both national and international levels classify ferrosilicon into different grades based on their silicon, manganese, and carbon content. Standard grades of ferrosilicon manganese meet industry standards and are suitable for most applications.

Ferrosilicon manganese available in the market is typically of Georgian, Indian, or Iranian origin. Georgian grades typically contain over 70% manganese and are commonly graded as 70.17, while Indian and Iranian grades have lower manganese content, commonly found in 65.15 and 60.14 grades.

Numerous factors impact the pricing of ferrosilicon manganese, including: absorption rate, impurity levels, overall quality, market conditions, buyer demand, manganese content, sulfur and manganese content in iron ore, and the percentage of silicon and manganese in the ferrosilicon manganese itself. The steel industry is highly sensitive to exchange rate movements, influencing the prices of all associated products and services. Product analysis is a crucial point that should be considered during pricing. Different analyses have different applications, which leads to varying prices for ferrosilicon manganese with different grades. The table below shows the percentage composition of various grades of ferrosilicon manganese.

Grade (%)	Si (% Min)	Si (% Min)	C (% Max)	P (% Max)	S (% Max)	Size (mm)
70	70	14	2.5	0.25	0.03	10-60
65	65	16	2	0.25	0.03	20-80

60	60	16	2	0.25	0.03	10-100
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Currently, there are 176 production units in the country with operating licenses for ferrosilicon manganese production. Considering that another 468 establishment licenses have been issued for the production of this product, this indicates a domestic market demand for this product.

5-1- Target Market Introduction:

Ferrosilicon manganese is a widely used alloy in the domestic steel industry, ranking as one of the five essential elements in steel production. The robust steel manufacturing sector in Southwest Asia, especially within Iran and Turkey, has resulted in a marked increase in ferrosilicon manganese exports from South Korea, India, and various African nations to this region. This trend underscores the interconnectedness of global supply chains and the reliance of emerging markets on specific alloy inputs critical for enhancing steel quality and production efficiency. While several domestic manufacturers are producing ferrosilicon manganese and many more are planning to do so to meet the high demand, the steel industry's substantial requirement for this essential alloy necessitates continued imports. The global ferrosilicon manganese market exhibited a 4% increase in growth between 2015 and 2020. The global ferrosilicon manganese market constitutes a significant segment of the broader ferroalloy industry. The primary driver of the ferrosilicon manganese market is demand from the steel production sector. Urbanization and industrialization, especially in emerging economies, are driving up the demand for steel, thereby boosting the ferrosilicon manganese market. Advances in production technologies and processes have led to significant improvements in the

efficiency and quality of ferrosilicon manganese, making it more desirable for steel manufacturers. The primary markets for ferrosilicon manganese include Asia Pacific, particularly China and India, Europe, North America, and other regions. Overall, the ferrosilicon manganese market, both domestically and globally, is expected to remain robust due to the alloy's critical role in steel production. However, market growth may face challenges such as intensifying competition, environmental concerns, and occasional supply chain disruptions. One of the primary challenges associated with importing ferrosilicon manganese in Iran is the reliance on foreign suppliers, which can lead to supply chain disruptions or price fluctuations. Consequently, it is imperative for Iran's steel industry to diversify its sources of ferrosilicon manganese imports and explore domestic alternatives to reduce foreign dependency. The global ferrosilicon manganese market is projected to experience steady growth through 2026, driven by increasing steel demand across various sectors such as construction, automotive, and infrastructure. Asia Pacific dominates the global ferrosilicon manganese market, with China, India, and Japan as the primary consumers. Accordingly, the import and export statistics of ferrosilicon manganese in the year 1402 are presented in the following table.

Ferro-Silico Manganese Exports in 2023 (1402)

Row	Tariff Code	Tariff Description	Country	Weight (kg)	Value (USD)
1	72023000	Ferro-Silico Manganese	Armenia	145,022	173,068
2	72023000	Ferro-Silico Manganese	Pakistan	1,255,880	1,312,732
Total				1,400,902	1,485,800

Imports of Ferro-Silico Manganese in 2023 (1402)

Row	Tariff Code	Tariff Description	Country	Weight (kg)	Value (USD)
1	72023000	Ferro-Silico Manganese	Slovenia	2,072,000	2,615,669
2	72023000	Ferro-Silico Manganese	Germany	800,000	8,654,380
3	72023000	Ferro-Silico Manganese	United Arab Emirates	28,709,890	34,111,280
4	72023000	Ferro-Silico Manganese	Taiwan	6,272,000	7,415,512
5	72023000	Ferro-Silico Manganese	Turkey	1,861,000	2,215,231
6	72023000	Ferro-Silico Manganese	Iraq	588,000	632,108
7	72023000	Ferro-Silico Manganese	Georgia	96,000	143,127
8	72023000	Ferro-Silico Manganese	India	8,878,800	9,526,847
9	72023000	Ferro-Silico Manganese	Hong Kong	300,000	324,339
Total				49,577,690	65,638,493

The positive import-export gap for ferrosilicon manganese in Iran highlights the domestic market's appetite for this alloy. The plan is expected to alleviate some of this demand pressure. Given the existing trade relations with countries such as Armenia and Pakistan for ferrosilicon manganese, the implementation of this plan can further facilitate exports to these markets, particularly considering their existing demand for this product.

Physical Progress of the Plan t Date: Yes ☐ No ☒

The purpose of this plan is to fulfill domestic requirements and to create export opportunities. There has been no progress in the implementation of this project so far.

4- Operational Program and Plan Implementation Schedule:

Below is the timeline for the project's execution

		M th. 1	M th. 2	M th. 3	M th. 4	M th. 5	M th. 6	M th. 7	M th. 8	M th. 9	M th. 10	M th. 11	M th. 12	M th. 13	M th. 14	M th. 15	M th. 16	M th. 17	M th. 18	M th. 19	M th. 20	M th. 21	M th. 22
Ferrosilicon Manganese Production Project	Feasib ility Study																						
	Licens es																						
	Constr uction																						
	Equip ment Install ation																						
	Traini ng																						
	Operat ional Launc h																						

8- Project Financial Plan:

8-1. Cost Estimates:

Costs Estimates

Row	Item	Cost (Million IRR)
1	Fixed Capital Investment	20946150

2	Operating Costs (Working Capital)	4634500
3	Financing Costs	25580650

Fixed Capital Investment Breakdown

Row	Item	Cost (Million IRR)	
1	Land Purchase	150000	
2	Landscaping and Site Improvement	29900	
3	Construction and Civil Works	559900	
4	Production Machinery & Equipment	13120800	
5	Support and Auxiliary Equipment	835740	
6	Environmental & Safety Equipment	932210	
7	Overhead Costs	3811330	
8	Pre-Production Expenses	Feasibility Study	34800
		Project Management and Organization	12280
		Technology Acquisition	487200
9	Contingencies	971990	
Total		20946150	

Working Capital Estimate (Production Costs)

Row	Item		Cost (Million IRR)
Ongoing Operating Costs			18488920
1	Raw Materials		15387000
2	Human Resources		532440
3	Marketing (excluding Human Resources)		446250
4	Other Operating Expenses	Fuel and Energy	32440
		Repair and Maintenance	1210370
		Unforeseen Expenses	880420
Fixed Cost			2110950
5	Raw Materials		0
6	Human Resources		133110
7	Marketing (excluding Human Resources)		0
8	Depreciation		1573710
9	Other Fixed Expenses	Fuel and Energy	36060
		Maintenance	302590
		Unforeseen Expenses	23590
		Insurance	41890
Total			20599870

8-2- Revenue Estimates:

Table: Revenue Estimates for the First 5 Years

Row	Product Item	Q1	Q2	Q3	Q4	Year 1	Year 2	Year 3	Year 4	Year 5
1	Ferro-Silico Manganese	59500 00	59500 00	59500 00	59500 00	238000 00	252875 00	267750 00	282625 00	297500 00
2	Total	59500 00	59500 00	59500 00	59500 00	238000 00	252875 00	267750 00	282625 00	297500 00

8-3- Project Operations Period:

Generally, production plan have three main lifecycle phases:

- Project Lifecycle (Construction Phase);
- Operational Lifecycle (Production Phase);
- Product Lifecycle.

The project life cycle is often equated with the construction phase, in which a lot of costs are usually paid. A successful project is one that can deliver this phase within a compressed timeline and at a reduced cost. This section requires the implementation of project management techniques with robust and timely controls to ensure that any issues identified can be rectified during the planning phase.

The operation lifecycle, which is the same as the production lifecycle, encompasses the entire production phase and often designed to be 15 years . For Ferro-Silico Manganese manufacturing projects, this is typically designed for a 20-year period. During the operational phase, we will generate both revenues and incur costs from product sales. However, revenues typically exceed costs; Otherwise, the project would not be economically viable. The emphasis in the operational phase shifts away from the intensive project management techniques used in earlier stages. Production planning and operational process methods are more suitable for scheduling, and in livestock projects, only maintenance management needs to be properly implemented during the operational phase.

8-4- Break-Even Analysis:

Fixed Capital= Pre-Operational Costs + Fixed Costs

$$20411870 + 534280 = 20946150$$

A. Product Cost Per Unit (IRR):

Product Unit Cost (IRR)= Total Annual Production Expenses / Total Production Quantity

$$\text{Product Unit Cost (IRR)} = 20111730 / 50000000 = 402235$$

B. Annual Break-Even Percentage:

Annual Break-Even Percentage= Total Fixed Costs (TFC) / Total Revenue (P) - Variable Costs (V)

$$\text{Annual Break-Even Percentage} = 2110950 / 29750000 - 18488920 = 19\%$$

The value of (P-V) holds particular significance and is referred to as the unit contribution margin. This amount represents the profit per unit or, in other words, the portion of each sale that contributes to covering fixed costs. Consequently, the break-even point occurs when the total contribution margin of all units equals the total fixed costs. In other words, this level of sales covers more than 19% of the fixed costs.

The relationship between total sales revenue and total costs indicates that this plan is 19% above the annual break-even point, generating profits for the company over three production periods and providing a margin of safety for production activities. In break-even analysis, the margin of safety reflects the extent to which actual or projected sales exceed the sales level required to reach the break-even point by more than 19%.

C. Gross Value Added (Million IRR):

Gross Value Added= Total Sales - (Maintenance + Fuel and Energy + Raw Materials and Packaging)

$$\text{Gross Value Added} = 29750000 - (15387000 + 68500 + 1512960) = 12781540$$

D. Net Value Added (Million IRR):

Net Value Added= Gross Value Added - (Pre-operational Depreciation + Depreciation)

$$\text{Net Value Added} = 12781540 - (1573710 + 106850) = 11100980$$

E. Gross and Net Profit (Million IRR):

Gross Profit= Sales Revenue - Sold Product Cost per Unit

Net Profit= Gross Profit - (Administrative, Sales, Advertising, and Other Expenses)

$$\text{Gross Profit} = 29750000 - 20111730 = 9638270$$

$$\text{Net Profit} = 9638270 - (488140) = 9150130$$

F. Fixed Capital per Capita (million IRR):

Per Capita Fixed Capital= Fixed Capital / Number of Employees

$$\text{Per Capita Fixed Capital} = 20946150 / 266 = 78744$$

G. Total Investment per Capita (million IRR):

Total Investment per Capita= Total Investment / Number of Employees

Total Investment per Capita= 25580650 / 266= 96168

H. Annual Return on Investment (ROI):

Annual Return on Investment (ROI): (Total Costs - Total Revenue) / Total Investment

Annual Return on Investment (ROI): 29750000 - 20599870 / 25580650= %36

I. Annual Payback Period:

$$\text{Payback Period} = \frac{1}{\text{IRR}} + \text{The duration of the construction period}$$

Annual Payback Period= 4 years and 4 months

8-5- Cost-Benefit Analysis:

Project Profitability Indicators

Present Value of Total Costs during Implementation & Operation	20599870
Present Value of Total Revenues during Implementation & Operation	29750000
Net Present Value (NPV)	11979028
Benefit-Cost Ratio (B/C)	1.44
Internal Rate of Return (IRR)	36 %

8-6. Sensitivity Analysis:

Sensitivity Analysis Table

Discount Rate (%)	Net Present Value (NPV) (Million IRR)
10	48323768
20	16985685
30	5074826
40	398674-
50	3228604-
60	4793939-
70	5686637-
80	6194085-
90	6469077-
100	6598571-

8-7- Summary:

Table: Project Economic Aspects Summary

Type of Activity	Detailed Activity Description with Code (ISIC)	Manufactured Product	Nominal Capacity (Unit)
Industry and Mining	2710412302	Ferro-Silico Manganese	50,000 tons
Execution Period	Total Fixed Investment (Million IRR)	Annual Working Capital (Million IRR)	Required Workforce
20 employees	20946150	4634500	266
Internal Rate of Return (IRR)	Net Present Value (NPV) (Million IRR)	Applicant Contribution (Million IRR)	Benefit-Cost Ratio (B/C)
%39	12987214	5116130	1.44

8-8. Exchange Rate Fluctuations Estimates during Project Implementation

Regarding the procurement of machinery and equipment for the plan, since a portion of the required equipment will be sourced from abroad, an increase in the exchange rate will lead to a higher initial capital investment for plan implementation. Conversely, a decrease in the exchange rate will reduce the initial capital investment required for the plan.

Regarding the procurement of raw materials for the plan, since all required materials are extracted from domestic mines within Kermanshah Province, fluctuations in the exchange rate will have no impact on the cost of the final product ready for sale.

Regarding the sale of products, since a portion of the plan's revenue is estimated from exports to other countries, an increase in the exchange rate will result in higher sales revenue. Conversely, if the exchange rate decreases, the products can be redirected to the domestic market for sale.

9- Capital Requirements, Funding Methods, and Collateral:

9-1- Required Foreign Currency Investment:

Row	Year	Foreign Currency Requirement
1	First	5.3 Millions of Euros
2	Second	15.9 Millions of Euros
3	Third	0
4	Fourth	0
5	Fifth	0

9-2- Participation and Funding Methods:

Participation in the present project and its financing are envisaged in the form of establishing a company within the country. The total financial resources required are envisaged through investor contributions. Domestic bank facilities have not been taken into account for the implementation of the project.

9-3- Payback Period:

Based on the fixed and variable capital invested, and annual sales, the payback period for a ferrosilicon manganese production project is typically realized within approximately 4 years and 4 months.

7- Plan Incentives, Features, and Benefits:

- Contractual parties who pay the usage rights and the price of workshop, industrial, etc., units in cash and in full at the time of contract conclusion will be eligible for discounts and exemptions based on the total contract amount. (The exemption percentage is determined by the Board of Directors of the Industrial Parks Company).
- Cash and installment payment of land and facility usage rights costs (only 20 to 40 percent of the land usage rights are paid in cash, and the rest is amortized without interest or fees).
- Possibility of transferring ownership documents and issuing separate deeds after obtaining the operation permit, completion certificate, and fulfilling the specified conditions.
- Possibility of pledging land and facility usage right contract booklets with banks and financial institutions, based on the approval of the esteemed Council of Ministers and current laws. Exemption from municipal laws.
- Issuance of construction and completion permits in the shortest possible time and free of charge

- Granting special incentives of up to 10 percent in land usage rights for veterans, elites, knowledge-based companies, inventors, foreign investors, and export consortia.
- Allocation of special incentives for early operation (within one year or less for lands with an area of two thousand square meters or less), up to a maximum of ten percent (10%).

Note 1: For every 500 square meters of additional land, one month is added to the one-year operation deadline (maximum deadline up to 30 months from the contract date for areas of eleven thousand square meters and more).

Note 2: The early operation incentive applies to industrial land allocation contracts that have not used less developed area incentives, have not subdivided or consolidated the allocated lands, and have paid installments on time.

- In the case of having a technical and economic feasibility report for large areas, an incentive equivalent to five percent (5%) and for problematic (uneven and low-quality) areas, up to ten percent (10%) incentive will be granted.