

Oil Colonialism and the Formation of Villa Architecture in Masjid I Sulaiman: A Spatial-Cultural Analysis Using Space Syntax and Hermeneutics

¹*Neda Arzani Birgani*, ²*Ahmad Reza Kaboli*, ³*Seyedeh Sedigheh Mirgozar Langaroudi*, ⁴*Mohamad Ali Rahimi*

¹ Department of Architecture, Ahv. C., Islamic Azad University, Ahvaz, Iran

² Department of Architecture, Mabs. C., Islamic Azad University, Mahshahr, Iran.

³ Department of Architecture, Ahv. C., Islamic Azad University, Ahvaz, Iran.

⁴ Department of Architecture, Bu.C., Islamic Azad University, Bushehr, Iran.

Received 27.07.2025; Accepted 03.09.2025

ABSTRACT: The oil industry in the modern era has played a pivotal role in population growth, industrialization, and the formation of modern cities, particularly in Iran's Khuzestan province. Beyond their industrial function, oil wells have had a profound impact on urbanization, architecture, and lifestyles in Masjid I Sulaiman, serving as significant symbols. The physical development of this city accelerated with the construction of residential complexes for oil industry workers and industrial infrastructure, leading to a redefinition of Masjid I Sulaiman's urban identity at the intersection of tradition and modernity—an identity that distinguishes the city. This study examines the impact of British colonial presence and oil industry activities on the development of villa-style housing in Masjid I Sulaiman, intending to analyze the formation of this housing type under these influences. Previous studies have focused on the economic and social impacts of the oil industry; however, the effects of oil wells on spatial and architectural patterns in oil cities, such as Masjid I Sulaiman, have been underexplored. This research analyzes the role of industrial elements in shaping residential patterns by examining spatial and architectural aspects. Employing a qualitative approach, the study uses hermeneutic phenomenology and space syntax to analyze the cultural and spatial dimensions of villa-style housing. The space syntax analysis reveals that the courtyards of Bagh-e Melli and G-Type, with high integration, enhance social interactions, while Scotch Crescent, with greater spatial depth, indicates class segregation. The hermeneutic analysis portrays bungalows as multilayered texts that represent social, cultural, and economic meanings, highlighting their architectural heritage.

Keywords: *Spatial analysis, hermeneutics, oil colonialism, villa architecture, Masjid I Sulaiman.*

INTRODUCTION

In the modern era, oil has played a pivotal and unparalleled role in population growth and the formation of industrial and modern cities (Tan et al., 2016; cited in Arbabi Sabzevari et al., 2024, 66). The discovery of oil led to the establishment of the Anglo-Iranian Oil Company and the rapid development of modern industry in Khuzestan province (Lavain Dorting, 1382, 199), creating a new structure for urban spaces in the oil-rich cities of this region. The transformations resulting from the discovery of oil fields and the introduction of the oil industry have fundamentally altered the region's economy,

triggering a chain of social, political, and cultural changes at both local and national levels (Mortaheb, 2020,1). Oil wells in Iran, particularly following the historic discovery of Well No. 1 in Masjid-I-Sulaiman in 1287 AH (1908 CE), not only served as industrial facilities for extracting hydrocarbon resources but also acted as Multifaceted phenomena, playing a key role in representing social, economic, and cultural concepts. The emergence of "housing" and "homes" in Masjid I Sulaiman, as the first region of industrial oil extraction in Iran, is a prominent example of the oil industry's impact on architecture, urban planning, and socio-cultural transformations. The

*Corresponding Author Email: Ah.kaboli@iau.ac.ir ORCID: 0000-0002-5779-816X

physical development of Masjid I Sulaiman was such that initially, suitable and less challenging lands near oil wells were used to construct residential units and facilities related to the oil industry (Atehari, 1991, 67). The city took shape with the drilling of oil wells and the creation of residential complexes to house oil industry workers (Abbasi Shahni, 1995, 404). Thus, in addition to the mountainous topography, oil exploration and drilling played a significant role in the city's physical structure and spatial distribution. With the onset of these activities, the construction of residential complexes around the wells for oil industry workers began (Chehrazi, 2019, 83).

Based on the provided explanations, Masjid I Sulaiman, one of Iran's first oil cities, underwent a significant transformation in economic, social, and cultural dimensions due to the development of the oil industry. The discovery of oil and the activities of related companies significantly reshaped the city's structure, settlement patterns, and social relations. Meanwhile, industrial infrastructure and workforce attraction led to modern urbanization and a redefinition of the city's identity at the intersection of tradition and modernity. Beyond being an economic resource, oil wells became cultural symbols that created a distinct identity for Masjid I Sulaiman, with their impacts still evident in the city's culture and society. As Iran's first oil settlement, Masjid-I-Sulaiman has received relatively little attention in architectural and urban studies, with existing research largely limited to the discovery of oil and its early development stages. Selecting this city to examine the impacts of oil exploration and extraction, due to its historical significance, can offer new perspectives on Iran's urban history and development. Accordingly, the central question of this study is: How did the British colonial presence and oil industry activities influence the formation and transformation of spatial and semiotic patterns of villa-style housing in Masjid I Sulaiman? The study pursues three main objectives: Analytical: Examining the impact of British colonial presence and oil industry activities on the spatial and architectural patterns of villa-style housing in Masjid I Sulaiman, focusing on the neighborhoods of Bagh-e Melli, Scotch Crescent, Posht-e Anbar-e Khordaki, and G-Type. Methodological: Employing space syntax analysis to evaluate spatial structures and hermeneutic phenomenology to explore the cultural and social meanings of villa bungalows. Interpretive: Representing the social, cultural, and economic meanings of bungalows as multilayered texts that reflect colonial hierarchies and urban interactions. Based on existing studies and literature on housing and urbanization, it appears that the British colonial presence, particularly through the activities of the Anglo-Iranian Oil Company, played a decisive role in redefining the structure and identity of villa-style housing in this city by creating spatial segregation among different neighborhoods and introducing Western architectural patterns and symbols. These impacts are observable not only in the city's spatial and physical layout but also in the cultural and social meanings associated with this

type of housing. In this regard, the present study emphasizes the connection between urbanization and social, economic, and political factors, striving to provide a deeper understanding of how urban and architectural identity were formed in this region. Therefore, this research not only contributes to the historical and spatial reinterpretation of Masjid I Sulaiman but also, by offering insights into the impact of oil colonialism on villa architecture, aids in preserving the cultural heritage of Masjid I Sulaiman. It provides a framework for sustainable urban development in oil-rich regions, which is valuable for urban planners and architectural historians. It helps foster a better understanding of the long-term effects of colonial and industrial presence on urban and architectural transformations in Iran.

Literature Review

In recent decades, numerous studies have explored the impacts of the oil industry on various aspects of oil-rich communities. These studies have primarily focused on historical, economic, and social dimensions. The present research, while drawing on the findings of previous studies, relies on archival documents and records to examine the formation and development of villa housing in the city of Masjed Soleyman. Regarding the impacts of the oil industry, numerous books and articles have been written, some of which are referenced in Table 1.

Previous studies emphasize the importance of thoroughly examining the impacts of the oil industry on cities. Masjid-I Sulaiman, as the first oil extraction hub in Iran and one of the prominent industrial centers of the contemporary era, has played a strategic role in the country's industrial and economic transformations. The discovery of vast oil resources and the extensive presence of foreign companies, particularly the Anglo-Persian Oil Company, fundamentally reshaped the city's physical and spatial structure. These changes not only influenced the city's urban planning and architecture but also profoundly transformed the social, cultural, and economic layers of Masjid I Sulaiman, making it a unique example of the oil industry's impact on urban development.

Theoretical Framework

Semiotics of Oil Wells and Urban Transformations in Oil-Rich Regions

Iran's oil wells, particularly following the discovery of the Masjid-I-Sulaiman Well No. 1 in 1287 AH (1908 CE), transcend their industrial function and serve as multilayered symbols with social, economic, and cultural meanings from a semiotic perspective. According to Saussure's theory, these wells, as signifiers, refer to concepts such as wealth, development, and geopolitical power (Saussure, 1916/1983). From Peirce's perspective, they are icons of oil resources, indices of an oil-dependent economy, and symbols of national identity and modernity (Peirce, 1931-1958). These meanings

Table 1: Systematic Review of Previous Studies

| Scholar | Title and Scope | Achievements | Research lacuna |
|-------------------------|---|---|--|
| Persian Sources | | | |
| Armaghan et al., (2023) | Reflection of Lifestyle Transformations in the Architecture of Occupational Classes' Houses in Iran's Oil Company Towns Before the 1970s (Case Study: Abadan Company Town) | His article analyzes the impact of lifestyle changes among different occupational classes in Abadan's oil company on residential architecture before the 1970s. Social and cultural needs led to transformations in house design, including the elimination of central courtyards and alterations in interior spaces. | <ul style="list-style-type: none"> - Data limitations: Lack of field data (e.g., interviews with residents) and reliance on archival documents. - Insufficient in-depth socio-cultural analysis: Focus on architectural form rather than social aspects. - Lack of quantitative analysis: Limited use of statistical data or advanced analytical tools. - Lack of field data: Reliance on documents without interviews or social data. |
| Khamseh et al., (2022) | Examining the Impact of the Oil Industry on the Design and Architecture of Company Houses in Masjid I Sulaiman | The formation and development of Masjid I Sulaiman were dependent on oil exploration and the construction and urban planning activities of the Anglo-Persian Oil Company. | <ul style="list-style-type: none"> - Absence of quantitative analysis: Lack of statistical data or advanced tools. - Lack of comparison: Focus solely on Masjid I Sulaiman, without comparison to other company towns. |
| Habibinejad (2021) | The Impact of the Oil Industry on the Architectural Style and Patterns of Buildings in Khuzestan's Oil-Rich Regions (From Oil Discovery to the Nationalization of the Oil Industry in 1951) | The physical and architectural transformations in industrial oil-rich regions are examined as manifestations of deeper social and economic shifts during this period, with a focus on the development of urban spaces and structural changes in these areas. | <ul style="list-style-type: none"> - Temporal limitation: Focus on Stenthe period from oil discovery (1287 AH/1908 CE) to nationalization (1330 AH/1951 CE), without examining post-period architectural developments. - Limited geographical scope: Analysis primarily on a few oil cities (e.g., Masjid I Sulaiman and Abadan) without a comprehensive comparison with other oil-rich regions in Khuzestan or elsewhere in Iran. |
| English Sources | | | |
| Sarkhosh (2024) | Surveying the Oil Landscape: Shaping Transnational Oil Modernity at the Intersection of Global Flows and Local Territories | Analyzes the profound and multifaceted impacts of the oil industry on the emergence of modernity on global and local scales. | <ul style="list-style-type: none"> - Scarcity of field and archival data: Reliance on historical sources and maps, with limited access to local documents due to political and historical constraints. - Lack of in-depth interdisciplinary analysis: Focus on architecture and urban planning, with less attention to the social, environmental, or gendered aspects of oil-driven modernity. |
| Mortahab (2020) | Building Petropolis: Oil Capitalism, Imperialism, and the Construction of Abadan, 1908–1933 | Analyzes the formation of Abadan as an oil city and its economic, social, and cultural impacts in relation to imperialist policies and the structures of oil capitalism. | <ul style="list-style-type: none"> - Temporal limitation: Focus on the period from 1908 to 1933 (from oil discovery to the new concession), without examining subsequent developments such as the nationalization of the oil industry in 1951. - Lack of modern analytical tools: Reliance on historical-descriptive methods without digital modeling or economic network analysis. |
| Sarkhosh (2018) | Shaping Transnational Oil Modernity in Ahvaz: At the Intersection of Oil Flows and International Planning Exchanges | Analyzes various dimensions of transformations driven by the oil industry and their impact on transnational modernity in Ahvaz. | <ul style="list-style-type: none"> - Lack of examination of local resistance: Global influences have been studied, but the responses and resistance of local communities (e.g., Khuzestan tribes) to oil-driven planning have been overlooked. |
| Heine & Sadeghi (2017) | Global Perspective on Iran's Oil: The Role of Oil in Shaping Khuzestan and Tehran | Analyzes the geopolitical and economic impacts of oil on the formation and development of various regions in Iran, particularly Khuzestan and Tehran. | <ul style="list-style-type: none"> - Lack of local and indigenous data: Reliance on international and governmental documents, without incorporating local narratives (e.g., oral histories of workers or Khuzestan's indigenous communities). |



Fig. 1: The location of Masjid I Sulaiman in the province and country



Fig. 2: Well number one in Masjid I Sulaiman, source: (British Petroleum archive, 1908)

Fig. 3: A corner of a Housing Estate at Masjid I Sulaiman, source: (British Petroleum archive, 1919)

have profoundly influenced the urbanization of oil-rich regions, particularly Khuzestan.

Explicitly, oil wells have been drivers of economic and demographic development. The discovery of the Masjid I Sulaiman well by the Anglo-Persian Oil Company led to the establishment of infrastructure, including modern housing, water and electricity systems, parks, and schools, creating a distinct model of planned urbanization in cities like Masjid I Sulaiman and Abadan (Katouzian, 1981, 112). These infrastructures, funded by oil revenues, enhanced the quality of life and served as markers of industrial development (Ferrier,

1982, 305).

Implicitly, oil wells symbolize modernity and progress, shifting traditional lifestyles toward urban and industrial patterns, thereby shaping a modern identity in oil-rich regions (Katouzian, 1981, 165). However, they have also contributed to social and economic inequalities. The concept of the "resource curse" underscores uneven urbanization and the deepening of the center-periphery divide (Ross, 2012, 32). Thus, oil wells, as dual signs, represent both progress and prosperity as well as inequality and deprivation. (Fig. 1, 2, 3)

MATERIALS AND METHODS

This study is classified as applied research in terms of its objective, qualitative research in terms of its nature, and historical-interpretive research in terms of its intent. The data collection methods rely on two primary approaches: library-based (review) and field-based (survey) methods. Within the library-based approach, data are extracted and analyzed from sources such as documents, records, photographs, and maps to obtain necessary information using written and visual resources. In the field-based approach, the research involves direct observation and site visits to the subject of study, collecting empirical and real-world data to achieve a more precise understanding of the spatial context and various aspects of the research (Table 2). As previously stated, this study aims to analyze the formation and development of villa housing in the city of Masjid I Sulaiman under the influence of British colonial presence and the rise of the oil industry, with a particular focus on spatial and architectural semiotics during the colonial oil era. Accordingly, for the qualitative

approach, the study employs hermeneutic phenomenology, an effective tool for deeply examining and analyzing cultural and social phenomena, and the space syntax technique, utilizing indicators such as integration, depth, and connectivity, to investigate spatial structures (class segregation) and the impact of colonial policies on spatial configurations. (Fig. 4)

This research was conducted in the company town neighborhoods of Masjid I Sulaiman (Scotch Crescent, Bagh-e Melli, Posht-e Anbar-e Khordaki, G-Type). In the field research phase, data collection is carried out through direct observation and site visits to gather empirical and factual data, aiming to achieve a more precise understanding of the spatial context and various aspects of the study. In the space syntax analysis phase, indicators (integration, depth, control, connectivity) are analyzed and evaluated using the Depthmap software (Table 3).

The independent variable is a characteristic or factor from the physical or social environment that is selected, manipulated, or controlled by the researcher and takes on certain values

Table 2:Tools and Methods of Data Collection

| Research Stage | Method | Tools | Considerations |
|--|-------------------------|---|---------------------------|
| Document Study | Historical-Interpretive | Study of documents, records, photos, maps | Library-based studies |
| Collecting Experiences, Analyzing the Meaning of Experiences | Qualitative | Personal observation, conversational interviews | Hermeneutic phenomenology |
| Modeling Maps in Software, Analyzing Indicators | Qualitative | Deep Map Software | Space Syntax technique |

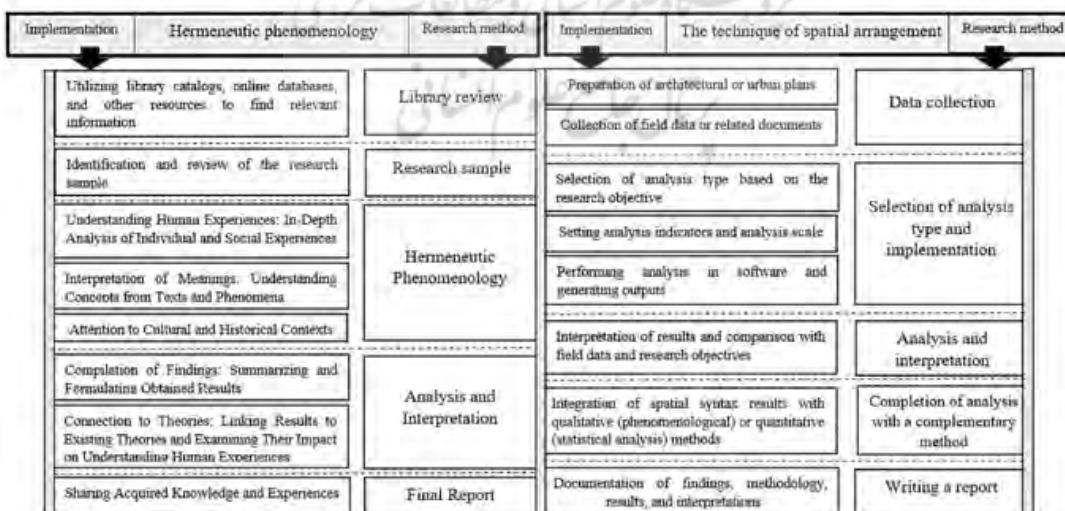


Fig.4: Research Methodology

Table 3: Neighborhoods Studied in the Research

| Neighborhood Name | Housing Type | Class Structure |
|---|--------------|---|
| Scotch Crescent | Garden Villa | Senior managers or foreign employees |
| Bagh-e Melli | Garden Villa | Mid-level or senior oil company employees |
| Posht-e Anbar-e Khoraki (Managers' Bungalows) | Garden Villa | Supervisors or mid-level managers |
| G-Type | Garden Villa | Mid-level employees |

to examine its impact on another variable (the dependent variable). In this study, "semiotic concepts in the oil industry" is designated as the independent variable. The dependent variable is the variable observed or measured to determine the effect of the independent variable on it. Accordingly, in this research, "villa housing in the oil-rich regions of southern Iran" is considered the dependent variable. (Table 4)

This research employs space syntax analysis and hermeneutic phenomenology as an integrated framework to examine the impact of oil colonialism on the architecture of single-family houses in Masjid I Sulaiman. Space syntax analysis, utilizing the Depthmap software, quantitatively analyzes the spatial structures of single-family houses (including integration, segregation, and connectivity metrics) to reveal spatial organization patterns and social-functional relationships in neighborhoods such as Bagh-e Melli and Scotch Crescent. In contrast, hermeneutic phenomenology focuses on interpreting the implicit and multilayered meanings of bungalows, exploring their cultural, social, and semiotic dimensions, and interpreting them as texts representing colonial, class-based, and local identities. The combination of these complementary methods enables a comprehensive understanding of the interplay between material (spatial) structures and immaterial (cultural) meanings. Space syntax provides objective data to identify

spatial patterns. At the same time, hermeneutics interprets these patterns within the historical and cultural context of oil colonialism, and this synergy leads to a deeper analysis of the impacts of colonialism on the architecture and urbanism of Masjid I Sulaiman. (Fig. 5)

RESULTS AND DISCUSSION

The statistical population of this study was selected based on criteria such as settlement patterns, accessibility to residents, availability of data, the historical significance of the urban fabric, and location along key city routes. Accordingly, the areas of Bagh-e Melli, Posht-e Anbar-e Khoraki, and Hasht Bangaleh, which have historically and currently been home to social groups associated with oil industry workers, were designated as the statistical population. These areas exhibit significant differences in terms of environmental, economic, cultural, social, and structural characteristics. In the first section, the concepts and terminology related to the research methodology are first explained, followed by a discussion of the descriptive and inferential findings.

Inferential Findings of the Research

General Understanding of the Structure and Form of Bungalows Bungalows in Masjid I Sulaiman are company housing units

Table 4: Research variables

| Variable | Component | Sub-Component | Description |
|-------------|--|--------------------------------------|--|
| Dependent | Spatial and semiotic patterns of villa-style housing | Spatial Patterns | Spatial structures of single-family houses (such as integration and segregation of spaces) were analyzed using space syntax (e.g., high integration of courtyards in Bagh-e Melli and spatial segregation in Scotch Crescent). |
| | | Semiotic Patterns | Cultural, social, and economic meanings represented by bungalows (such as colonial signs in Scotch Crescent or the integration of tradition and modernity in Bagh-e Melli) are explored through a hermeneutic approach. |
| Independent | Semiotic Concepts in the Oil Industry | Oil Activities | The exploration, extraction, and exploitation of oil attracted labor, leading to the development of residential infrastructure. |
| | | Colonial Policies | Planning by colonial governments (particularly Britain) for the design and construction of housing for oil company employees. |
| | | Economic Conditions | Oil revenues and investments in the oil industry provided financial resources for constructing villa housing. |
| | | Socio-Cultural Conditions | Interactions among local workers, migrants, and foreign managers influenced housing needs and design. |
| | | Imported Technology and Architecture | Use of Western architectural patterns and imported materials in the design of villa housing. |

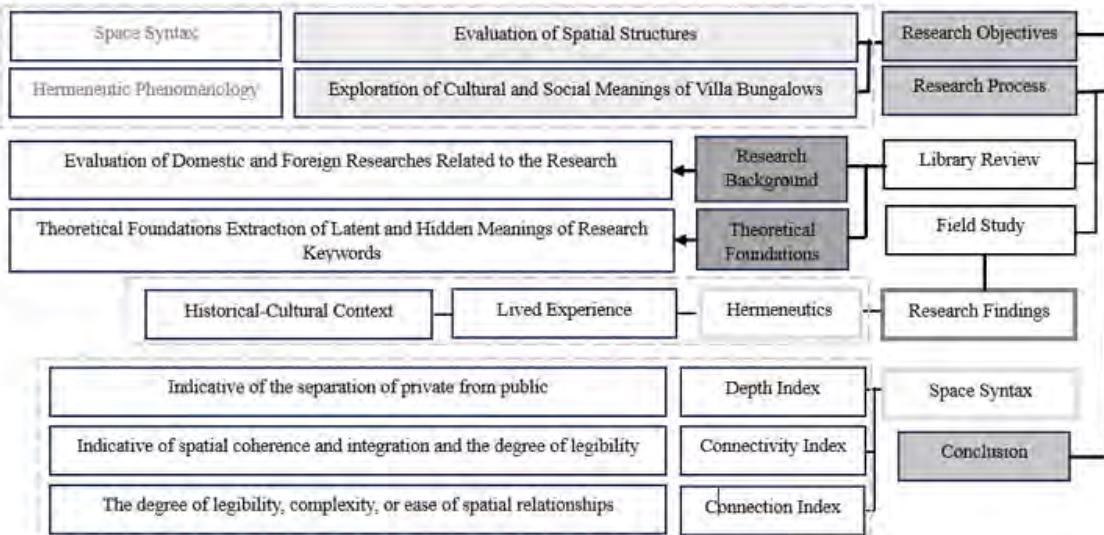


Fig.5: Research Process

constructed by the British oil company in the early 20th century. With the arrival of foreign engineers, workers, and managers—primarily British and Indian—and the need to provide accommodation for them, the oil company built these residential units, which became known as "bungalows." Beyond their residential function, these structures represent a symbol of the social and cultural transformations in Masjid I Sulaiman during the period of industrialization. The bungalows housed individuals from diverse cultures, including British, Indian, and Iranian, thereby creating a platform for cultural exchange and interaction. These houses not only met the accommodation needs of employees during the oil exploration era but also stand as a symbol of the industrial, cultural, and social transformations that the city underwent. The distinctive architecture of these buildings, inspired by Scottish and colonial styles, combined with their role in shaping the modern identity of Masjid I Sulaiman, has made the bungalows a valuable part of Iran's cultural heritage. (Table 5)

Hermeneutic Analysis

Hermeneutics, as a philosophical and interpretive approach, examines and seeks to understand the deep and latent meanings embedded in spaces, emphasizing the historical, cultural, and social contexts in which these spaces were formed. This method views spaces not merely as physical structures but as living texts that carry specific narratives, values, and meanings, through the analysis of which a deeper understanding of their identity and function can be achieved. In this regard, the neighborhoods under discussion, which reflect the industrial and social transformations of Masjid I Sulaiman, serve as a prominent example of this concept. These neighborhoods, shaped within their historical and social contexts, were

influenced by industrial advancements, population migrations, and cultural changes resulting from the development of the oil industry. They have not only witnessed physical and urban transformations but also, as social spaces, represent sites of human interactions, collective identity, and the memories of their inhabitants. Therefore, a hermeneutic analysis of these neighborhoods can reveal the hidden layers of meaning and elucidate how historical and social factors have influenced their formation and evolution. (Table 6)

Scotch Crescent

Historical and Cultural Context

Scotch Crescent, beyond being a residential neighborhood, is a text that narrates the dynamics of colonial power, class distinction, and the infiltration of industrial modernity within an Iranian context. The neighborhood was designed to spatially and socially segregate its residents—primarily foreign managers and high-ranking oil company officials—from the local community and other employee classes. This segregation, reinforced through strategic location, architectural design, and superior amenities, served as a marker of the hierarchical and class-based structure imposed on the city by the oil industry. The bungalows of Scotch Crescent, characterized by imported architectural features and a Western lifestyle, not only reflected foreign cultural influence but also functioned as tools to establish a colonial and industrial identity in the heart of an Iranian city.

Meaning and Lived Experience

The lived experience of Scotch Crescent's residents, particularly foreign managers and a small number of high-

Table 5: Studied Bungalows

| Neighborhood | Planned Layout | Historical Context | Etymology |
|---|----------------|---|--|
| Scotch Crescent | | Scotch Crescent, an upscale neighborhood in the Eight-Bungalow area, was designed for senior managers or foreign employees of the Anglo-Persian Oil Company. Its name, meaning "Scottish Crescent," reflects British cultural influence. The bungalows are large, with intricate designs inspired by colonial architecture. | Derived from eight luxurious villas constructed for British managers. (Habibinejad, 2021, 95) |
| Bagh-e Melli (National Garden) | | The bungalows in this area were designed for mid-level or senior employees, blending local architectural elements (such as central courtyards) with imported industrial standards. | Named after the adjacent Bagh-e Melli Park. (Habibinejad, 2021, 95) |
| Posht-e Anbar-e Khoraki (Behind the Provisions Warehouse) | | Located near the oil company's warehouses, this neighborhood was primarily for lower-ranking workers or service staff. However, in similar neighborhoods, some bungalows were built for supervisors or mid-level managers to oversee warehouse operations or workers. | Named for its proximity to the company's provisions warehouse. (Habibinejad, 2021, 95) |
| G-Type | | G-Type residences, located in the Cooler Shop neighborhood, were designed for mid-level employees. These bungalows are simpler than upscale ones but more equipped than workers' accommodations. | Derived from the Cooler Shop, likely referring to a company store or facility. (Habibinejad, 2021, 95) |

ranking Iranian employees, was profoundly shaped by the luxurious design and amenities of these bungalows. Spacious layouts, private gardens, and intricate architectural designs not only ensured comfort and convenience but also served as symbols of the residents' elevated social and economic status. These bungalows, equipped with modern facilities and Western standards, provided a familiar and comfortable environment for foreign employees, enabling them to maintain a lifestyle rooted in British or Western culture within an unfamiliar setting. However, for the few Iranian residents, this experience was markedly different. The spatial and cultural separation of Scotch Crescent from the local fabric and indigenous neighborhoods

of Mosque-Soleyman often fostered feelings of isolation or alienation among Iranian inhabitants. While these bungalows offered material comfort, their imported design and lack of alignment with local cultural and social patterns may have weakened the sense of place attachment for Iranian residents. In contrast, for foreign residents, these spaces functioned as a reconstruction of a familiar environment, allowing them to preserve their cultural identity.

Bagh-e Melli

Historical and Cultural Context

Bagh-e Melli can be regarded as a symbol of the effort to create

Table 6:Hermeneutic Analysis

| Neighborhood | Historical and Cultural Context | Meaning and Lived Experience | Neighborhood Image |
|---|---|--|---|
| Social Crescen | <ul style="list-style-type: none"> - Upscale neighborhood for managers/foreign employees - Influenced by colonial architecture - Symbol of colonial power and class distinction | <ul style="list-style-type: none"> - Luxurious and isolated lifestyle - Large spaces reflecting social status - Sense of alienation for Iranians |  |
| Bagh-e Melli | <ul style="list-style-type: none"> - Historical neighborhood for senior/mid-level employees - Blend of local and imported architecture - Symbol of urban modernity with preserved traditions | <ul style="list-style-type: none"> - Balanced lifestyle between tradition and modernity - Courtyards fostering family interaction - Sense of urban belonging |  |
| Posht-e Anbar-e Khoraiki (Managers' Bungalows) | <ul style="list-style-type: none"> - Residences for managers/supervisors - Located in a working-class area near warehouses - Symbol of social hierarchy and supervisory role | <ul style="list-style-type: none"> - Relatively comfortable lifestyle compared to workers, but marginal - Small courtyards with limited family interaction - Sense of isolation and unstable status |  |
| G-Type | <ul style="list-style-type: none"> - Standard bungalows for mid-level employees - Symbol of industrial efficiency and the middle class - Functional design | <ul style="list-style-type: none"> - Functional and comfortable lifestyle - Small courtyards with limited interaction - Sense of uniformity |  |

Source: ([Masjid I Sulaiman Municipality, 1941](#))

source: ([British Petroleum archive, 1908](#))

Source: ([Masjid I sulaiman Oil Company, 1944](#))

Source: ([Masjid I Sulaiman Municipality, 1941](#))

a modern urban space while maintaining a commitment to preserving certain traditional and indigenous characteristics. This neighborhood served not only as a residential area but also as a social and cultural hub where interactions between oil company employees and the local community took shape. Drawing on the perspective of Hans-Georg Gadamer, a prominent hermeneutic philosopher, the understanding of a space results from a "fusion of horizons"—the interplay between the cultural and historical horizons of residents, designers, and the socio-historical context of the space. In Bagh-e Melli,

this fusion manifests at the intersection of imported industrial culture (focused on efficiency and standardization) and local identity (rooted in social and architectural traditions). The bungalows in this neighborhood are hermeneutic texts that narrate the story of interaction between these two cultural worlds, reflecting an attempt to balance tradition and modernity within an industrial context.

Meaning and Lived Experience

The bungalows of Bagh-e Melli are multilayered texts

that encapsulate multiple meanings. These structures not only addressed the operational and functional needs of the oil industry but also, as spaces for living, experience, and interaction, defined a new identity for their residents. They illustrate the formation of an urban culture within an industrial context, where traditional and modern elements intertwine to create a unique living experience for inhabitants.

Posht-e Anbar-e Khoraki

Historical and Cultural Context

The bungalows for managers, if present, in Posht-e Anbar-e Khoraki were designed and constructed as residences for supervisors or mid-level managers of the oil company in Masjid I Sulaiman. These managers, responsible for overseeing warehouse operations or coordinating with service workers, played a significant role in the company's operational structure. Located in a peripheral neighborhood primarily inhabited by service workers, these bungalows signify the social hierarchy and class distinctions within the oil company's organization.

Meaning and Lived Experience

The lived experience of the residents of these bungalows, primarily mid-level managers or supervisors, was a blend of relative comfort and the limitations imposed by the neighborhood's peripheral location. While these bungalows were more advanced in terms of amenities and design compared to the accommodations of service workers, they were simpler and more limited than the luxurious residences of senior managers. Although these spaces provided relative material comfort, their marginal location and distance from the city center may have weakened the residents' sense of belonging to the urban community.

G-Type

Historical and Cultural Context

G-Type bungalows symbolize industrial efficiency and the emergence of a middle class within the context of oil-driven modernity. These structures reflect the social and economic transformations that resulted from the development of the oil industry in Masjid I Sulaiman, leading to the formation of a new class of skilled workers and an urban middle class. Positioned socially and economically between unskilled laborers and senior managers, this class played a pivotal role in advancing industrial activities and shaping a modern urban culture. The designers' intent (the oil company and its engineers) was to provide cost-effective, standardized, and efficient housing for mid-level employees that simultaneously met their functional needs and budgetary constraints.

Meaning and Lived Experience

The residents of these bungalows, primarily technicians and their families, experienced a modern lifestyle within a standardized, industrial setting. While this experience was

accompanied by relative comfort, the uniformity of the design and the absence of locally resonant identity elements may have diminished a deep sense of place attachment for some residents. These spaces were heavily influenced by industrial patterns and imported standards, which sometimes clashed with the cultural and social expectations of local inhabitants. Nevertheless, courtyards and verandas, as semi-private spaces, allowed for the preservation of certain social and familial traditions, thereby creating a relative balance between industrial modernity and the residents' social needs.

Space Syntax Analysis

As previously mentioned, to analyze the configuration of buildings using the Space Syntax technique, plans were imported into the Depthmap software, and the indicators of integration, depth, and connectivity in the spatial layout of these buildings were examined and analyzed. Based on the graphical analysis of the indicators in the tables, a color spectrum ranging from cool (blue) to warm (red) indicates the lowest to highest values, respectively. (Table 7)

Integration: According to the graph analysis and table, the residences in Posht-e Anbar-e Khoraki exhibit the highest level of integration in spaces such as the dining room, living room, and the entrance to rooms, which serve as central areas that connect with other spaces. In Scotch Crescent residences, the highest integration values are associated with the entrances to private and public spaces, as well as hallways, which facilitate the separation of public and private areas within the house. Additionally, in Bagh-e Melli and J-Type residences, the inner or central courtyard has the highest integration and the lowest depth, indicating an inverse relationship between the depth and integration indicators. The "shah-neshin" (a traditional elevated seating area) in Posht-e Anbar-e Khoraki, Bagh-e Melli, and G-Type residences, as well as the dining and living areas in Scotch Crescent residences, are the most integrated and permeable nodes, possessing the greatest potential for creating spatial coherence and exerting control over other spaces.

Depth: The highest depth index in Bagh-e Melli and Scotch Crescent residences is attributed to the bathroom, which assumes a highly private character. Similarly, the depth of bedrooms in these residences falls within the private category, indicating the onset of spatial hierarchy and division in these houses. In Scotch Crescent, Posht-e Anbar-e Khoraki, and G-Type residences, the living room is positioned near the entrance, allowing guests to be accommodated without entering the private areas of the house. The designer allocated the first space after the entrance to the guest area. In Posht-e Anbar-e Khoraki and Bagh-e Melli residences, the living room has less depth compared to the private areas of the house.

Furthermore, hallways in Scotch Crescent residences and courtyards in Bagh-e Melli and G-Type residences exhibit the lowest depth index. As the depth index increases, the degree of privacy in a space rises, though this trend is less pronounced

Table 7: Analysis of Software Indicators in Space Syntax

| Neighborhood | Integration | | Depth | | Connectivity | |
|-------------------------|--------------|-------------|-------------|-------------|--------------|------------|
| Scotch Crescent | | | | | | |
| Quantitativ | Max 13/33 | Min 3/19 | Max 3/08 | Min 0/55 | Max 4844 | Min 24 |
| Bagh-e Melli | | | | | | |
| Quantitativ | Max 12/66 | Min 2/96 | Max 2/94 | Min 0/41 | Max 2839 | Min 23 |
| Posht-e Anbar-e Khoraki | | | | | | |
| Quantitativ | Max 14/55 | Min 4/78 | Max 1/39 | Min 0/37 | Max 3345 | Min 447 |
| G-Type | | | | | | |
| Quantitativ | Max 15/08 | Min 4/02 | Max 1/72 | Min 0/24 | Max 2733 | Min 63 |

in Posht-e Anbar-e Khoraki residences. Scotch Crescent and Bagh-e Melli residences, with the highest depth values, demonstrate the greatest spatial depth, indicating a significant increase in privacy and a corresponding reduction in visibility and exposure.

Connectivity: In Bagh-e Melli and J-Type residences, the courtyard, with the highest level of spatial connectivity, is the most permeable node and possesses the greatest potential for fostering spatial coherence. In the spatial system of Posht-e Anbar-e Khoraki and Scotch Crescent residences, the placement of the courtyard in the initial layers diminishes its significance, with its role transferred to other spaces such as entrances, hallways, and living rooms. The highest connectivity index in Scotch Crescent residences is found in the transitional

space between private and public areas, while the lowest is associated with bedrooms and bathrooms. Living spaces, due to their nested layout and limited connections, exhibit lower connectivity and, consequently, a higher degree of control. Quantitatively, a higher connectivity index corresponds to lower privacy. The bungalows of Scotch Crescent, with a connectivity index of 4844, have the lowest connectivity and the highest degree of privacy. Following them, the bungalows of Posht-e Anbar-e Khoraki, Bagh-e Melli, and G-Type exhibit progressively higher connectivity indices, indicating a gradual reduction in privacy in these houses. This precise and hierarchical spatial configuration aligns closely with the social status of the residents and reflects their lifestyle.

CONCLUSION

The city of Masjid I Sulaiman, recognized as the cradle of Iran's oil industry, rapidly transformed from a traditional settlement into a hub of economic, social, and cultural changes following the discovery of oil in the early 20th century. These transformations, primarily driven by the activities of foreign oil companies, particularly the Anglo-Persian Oil Company (later British Petroleum), not only reshaped the physical structure of the city but also redefined its social and cultural identity. The discovery of oil in 1908 in Masjid I Sulaiman marked a turning point in the city's history, leading to the introduction of industrial technologies, the influx of domestic and foreign labor, and the development of modern infrastructure. This process led to rapid urbanization and significant changes in settlement patterns and social interactions.

The main objectives of the research are: Analytical: To examine the impact of British colonial presence and oil industry activities on the spatial and architectural patterns of single-family houses in Masjid I Sulaiman, focusing on neighborhoods such as Bagh-e Melli, Scotch Crescent, Posht-e Anbar-e Khordaki, and G-Type. Methodological: To employ space syntax analysis to evaluate spatial structures and hermeneutic phenomenology to explore the cultural and social meanings of bungalow houses. Interpretive: To represent the social, cultural, and economic meanings of bungalows as multilayered texts reflecting colonial hierarchies and urban interactions. The research question posed is: How have British colonial presence and oil industry activities influenced the formation and transformation of spatial and semiotic patterns of single-family housing in Masjid I Sulaiman? Based on the research findings and data analysis using the Depthmap software, the spatial structure of bungalows in Masjid I Sulaiman's company town was examined. The data obtained from this analysis align with the theories of [Hillier and Hanson \(1984\)](#) regarding the relationship between spatial organization and social interactions, demonstrating that the spatial patterns of single-family houses in Masjid I Sulaiman, beyond their material structures, reflect power relations and colonial hierarchies. Hillier and Hanson argue that spatial configurations, such as integration and segregation, directly influence social interaction patterns. In this study, space syntax analysis revealed that the courtyards of Bagh-e Melli and G-Type, with high integration, create spaces that foster dynamic social interactions, aligning with local culture and the social needs of residents.

In contrast, Scotch Crescent, with high spatial depth and segregation of public and private spaces, reinforces class-based isolation and reflects British colonial hierarchies. These findings also align with [King's \(1984\)](#) theories on colonial architecture, which argue that colonial buildings serve as material tools for exerting power and class distinction. The bungalows of Scotch Crescent, with their elite design and British architectural style, fulfill this role and position colonial identity in opposition

to local identity. This theoretical generalization provides a framework for analyzing industrial cities in postcolonial contexts, demonstrating that the spatial and semiotic patterns of villas in Masjid I Sulaiman not only represent colonial history but also serve as a guide for preserving cultural heritage and sustainable urban planning. The findings of this research align with [Apter's \(2005\)](#) analysis of oil urbanism in Nigeria, which demonstrates how oil infrastructure has shaped spatial and semiotic patterns, representing colonial and local interactions in architecture. They also resonate with [Cronjé's \(1997\)](#) analysis of oil urbanism in Venezuela, which shows that spatial and semiotic patterns in oil cities, such as Masjid I Sulaiman, serve as tools for exerting colonial power while simultaneously reflecting local cultural interactions.

In the hermeneutic analysis of the studied neighborhoods, the findings align with hermeneutic theories, particularly those of [Gadamer \(1975\)](#) and [Ricoeur \(1981\)](#), which focus on the interpretation of texts and multilayered meanings. This analysis portrays the bungalows of Masjid I Sulaiman as cultural texts that reflect complex social, colonial, and local relationships. Gadamer argues that cultural meanings are formed within historical and social contexts and are understood through a dialectic between past and present. In this study, the bungalows of Bagh-e Melli, with their integration of local and industrial elements, represent a dialogue between local traditions and colonial modernity, fostering a sense of urban belonging. In contrast, the bungalows of Scotch Crescent, with their British design and spatial segregation, represent signs of colonial power and class distinction, aligning with Ricoeur's theory of texts as carriers of symbolic meanings. This hermeneutic analysis interprets bungalows beyond their physical structures as narratives of identity, power, and resistance within the context of oil colonialism. This perspective contributes to the discourses of urban semiotics and postcolonial architecture, providing a framework for understanding cultural meanings in industrial cities. The hermeneutic analysis of this research aligns with [Fuccaro's \(2013\)](#) findings on Manama, which demonstrate that bungalows in oil cities, such as Masjid I Sulaiman, function as multilayered texts that represent colonial and local identities.

This research offers significant innovations from three key perspectives, enriching the understanding of the impact of oil colonialism on bungalow architecture in Masjid I Sulaiman. Methodologically, the integration of space syntax analysis and hermeneutic phenomenology introduces a novel dual approach that distinguishes it from previous single-dimensional methods. Space syntax analysis, using the Depthmap software, provides quantitative metrics such as integration, segregation, and connectivity to examine the spatial structures of neighborhoods like Bagh-e Melli, Scotch Crescent, Posht-e Anbar-e Khordaki, and G-Type. At the same time, hermeneutics adds a qualitative dimension by interpreting the cultural and social meanings of these structures as multilayered texts. Empirically, the case

study of Masjid I Sulaiman, as one of Iran's first oil cities, fills a knowledge gap regarding the spatial and cultural impacts of the oil industry on urbanism and architecture. By thoroughly analyzing the mentioned neighborhoods, this research provides new insights into how settlement patterns were shaped under the influence of colonial and industrial infrastructure, an area that has been less explored in previous studies, such as [Ehsani \(2014\)](#) and [Sarkhosh \(2024\)](#). Theoretically, reinterpreting bungalows as multilayered texts that represent social, cultural, and economic meanings offers a new understanding of colonial-local interactions in architecture. This perspective, which views bungalows not only as physical structures but also as carriers of class-based, local, and colonial identity signs, aligns with urban semiotics theories (e.g., [Dovey, 1999](#)) and postcolonial architecture (e.g., [King, 1984](#)). These innovations collectively provide a comprehensive framework for analyzing industrial cities in colonial contexts, paving the way for future studies on cultural heritage preservation and sustainable urban development in oil-rich regions. ([Fig. 6](#))

AUTHOR CONTRIBUTIONS

This article is derived from the doctoral dissertation of Neda Arzani Birgani, prepared under the supervision of Dr. Ahmadreza Kabeli and with the guidance of Dr. Seyedeh Sedigheh Mirputzar Langeroudi and Dr. Mohammadali Rahimi.

ACKNOWLEDGEMENT

This article is derived from the doctoral dissertation of the first author, Neda Arzani Birgani, titled "Explaining the Strategic Principles of Villa Housing Architecture in the Oil-Rich Regions of Southern Iran with an Emphasis on Semiotic Concepts in the Oil Industry, Case Study: Villa Housing in Masjed Soleyman (1290–1357 AH)." The dissertation is being conducted under the supervision of Dr. Ahmadreza Kabeli, with consultation from Dr. Seyedeh Sedigheh Mirzargar Langeroudi and Dr. Mohammad Ali Rahimi at Azad University of Ahvaz.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the authors have acknowledged the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy.

REFERENCES

Abbasi Shehni, D. (1995). History of Masjid I Sulaiman, History of Oil Industry Transformations. Tehran: Hirmand Publications. [In Persian]

Arbabi Sabzevari, A., Ghasempour, A., Ebadi, N., Sa'dinejad, F., & Rostampishe, M. (2024). Driving Forces of the Oil Economy Influencing Spatial Transformations in Bandar Mahshahr. *Geographical Research*, 38, 65-72. [In Persian] <https://www.magiran.com/p2577810>

Armaghan, M., Younesi, G., & Saghafi, M. J. (2023). Reflection of Lifestyle Changes in the Architecture of Houses in Different Occupational Classes of Iran's Oil Company-Towns Before the 1970s (Case Study: Abadan Company-Town). *Bagh-e Nazar*, 118, 23-36. [In Persian] <https://doi.org/10.22034/bagh.2022.349486.5219>

Atehari, K. (1991). Masjid I Sulaiman, A Civilized Company-Town. *Political-Economic Information Monthly*, 48, 65-69. [In Persian] <http://noo.rs/Cb4kU>

Apter, A. (2005). The Pan-African Nation: Oil and the Spectacle of Culture in Nigeria. University of Chicago Press. <https://www.amazon.co.uk/Pan-African-Nation-Spectacle-Culture-Nigeria/dp/0226023559>

British Petroleum Archive. (1908). No. 1 M.1 discovery well, Masjid-i-Sulaiman, South Iran (Archival document, Document Code: ARC178503-001). Historical Documents Section.

British Petroleum Archive. (1919). A corner of a housing estate at Masjid-i-Sulaiman (Archival document, Document Code: ARC36523-037). Historical Documents Section.

British Petroleum Archive. (1908). National Garden neighborhood (Archival document, Document Code: ARC36523-036). Historical Documents Section.

Bavar, C. (2021). Oil, Industrial Civilization, and Architecture in Khuzestan, Iran. Tehran: Mirdashti Cultural Center. [In Persian]

Chehrazi, S. (2019). The Establishment of the Oil Industry in Khuzestan and Its Impact on the Political, Economic, Social, and Cultural Issues of the Region's People. Master's thesis, Payame Noor University, Gorgan. [In Persian]

Coronil, F. (1997). The Magical State: Nature, Money, and Modernity in Venezuela. University of Chicago Press. <https://www.amazon.co.uk/Magical-State-Nature-Modernity-Venezuela/dp/0226116026>

Dovey, K. (1999). Framing places: Mediating power in built form. Routledge. <https://www.amazon.co.uk/Framing-Places-Mediating-Power-Architext/dp/041517368X>

Ehsani, K. (2014). The social history of labor in the Iranian oil industry: the built environment and the making of the industrial working class (1908-1941). Doctoral thesis, Leiden University, the Netherlands.

Ferrier, R. W. (1982). The History of the British Petroleum Company: Volume 1, The Developing Years, 1901-1932. Cambridge: Cambridge University Press. <https://www.amazon.co.uk/History-British-Petroleum-Company-Developing/dp/0521246474>

Fuccaro, N. (2013). Histories of City and State in the Persian Gulf: Manama Since 1800. Cambridge University Press. <https://doi.org/10.1017/CBO9780511605420>

Gadamer, H.-G. (1975). Truth and Method. Continuum. <https://www.amazon.co.uk/Truth-Method-Continuum-Georg>

Gadamer/dp/0816492204

Habibinejad, R.(2021). The Impact of the Oil Industry on the Architectural Style and Pattern of Buildings in Khuzestan's Oil-Fields (From the Discovery of Oil to the Nationalization of the Oil Industry, 1951). Tehran: Nazari Publications. [In Persian]

Habibinejad, R., Khamseh, H., & Bahrani Pour, A.(2021). The Role of the Anglo-Persian Oil Company in Shaping the Spatial-Physical Structure of the Masjid I Sulaiman Company-Town (From the Discovery of Oil to the Nationalization of the Oil Industry, 1908-1951). Local Histories of Iran, 18, 213-230. [In Persian] <https://www.doi.org/10.30473/lhst.2021.8056>

Heine, C, & Sadeghi, M. (2017). Iran's global petroleum scape: the role of oil in shaping Khuzestan and Tehran. Architectural Theory Review (online), 21(3), 349-374. <https://doi.org/10.1080/13264826.2018.1379110>

Husserl, E. (1970). The Crisis of European Sciences and Transcendental Phenomenology. Northwestern University Press. <https://www.amazon.co.uk/Crisis-European-Sciences-Transcendental-Phenomenology/dp/081010458X>

Heidegger, M. (1962). Being and Time (J. Macquarrie & E. Robinson, Trans.). Oxford, UK & Cambridge, USA: Blackwell Publishers Ltd. (Original work published 1927). https://www.researchgate.net/publication/335060851_Heidegger_M_1962_Being_and_Time_J_Macquarrie_E_Robinson_Trans_Oxford_UK_Cambridge_USA_Blackwell_Publishers_Ltd_Original_work_published_1927

Katouzian, H. (1981). The Political Economy of Modern Iran: Despotism and Pseudo-Modernism, 1926-1979. London: Macmillan Press. <https://www.amazon.co.uk/Political-Economy-Modern-Iran-Pseudo-modernism/dp/0333269616>

Khamseh, H., Habibinejad, R., & Bahrani Pour, A.(2022). Investigating the Impact of the Oil Industry on the Design and Architecture of Residences in the Masjed Soleyman Oil Company (From the Discovery of Oil to the Nationalization of the Oil Industry, 1908-1951). Historical Studies of the Islamic World, 24, 28-51. [In Persian] <https://doi.org/10.22034/mte.2021.9157.1340>

Kianinia, R. (2021). Examining the Role of the Emergence of the Oil Industry in Social Development (Case Study: Masjid I Sulaiman, 1901-1933). Social Sciences, Islamic Azad University, Shushtar Branch, 54, 64-83. [In Persian]

King, A. D. (1984). The bungalow: The production of a global culture. Routledge & Kegan Paul. <https://www.amazon.co.uk/Bungalow-Production-Global-Culture/dp/0710095384>

Lavigne Döring, P.(2003). The Anglo-Persian Oil Company in Khuzestan: A Study on the History of Urbanization (1908-1951). Translated by Bashir Yaghmourli. Foreign Relations History, 15, 199-209. [In Persian] <http://noo.rs/X5ZAM>

Masjid I Sulaiman Municipality Archive. (1941). Album of the Masjid I Sulaiman Engineering Services Department. [In Persian]

Persian]

Masjid I Sulaiman Oil Company. (1944). Masjid I Sulaiman Engineering Services Department Album (Archival Document). Archive of the Engineering Department, Masjid I Sulaiman Oil Company. Historical Documents Section, Document Code: NO.03.

Masjid I Sulaiman Municipality. (1941). Performance Report of Districts in Masjid I Sulaiman City in 1941. Public Relations Department, Masjid I Sulaiman Municipality.

Mortaheb, R. (2020). Building the petro-polis oil capitalism imperialism, and the making of Abadan, 1908-1933. Doctoral thesis of philosophy in urban systems, New Jersey Institute of Technology, and Rutgers, The State University of New Jersey – Newark. <https://digitalcommons.njit.edu/dissertations/1458/>

Peirce, C. S. (1931-1958). Collected Papers of Charles Sanders Peirce (Vols. 1-8). Cambridge, MA: Harvard University Press. <https://colorysemitica.wordpress.com/wp-content/uploads/2014/08/peirce-collectedpapers.pdf>

Ross, M. L. (2012). The oil curse: How petroleum wealth shapes the development of nations. Princeton, NJ: Princeton University Press. <https://doi.org/10.1515/9781400841929>

Rostampour, K. (2019). The Role of Housing Provision Policies in the Dissatisfaction of Workers of the Anglo-Persian Oil Company in Khuzestan's Oil-fields, Case Study: From the Discovery of Oil to the Nationalization of the Oil Industry (1908-1951). History of Islam and Iran, 43, 53-74. [In Persian] <https://doi.org/10.22051/hi.2019.21648.1743>

Ricoeur, P. (1981). Hermeneutics and the human sciences: Essays on language, action and interpretation (J. B. Thompson, Ed. & Trans.). Cambridge University Press. <https://doi.org/10.1017/CBO9781316534984>

Sarkhosh, R. (2018). Shaping Ahwaz's Transnational Oil Modernity: At the Crossroads of Oil Flows and International Planning Exchanges. Proceedings International Planning History Society, 18, 160-171. <https://doi.org/10.7480/iph.2018.1.2678>

Sarkhosh, R. (2024). Navigating a Petroleum Scape: Shaping transnational oil modernity at the crossroads of global flows and local territories. Doctoral thesis, Delft University of Technology. <https://research.tudelft.nl/en/publications/navigating-a-petroleum-scape-shaping-transnational-oil-modernity-a>

Saussure, F. de (1916/1983). Course in General Linguistics. Translated by Roy Harris. London: Duckworth. <https://english.hku.hk/staff/kjohnson/PDF/SaussureFerdinandGENERAL1972.pdf>

Tan, J.; Zhang, P.; Lo, K.; Li, J.; Liu, S. (2016). The Urban Transition Performance of Resource-Based Cities in Northeast China. Journal of Sustainability, 8(10), 1-17. <http://dx.doi.org/10.3390/su8101022>



© 2025 by author(s); Published by Science and Research Branch Islamic Azad University, This work for open access publication is under the Creative Commons Attribution International License (CC BY 4.0). (<http://creativecommons.org/licenses/by/4.0/>)