INTERNATIONAL JOURNAL OF ECONOMICS AND FINANCE STUDIES
Vol: 17 **No:** 03 **Year:** 2025 **ISSN:** 1309-8055 (Online) (**pp.** 295-314) **Doi:** 10.34109/ijefs.202517315
Received: 19.06.2025 | **Accepted:** 22.08.2025 | **Published Online:** 30.10.2025

-RESEARCH ARTICLE-

A COMPETENCY MODEL FOR FINANCIAL MANAGERS IN IRAQI OIL COMPANIES BASED ON GROUNDED THEORY AND FUZZY QUALITATIVE COMPARATIVE ANALYSIS (FSQCA)

Safa Fadhl Chfat Chfat

Department of Accounting, Faculty of Administrative Sciences and Economics, University of Isfahan, Isfahan, Iran.
ORCID: https://orcid.org/0009-0002-9089-1240
Email: safa1992310@ase.ui.ac.ir

Amin Hajiannejad*

Department of Accounting, Faculty of Administrative Sciences and Economics, University of Isfahan, Isfahan, Iran
ORCID: https://orcid.org/0000-0003-2525-1036
Email: a.hajiannejad@ase.ui.ac.ir

Amin Rostami

Department of Accounting, Faculty of Administrative Sciences and Economics, University of Isfahan, Isfahan, Iran
ORCID: https://orcid.org/0000-0002-2156-0918
Email: a.rostami@ase.ui.ac.ir

—Abstract—

This research explores the competence of financial managers as a critical success factor for business, broadly applicable in the context of the oil industry, and serving as an important criterion for sustainability. In the context of a developing economy like Iraq, the oil industry challenges the economy as a major catalyst for economic activities; however, it is presently faced with certain issues of developing their human resources. Developments in identifying competence levels of financial managers for ensuring the development of the organization are no longer the need of the hour but imperative for an urgent solution. Despite the presence of heavy cash flows and unique tasks of the oil industry, it is observed that the maximum work for ensuring

Citation (APA): Chfat, S. F. C., Hajiannejad,. A., Rostami, A. (2025). A Competency Model for Financial Managers in Iraqi Oil Companies Based on Grounded Theory and Fuzzy Qualitative Comparative Analysis (fsQCA). *International Journal of Economics and Finance Studies*, 17(03), 295-314. doi: 10.34109/ijefs.202517315

competency of the staff in an integrated approach for developing their skills remains pending in the Iraqi context. The current study aims to propose a competency framework for the financial managers of the oil industry of the country of Iraq by using grounded theory and fuzzy set qualitative comparison analysis. It is revealed that problem-solving competency is the most important aspect that needs to be amalgamated into the competency framework. These are followed by three other factors of reduced importance: leadership and development of skills, communication skills, and flexibility.

Keywords: Grounded Theory, Competency, Human Resources, Oil Company, Fuzzy algorithms.

INTRODUCTION

Being that the relationship between financial managers' abilities or talents and corporate performance is established, it is broadly argued that the skills of financial managers can significantly improve sustainable competitive advantage for a firm (Aidara et al., 2021). Recently, it was confirmed that the skills of managers in general, or finance-related ones, are some of the strongest determinants of sustainable corporate advantage (Bui et al., 2020). These individuals engage in continuous, frequent interactions with various stakeholders, including high-level executives, accounting departments, or consulting firms, among many, to further the relevant goals or directions for their firms (Austin et al., 2021). Therefore, acquiring the skills is a pre-condition for such roles. A skill can be referred to as a certain professional aptitude that helps the individual achieve positive results (Janeček et al., 2021). It is made up of a unique combination of knowledge, skills, abilities, and visible characteristics adding to better performance by financial managers, as a result of which their firms' effectiveness is achieved (Bawono et al., 2022). When discussing financial management leadership roles, it is clearly mentioned that financial managers need to showcase their ability to combine technical knowledge, decision-making abilities, and virtuous actions (Han et al., 2025). Moreover, qualities such as creativity, rigor, analytical thinking, endurance, or problem-solving abilities should be imperative in a situation where there is uncertainty in both economics as well as the political surroundings (Funke, 2025). These qualities would become even more important in industries that face high global uncertainty in their markets, such as the oil and gas firms (Gamso et al., 2024). Financial management is often cited as a bedrock of good business practices or sustainable development (Lumanauw & Lolowang, 2024). This implies that firms need financial managers with better-than-benchmark innovative skills for their inherent qualities, needs, or competitive environments (Kuckertz et al., 2024). In the context of Iraq, it remains little observed in various firms, including the oil companies (Morrison et al., 2024). Being one of the support systems of the economy of Iraq, the role of the oil firms is increasingly faced

Vol: 17 **No:** 03 **Year:** 2025 **ISSN:** 1309-8055 (Online) (**pp.** 295-314) **Doi:** 10.34109/ijefs.202517315

with challenges that need executive staff with cutting-edge skills that are adaptable or innovative (Al-lami et al., 2024). Research in similar corporate environments shows that innovation, along with effective management skills (technological, strategic, and adaptive), tends to produce better financial or organizational performance (Migdadi, 2021). Within the context of complex dynamic industries such as oil and gas, this implies that companies could derive better results from more effective, technological, strategic, and adaptable management. An inability on the other hand in management practices, as well as following a dependent approach on the governments for safeguarding, has resulted in low operational efficiency on the part of the oil companies of the state of Iraq (Ali & Hussein, 2024). Research work in similar oil-producing nations suggests that improvement of management skills, especially in financial management, could improve operational efficiency significantly (Ali & Hussein, 2024). Chief financial officers' importance is of prime significance in minimizing costs, maximizing earnings, or long-term company stability (DeAngelo, 2021). However, such ends would remain difficult to achieve without optimum skill development or governance improvement. Financial management is the guiding framework that ultimately helps in developing any organization or company. The importance of effective financial management is about ensuring stability or growth of the organization or company (Innola et al., 2021). This key point reiterates that the importance of the role of financial managers or their importance in the context of company performance or role of finance in oil companies remains unclear or unforeseen by research work still (Hajiyev et al., 2024). As one of the increasingly important professional sectors of the region of Iraq, the competency of its respective financial managers would remain one of its crucial determinants that emphasize the importance of developing a capability framework for their respective finance managers of oil companies in the country of Iraq. Though the oil company of the state of Iraq is one of those with substantial or complex financial or operational procedures, it still lacks any standardized scientifically sound or balanced competency framework or development framework for such finance professionals. Therefore, research study tends to make use of grounded theory or qualitative FCA for deriving detailed competency for the respective CFOs of oil companies of the state of Iraq. Grounded theory is an inductive methodology that starts with some observations to generate more generalized concepts. It facilitates the development of theoretical concepts from data (Makri & Neely, 2021). Ultimately, the objectives of this research work are to provide a strong competency framework that is relevant to the context of the Iraqi situation, capable of supporting the selection, training, testing, development of CFOs, ensuring enhanced performance and sustainability of such organizations in the strategic oil companies of Iraq. In this context, results indicate the conceptually organized study of reality, as distinct data points. Grounded theory seeks to develop a clear, perceptive, or insightful theory that is context dependent. This research work would be executed through conducting interviews. Grounded theory methodology is suited for conducting research work through interviews, as the key source of data

Vol: 17 **No:** 03 **Year:** 2025 **ISSN:** 1309-8055 (Online) (**pp.** 295-314) **Doi:** 10.34109/ijefs.202517315

gathering could be interviews. Moreover, the research work would make use of fuzzy qualitative data analysis techniques that would systematically identify, record, and subsequently develop information about the features of text-based or audio-based data, such as transcripts of interviews gathered while conducting research work. Determining the significance of skills of financial managers for the performance of oil companies in the state of Iraq is complex research work. Skills of individuals do not contribute to the direct performance of companies, yet their respective relative strengths and weaknesses could help in developing their role for improving company performance.

This research uses fuzzy qualitative content analysis to identify the effective skill set for managers as well as for better promotion of sustainable growth in organizations by investigating the role of Chief Financial Officer (CFO) skills in the performance of Iraqi oil companies. This research is aimed at developing a skills framework for CFOs in the context of the Iraqi oil industry using Grounded Theory and fuzzy qualitative comparative analysis (fsQCA). Based on this objective, research questions are framed in the following way:

1. What are the elements or dimensions of the skills framework for Chief Financial Officers (CFOs) in the oil industry?
2. How are the categories that make up skill dimensions of CFOs in the oil industry classified using grounded theory?
3. What is the appropriate approach for determining the qualities of effective managers in the petroleum industry?
4. How should one prioritize the factors of competent management qualities?

MATERIAL AND METHODS

This applied research aims to examine the design of a model of competencies of chief financial officers in the oil companies in Iraq. With a qualitative approach, this research utilizes exploratory and descriptive surveys. Additionally, this research utilizes a technique called Behavioral Event Interviewing to examine the necessary competencies of a chief financial officer. The population in this research will include academic authorities, senior managers, deputy directors, department managers, and oil industry specialists in Iraqi oil companies and their subsidiaries in 2023. Moreover, this research utilizes purposive sampling with snowball sampling.

RESEARCH FINDINGS

Descriptive Statistics

Qualitative research participants were 20 in total, all males. Their present age composition includes 15% in 32-35 years, 20% in 36-40 years, 30% in 41-50 years, and 35% above 50 years. Industry experience level includes 45% with 8-15 years, 25% with 15-20 years, and 30% over 20 years. The total male interviews conducted were 20, which accounted for 100% of total samples studied. More specifically, 9 participants (45%) had between 8 and 15 years of experience, 5 participants (25%) between 15 and 20 years, and 6 participants (30%) more than 20 years. In terms of age, 3 participants (15%) were between 32 and 35 years old, 4 (20%) between 36 and 40 years old, 6 (30%) between 41 and 50 years old and 7 (35%) were over 50 years old.

Qualitative Research Findings

The interview data were analyzed using a three-step coding process: open coding, axial coding, and selective coding, to develop a competency model for financial managers of oil companies.

Open Coding

Open coding involves conceptualizing and categorizing interview transcripts. By transcribing, reading, and summarizing the primary data verbatim, while minimizing subjective bias, it is possible to extract concepts and categories related to the competencies of financial managers. In this study, a structured coding approach is first applied to code relevant conversations from the interviews. Thus, the data are first conceptualized and then categorized.

Axial Coding

In this step, all the themes identified during open coding, initially scattered, are grouped into broader components based on their semantic similarities. These components serve as the basis for evaluating the phenomena under study in the subsequent selective coding phase, where they are refined into scientific theories and terminology. This process is repeated until the themes from open coding are organized into smaller subcategories called components.

Selective Coding

Selective coding is the final stage of the grounded theory coding process. It involves grouping similar components under a unified category to construct the final structure of the phenomenon under study. This stage is also called narrative development and axial code integration to establish a shared framework of understanding. To present a theoretical framework as a multidimensional model, an integrated set of generated codes is first presented (see Table 1), which is then developed to form the theoretical framework of the subject under study within the multidimensional model.

Based on the identification of coding processes following Glaser's approach in grounded theory analysis, the research proceeds to present the theoretical framework in a multidimensional manner.

Vol: 17 **No:** 03 **Year:** 2025 **ISSN:** 1309-8055 (Online) (**pp.** 295-314) **Doi:** 10.34109/ijefs.202517315

Table 1: The Process of Selective Coding Based on Open and Axial Coding

Open Coding (Conceptual Themes)	Axial Coding (Main Components)	Selective Coding (Categories)	Primary Classification
Leadership power, negotiation ability, effective communication	Key Competencies of Oil Industry Managers	Problem-Solving Skills of Oil Industry Managers	Competency Model for Financial Managers in Iraqi Oil Companies
Financial analysis ability, risk management, strategic planning			
Strategic vision	Key Problem-Solving Skills of Oil Industry Managers		
Conflict resolution			
Creativity			
Flexible behavior, responsibility, foresight	Key Communication Skills of Oil Industry Managers	Communication Skills of Oil Industry Managers	
Empathy and humility			
Initiative, creativity, patience	Key Adaptability and Flexibility Traits of Oil Industry Managers	Adaptability and Flexibility Skills	
Transparency, team building			
Reasoning skills, project management			
Honest and inspiring behavior	Key Leadership and Staff Development Characteristics	Leadership and Staff Development Traits	
Conducting training classes			
Mentoring, coaching, and feedback			

Figure 1: Theoretical Framework of the Study

Vol: 17 **No:** 03 **Year:** 2025 **ISSN:** 1309-8055 (Online) (**pp.** 295-314) **Doi:** 10.34109/ijefs.202517315

Based on the identified dimensions, a Delphi analysis must be conducted to assess the reliability of the selected components. To determine the level of consensus among experts in terms of the relevancy of research elements to oil managers' competencies, a Fuzzy Delphi Technique was used. As shown in Figure 1 below, oil managers' financial competencies in Iraqi oil companies can be measured for five major dimensions including core competencies, problem-solving capabilities, communications, adaptability, motivational behavior, and skill development. To perform the fuzzy Delphi analysis, the triangular fuzzy number (TFN) scale (Padilla-Rivera et al., 2021), which includes a five-point linguistic scale presented in Table 2, must be used.

Table 2: Triangular Fuzzy Number (TFN) Scale

Linguistic Scale	Linguistic Expression	Fuzzy Numbers (L, M, U)
1	Very High	(9, 7, 10)
3	High	(5, 7, 9)
5	Moderate	(3, 5, 7)
7	Low	(1, 3, 5)
9	Very Low	(0, 1, 3)

Subsequently, by developing a suitable fuzzy scale, expert opinions are collected and recorded in fuzzy form for later evaluation (Muhsen et al., 2023). In this method, experts typically express their opinions using three values: the minimum possible value, the most probable value, and the maximum possible value (i.e., triangular fuzzy numbers). The next step is to aggregate the expert opinions. To do this, the fuzzy averaging method is used to consolidate their views. The fuzzy mean of n triangular fuzzy numbers (representing the aggregation of n experts' opinions) is calculated using equation (1).

$$\mathrm{F_{AVE}} = \left(\frac{\sum \mathrm{l}}{\mathrm{n}}, \frac{\sum \mathrm{m}}{\mathrm{n}}, \frac{\sum \mathrm{u}}{\mathrm{n}}\right)$$

Next, by fuzzy aggregating expert opinions, the values must be DE fuzzified, a process that can be calculated for each indicator (Al Fozaie & Wahid, 2022). In other words, the net value of the fuzzy expert opinions must be determined. To this end, equation (2) is used as follows:

$$\mathrm{DF_{ij}} = \frac{[(\mathrm{u_{ij}} - \mathrm{l_{ij}}) + (\mathrm{m_{ij}} - \mathrm{l_{ij}})]}{3} \mathrm{l_{ij}}$$

According to Equation (2), ii refers to the number of experts, and jj refers to the number of evaluation criteria. Additionally, $uiju\_ij, mijm\_ij, and\ lijl\_ij$ represent the maximum, most probable, and minimum evaluation values for the jj-th criterion, respectively.

Vol: 17 **No:** 03 **Year:** 2025 **ISSN:** 1309-8055 (Online) (**pp.** 295-314) **Doi:** 10.34109/ijefs.202517315

In the final step, to screen the influential indicators, a tolerance threshold must be considered, which in this study is set as a difference less than 0.2. It is noteworthy that the determination of the tolerance threshold may vary from one study to another depending on the analytical nature and the researchers' perspectives. Therefore, setting the tolerance threshold as a difference less than 0.2 serves as a basis for confirming the identified dimensions (components) of the model. The results of the first round of the Fuzzy Delphi process, including the aggregated fuzzy values and DE fuzzified (crisp) values for each sub-criterion, are presented in Table 3.

After the first round of the Delphi process, in the second round, the validated rating checklist along with each participant's previous responses and the extent of their deviation from the views of other experts was redistributed to the participants to assess whether a consensus could be reached in this round.

Based on the perspectives gathered during the first stage and their comparison with the results of the current stage, if the difference between the two stages is less than the threshold of 0.2, the survey process is stopped.

Table 3: Fuzzy Delphi Process – Round One

Row	Sub-Criteria	Very High (7, 9, 10)	High (5, 7, 9)	Moderate (3, 5, 7)	Low (1, 3, 5)	Very Low (0, 1, 3)	Aggregated Fuzzy Values (L, M, U)	DE fuzzified (Crisp) Value
1	Problem-Solving Skills	15	5	0	0	0	(6.10, 8.35, 9.20)	7.88
2	Communication Skills	14	6	1	0	0	(6.10, 8.65, 9.40)	7.60
3	Adaptability & Flexibility Skills	18	2	0	0	0	(6.20, 7.50, 9.35)	8.25
4	Leadership & Skill Development	16	3	1	0	0	(6.40, 8.80, 9.70)	8.30

As shown in Table 4, all the elements identified during the qualitative phase were confirmed, and a consensus was reached. Subsequently, through a standard Delphi analysis and the development of a seven-point evaluation grid, the study aims to determine the reliability of the core themes.

Table 4: Fuzzy Delphi Analysis Process – Second Round

No.	Sub-Criteria	Very High (7, 10, 9)	High (5, 7, 9)	Medium (3, 5, 7)	Low (1, 3, 5)	Very Low (0, 1, 3)	DE fuzzified Mean	Mean Deviation	Final Decision
1	Problem-Solving Skills	16	4	0	0	0	7.95	0.07	Accepted
2	Communication Skills	14	6	0	0	0	7.73	0.13	Accepted

Vol: 17 **No:** 03 **Year:** 2025 **ISSN:** 1309-8055 (Online) (**pp.** 295-314) **Doi:** 10.34109/ijefs.202517315

Table 4: Fuzzy Delphi Analysis Process – Second Round (cont…)

No.	Sub-Criteria	Very High (7, 10, 9)	High (5, 7, 9)	Medium (3, 5, 7)	Low (1, 3, 5)	Very Low (0, 1, 3)	DE fuzzified Mean	Mean Deviation	Final Decision
3	Adaptability and Flexibility Skills	15	5	0	0	0	8.40	0.15	Accepted
4	Leadership and Skill Development	18	2	0	0	0	8.35	0.05	Accepted

As observed in Table 5, all 13 core themes identified in the managerial competency model for financial managers in the oil industry were validated. This validation is based on the fact that all themes achieved agreement coefficients above 0.5 and mean scores above 5.00 in both rounds of the Fuzzy Delphi process. Consequently, all 13 core themes were confirmed and proceeded to the subsequent phase of fuzzy network analysis.

Table 5: Evaluation of Core Themes in Managerial Competencies (Oil Industry – Fuzzy Delphi Method)

Component	Theme	Round 1 Mean	Round 1 Agreement Coefficient	Round 2 Mean	Round 2 Agreement Coefficient
Problem-Solving Skills	Leadership, Negotiation, and Effective Communication	6.50	0.70	6.80	0.85
	Financial Analysis, Risk Management, Strategic Planning	6.60	0.70	6.90	0.85
	Strategic Vision	5.60	0.65	6.30	0.80
	Conflict Resolution	6.20	0.80	6.30	0.90
	Creativity	6.00	0.80	6.20	0.90
Communication Skills	Flexible Behavior, Responsibility, and Foresight	6.40	0.70	6.80	0.85
	Empathy and Humility	6.00	0.80	6.20	0.90
Adaptability and Flexibility Skills	Initiative, Creativity, and Patience	6.30	0.85	6.50	0.88
	Transparency and Team Building	6.60	0.85	6.90	0.89
	Reasoning Skills and Project Management	6.20	0.78	6.70	0.80
Leadership and Employee Development	Honest and Inspirational Behavior	5.78	0.65	6.10	0.78
	Providing Training Courses	6.45	0.85	6.70	0.88
	Mentoring, Coaching, and Feedback	5.60	0.65	6.30	0.80

Note: All themes reached the consensus threshold and were validated through the Delphi process

Analytical Process in the Quantitative Section

To address the research questions in the quantitative section, the study employed the two-dimensional fuzzy analysis method (Peng et al., 2022). The following four questions were posed in this phase:

1. What are the components and dimensions of the competency model for financial managers in the oil industry?
2. Based on grounded theory, how are the categories constituting the competency dimensions of financial managers in the oil industry classified?
3. What is the appropriate model for the characteristics of competent managers in the oil industry?
4. How are the dimensions and components of competent managers' characteristics prioritized?

Fuzzy TODIM Analysis Process

In this analytical process, the study uses pairwise comparison matrices based on fuzzy numbers, prompting participants to answer the four research questions mentioned above. The fuzzy TODIM method is then applied (Wang et al., 2020). Each component validated during the qualitative phase is assigned to the rows (i) and columns (j) of the matrix, and pairwise comparisons are performed to examine the existence of a direct, inverse, or reciprocal influence between the matrix dimensions. Table 6 presents the linguistic scales used for these pairwise relationships.

Table 6: Linguistic Scales Based on Pairwise Relationships

Linguistic Variables	Fuzzy Values
Very High Influence	(8, 9, 9)
High Influence	(6, 7, 8)
Low Influence	(4, 5, 6)
Very Low Influence	(2, 3, 4)
No Influence	(1, 1, 1)

In other words, in this section, a five-point scale ranging from "Very strong influence" to "No influence" was used for each statement in the questionnaire, with the corresponding fuzzy sets defined using fuzzy membership functions (Bhalaji et al., 2022). This choice is justified by the fact that such values are frequently used in fuzzy controllers for decision-making processes aimed at selecting the optimal solution (Ali & Hussein, 2024). To extend the fundamental definitions of fuzzy numbers, mathematical models are first presented.

Designing Fuzzy Linguistic Criteria

At this stage, based on the criteria identified during the qualitative analysis, decisions are made regarding the prioritization of components for assessing the organization's sustainable development performance using the balanced scorecard methodology. To reduce uncertainty, these criteria are formulated as linguistic variables. After

Vol: 17 No: 03 Year: 2025 ISSN: 1309-8055 (Online) (pp. 295-314) Doi: 10.34109/ijefs.202517315

questionnaire collection, each linguistic term is assigned a corresponding fuzzy value, as shown in Table 2.

Providing Matrix Checklists to Participants

At this stage, each participant is asked to determine the influence of each dimension on the others through pairwise comparisons. Specifically, the notation $\tilde{o}_{ij} = (l_{ij} \cdot m_{iy} \cdot u_{ij})$represents the respondent's opinion on the effect of the identified dimension in column "i" on the dimension in row "j." In other words, the influence of column dimension "i" on row dimension "j" is examined.

Initial Decision Matrix

The initial decision matrix õ is calculated as the simple average of the ratings assigned by all the participants who evaluated the checklists. It is calculated through equation (3), whereby $\tilde{o}_{ij} = (l_{ij} \cdot m_{iy} \cdot u_{ij})$.

$$\tilde{o} = \begin{bmatrix} \tilde{o}_{11} & \cdots & \tilde{o}_{1n} \\ \vdots & \ddots & \vdots \\ \tilde{o}_{m1} & \cdots & \tilde{o}_{mn} \end{bmatrix} \cdot \tilde{o}_{ij} = \frac{1}{P} \times \sum_{P=1}^{P} \tilde{\alpha}_{ij}^{P}$$

Calculation of the Normalized Matrix (z)

In order to standardize the matrix related to the data dimensions, every cell will be divided by the total number of elements in its corresponding column. Thus, according to Equations (4)-(6), the resulting standardized matrix will be derived.

$$\tilde{Z}_h = {}^{1}/_{K} \times \tilde{O}_h; \quad h = l.m.u$$

$$K = \max_{1 \le i \le n} \left(\sum_{j=1}^{n} U_{ij}\right)$$

$$Z = \begin{bmatrix} \tilde{Z}_{11} & \cdots & \tilde{Z}_{1n} \\ \vdots & \ddots & \vdots \\ \tilde{Z}_{m1} & \cdots & \tilde{Z}_{mn} \end{bmatrix}$$

Calculation of the Matrix $\tilde{v}$

Since three-component triangular linguistic variables are used in this analysis, each three-element entry in the normalized matrix is decomposed into three separate matrices: $\tilde{Z}_l$ ، $\tilde{Z}_m$ $\tilde{Z}_u$ Subsequently, the fuzzy bounds $l''_{ij}; m''_{ij}; u''_{ij}$ for each matrix are calculated according to Equations (7) to (9).

$$l''_{ij} = Z_l \times (I - Z_l)^{-1}$$

Vol: 17 No: 03 Year: 2025 ISSN: 1309-8055 (Online) (pp. 295-314) Doi: 10.34109/ijefs.202517315

$$m''_{ij} = Z_m \times (I - Z_m)^{-1}$$
$$u''_{ij} = Z_u \times (I - Z_u)^{-1}$$

The process for obtaining the matrix $\tilde{v}$ will involve the aggregation of the lower, middle, and upper bounds for the triangular fuzzy numbers, which will need to follow the calculations below. The values $l''_{ij}; m''_{ij}; u''_{ij}$ are, respectively, the first, second, and third entries of each element in the matrix $\tilde{v}$, described by equation (10).

$$\tilde{v} = \begin{bmatrix} \tilde{v}_{11} & \cdots & \tilde{v}_{1n} \\ \vdots & \ddots & \vdots \\ \tilde{v}_{m1} & \cdots & \tilde{v}_{mn} \end{bmatrix}$$

Defuzzification of Fuzzy Numbers

In this stage, the fuzzy numbers must be DE fuzzified based on Equation (11), where, according to Relation (4-9), l, m, and u represent the first, second, and third elements of each fuzzy number, respectively.

$$V = \frac{(l + 4_m + u)}{6}$$

Calculation of $D_i - R_i$ و $D_i + R_i$for Utility Optimization

At this point, the corresponding D and R values are calculated for each factor by summing the elements in the DE-fuzzified matrix. Furthermore, based on the respective elements $Di - Ri$ and $Di + Ri$, the intensity of influence and susceptibility are determined. To conclude, in the context of the TODIM method, the weights of the criteria expressing their respective importance in relation to optimization are incorporated.

Fuzzy TODIM Inference Process

This process is considered an innovative method for fuzzy multi-criteria decision support, incorporating weightings from the DEMATEL technique (Koca et al., 2021). Table 7 presents the fuzzy TODIM inference used to determine the importance of the main criteria.

In this given matrix, m criteria F1,…… Fm are considered, and n alternatives E1, ., En are provided, in such a way that Pij represents the score given to the i-th alternative for the jth criterion Fj $(j = 1, . . , m)$, and W_F stands for the weight of importance of criterion F. The fuzzy inference process implementation is described through three consecutive steps, as pointed out by equations (12) to (14).

Vol: 17 **No:** 03 **Year:** 2025 **ISSN:** 1309-8055 (Online) (**pp.** 295-314) **Doi:** 10.34109/ijefs.202517315

Table 7: Fuzzy TODIM Inference for Determining the Importance of Primary Criteria

	F_1	F_2	⋯	F_n
W_F	W_1	W_2	⋯	W_m
E_1	P_{11}	P_{12}	⋯	P_{1m}
E_2	P_{21}	P_{22}	⋯	P_{2m}
⋮	⋮	⋮	⋮	⋮
E_n	P_{n1}	P_{n2}	⋯	P_{nm}

Step 1: Assuming that Pij and Pji are the sum of the points attributed to the research options, respectively, on the components j = 1, …, m, the relative difference $(Pij - Pji)$ of the determined criteria must be calculated first. As a result, starting from equation (12), $\varphi F = (Ei, Ej)$.

$$\varphi_F = (E_i, E_j) = \begin{cases} \sqrt{w_F \times (P_{ij} - P_{ji})}, & (P_{ij} - P_{ji}) > 0 \\ 0, & (P_{ij} - P_{ji}) = 0 \\ \frac{-1}{\theta}\sqrt{\frac{-(P_{ij} - P_{ji})}{w_F}}, & (P_{ij} - P_{ji}) < 0 \end{cases}$$

Therefore, θ should be considered as the attenuation factor.

Step 2: In this step, the dominance degree of alternative E_i over $\delta(E_i, E_j)$denoted as formulation provided in Equation (13).

$$\delta(E_i, E_j) = \sum_{F=1}^{m} \varphi_F = (E_i, E_j), \forall\,(i, j), i \neq j$$

Step 3: Finally, the final weights of each identified criterion should be calculated according to the expanded form of Equation (14), as detailed below.

$$w_j = \frac{\delta(E_j)}{\sum_{j=1}^{n} \delta(E_j)}$$

Accordingly, based on the identified criteria for the competency model of oil industry managers in Iraq, weighting is conducted to determine the most important dimension within the model. As explained, to compare the criteria with one another, a fuzzy matrix is constructed using the five linguistic terms outlined in Table 6. As observed, the fuzzy pairwise comparison matrix for each dimension is presented in Table 8. Subsequently, using the fuzzy DEMATEL algorithm (Hashemi et al., 2020), the relative differences of rows and columns are first calculated to optimize the utility of

Vol: 17 **No:** 03 **Year:** 2025 **ISSN:** 1309-8055 (Online) (**pp.** 295-314) **Doi:** 10.34109/ijefs.202517315

each identified dimension. In this matrix, as previously explained,

$$\tilde{x}_{ij} = (l_{ij}, m_{ij}, u_{ij}) \text{ The values are represented as triangular fuzzy numbers, and } \tilde{x}_{ii} = (i = 1,2,3,\dots,n) \text{ considered in a fuzzy manneras } (0,0,0)$$

To incorporate the opinions of all experts, the arithmetic mean is calculated according to Equation (15).

$$\tilde{z} = \frac{\tilde{x}^1 \oplus \tilde{x}^2 \oplus \tilde{x}^3 \oplus \dots \oplus x^p}{p}$$

In this formula P the number of experts and $\tilde{x}^1$ ، $\tilde{x}^2$، $\tilde{x}^p$ respectively represent the pairwise comparison matrices of each research participant. And $\tilde{z}$ A triangular fuzzy number is represented as $\tilde{z}_{ij} = (l'_{ij}, m'_{ij}, u'_{ij})$ Table (8) presents the average of the pairwise comparisons:

Table 8: The average of the pairwise comparisons

	v_1			v_2			v_3			v_4		
	I	***m***	***u***	**I**	***m***	***u***	**I**	***m***	***u***	**I**	***m***	***u***
v_1	0	0	0	0.75	0.95	0.9	0.9	0.9	0.08	0.9	0.68	0.77
v_2	1	0.8	0.75	0	0	0	0.75	1	0.7	0.88	0.8	0.8
v_3	0.68	0.6	1	0.9	0.88	0.78	0	0	0	0.95	1	0.77
v_4	0.6	0.65	0.65	0.8	0.95	0.75	0.8	0.88	0.95	0	0	0

The matrices obtained from Equations (16) and (17) are normalized using this method

$$\tilde{H}_{ij} = \frac{\tilde{z}_{ij}}{r} = \left(\frac{l'_{ij}}{r}, \frac{m'_{ij}}{r}, \frac{u'_{ij}}{r}\right) = (l''_{ij}, m''_{ij}, u''_{ij})$$

Where r is obtained from the following equation:

$$r = \max_{1 \le i \le n}\left(\sum_{j=1}^{n} u_{ij}\right)$$

Table (9) presents the normalized relationship matrix of the research criteria.

Table 9: Normalized relationship matrix of the research criteria

	v_1			v_2			v_3			v_4		
	I	***m***	***u***	**I**	***m***	***u***	**I**	***m***	***u***	**I**	***m***	***u***
v_1	0	0	0	0.145	0.104	0.108	0.09	0.095	0.08	0.088	0.068	0.114
v_2	0.124	0.102	0.065	0	0	0	0.077	0.124	0.077	0.084	0.085	0.102
v_3	0.088	0.112	0.117	0.095	0.095	0.088	0	0	0	0.095	0.145	0.089
v_4	0.095	0.075	0.13	0.148	0.095	0.085	0.143	0.114	0.085	0	0	0

In the next step, the row and column sums of the matrix $\tilde{T}$ are obtained. The row and column sums are calculated based on Equations (18) and (19).

$$\tilde{D} = (\tilde{D}_i)_{n\times 1} = [\sum_{j=1}^{n} \tilde{T}_{ij}]_{n\times 1}$$

$$\tilde{R} = (\tilde{R}_i)_{1\times n} = [\sum_{i=1}^{n} \tilde{T}_{ij}]_{1\times n}$$

Where $\tilde{D}$ and $\tilde{R}$ are n×1 and 1×n matrices, respectively. The next step is to determine the importance of the dimensions ($\tilde{D}_i + \tilde{R}_i$) and the relationship between the criteria ($\tilde{D}_i - \tilde{R}_i$). If $\tilde{D}_i - \tilde{R}_i > 0$, the relevant criterion is effective, and if $\tilde{D}_i - \tilde{R}_i < 0$, the relevant criterion is effective. Table (10) shows $\tilde{D}_i - \tilde{R}_i$and $\tilde{D}_i + \tilde{R}_i$.

Table 10: Importance and Influence of the Dimensions

Research Dimensions	A	$\tilde{D}$	$\tilde{R}$	$\tilde{D} + \tilde{R}$	$\tilde{D} - \tilde{R}$	Result
Problem-Solving Skills	V1	5.456	5.225	7.45	0.225	Cause
Communication Skills	V2	4.450	5.351	6.60	0.350	Cause
Adaptability and Flexibility Skills	V3	4.569	5.475	6.80	0.320	Cause
Leadership and Skills Development	V4	5.768	5.689	7.61	0.328	Cause

From the above table, $\tilde{D}+\tilde{R}$ is the sum of the effects conferred on a particular factor by the other factors as well as the effects of the particular factor on the other factors. Essentially, $\tilde{D}+\tilde{R}$ is the sum of each factor’s effect on other factors and the effect on it from other factors. On the contrary, $\tilde{D}-\tilde{R}$ is a measure of the difference between the effects of a particular factor on the other factors and the effects a particular factor receives from the other factors. Essentially, $\tilde{D}-\tilde{R}$ measures the overall effect of a particular factor on the other factors. The overall effect of a particular factor on the other factors is noted to be affirmative if the particular factor has a profound effect on the other factors. Furthermore, a negative overall effect depicts a particular factor as being influenced. The value of $\tilde{D}+\tilde{R}$ varies in accordance with the perceived importance of a particular factor. From the above results, the challenge of the balanced scorecard approach has been determined to be the greatest dimension amongst the factors studied. Further, the opinions of the participants are used in establishing a fuzzy inference in estimating the overall importance of the initial criteria as reflected in Table (11).

Table 11: Fuzzy TODIM Inference Based on Research Criteria

Research Dimensions	A	V1	V2	V3	V4
Problem-Solving Skills	V1	1	3.236	3.678	2.660
Communication Skills	V2	0.310	1	2.205	2.569
Adaptability and Flexibility Skills	V3	0.255	0.275	1	3.425
Leadership and Skills Development	V4	0.305	0.267	0.325	1

Vol: 17 **No:** 03 **Year:** 2025 **ISSN:** 1309-8055 (Online) (**pp.** 295-314) **Doi:** 10.34109/ijefs.202517315

Then, the decision matrix is constructed to combine the weights of each criterion based on the results obtained from the DEMATEL algorithm. In the above matrix, the value of W_{rc} must be determined by dividing the initial weight of each criterion, as determined by DEMATEL, in accordance with the initial TODIM decision matrix based on Equation (20). Table 12 presents the initial TODIM decision matrix including the weighted criteria.

Table 12: Initial TODIM Decision Matrix

Research Dimensions	Wrc	V1	V2	V3	V4
Problem-Solving Skills (V1)	0.865	1	0.54	0. 040	0. 035
Communication Skills (V2)	0.680	0. 018	1	2.205	0. 033
Adaptability and Flexibility Skills (V3)	0.825	0. 025	0. 030	1	0. 017
Leadership and Skills Development (V4)	0.860	0. 016	0. 045	0. 022	1

Note: Wrc represents the weights of each criterion as determined by the DEMATEL method, which are incorporated into the initial TODIM decision matrix in accordance with Equation (20).

Based on the constructed initial decision matrix, the prioritization matrix of the criteria should be formed according to Table (13).

Table 13: Final Criteria Prioritization Matrix

Research Dimensions	A	V1	V2	V3	V4	Final Weight	Rank
Problem-Solving Skills (V1)	V1	1.000	0.236	0.404	0.435	0.345	1st
Communication Skills (V2)	V2	0.240	1.000	0.217	0.338	0.288	3rd
Adaptability and Flexibility Skills (V3)	V3	0.255	0.280	1.000	0.278	0.250	4th
Leadership and Skills Development (V4)	V4	0.212	0.265	0.465	1.000	0.315	2nd

Based on the fuzzy inference matrix of TODIM and determining the final weight of each of the research criteria, it was determined that, in line with the DEMATEL analysis, criteria V1, V2, V3, and V4 should be considered in evaluating the competencies of oil industry managers. Among these four criteria, the most important is problem-solving skills (V1). (fig 2).

Figure 2: The appropriate model of competent managers' characteristics for the oil industry

Vol: 17 No: 03 Year: 2025 ISSN: 1309-8055 (Online) (pp. 295-314) Doi: 10.34109/ijefs.202517315

DISCUSSION

One of the most crucial and vital aspects of an organization and the primary reason for its recognition in global markets is its financial health. This is precisely why financial management departments are created and why companies subsequently hire chief financial officers (CFOs). In other words, a CFO is responsible for maintaining and improving an organization's financial health. This role is considered one of the most important and essential within organizations, government agencies, and businesses of all sizes.

Naturally, the responsibilities of a chief financial officer (CFO) have their own specific characteristics, requiring rigor, expertise, and appropriate skills qualities collectively referred to as competence. The competence of CFOs is a crucial criterion for all companies, particularly those in the oil sector, and is a key factor in their long-term viability. In a developing country like Iraq, the oil industry is recognized as the engine of the economy. The results of this study indicate that four dimensions should be considered in the competency model for financial managers in the oil sector: problem-solving, communication, adaptability and flexibility, leadership, and skills development.

CONCLUSION

The results indicate that the components constituting the dimensions of financial managers' skills in the oil industry, according to grounded theory, are as follows: Problem-solving skills (leadership, negotiation skills, and effective communication; financial analysis, risk management, and strategic planning; strategic vision; conflict resolution; creativity). Communication skills (adaptability, sense of responsibility and foresight; empathy and humility). Adaptability and flexibility skills (initiative, creativity, and patience; transparency, teamwork, reasoning, and project management). Leadership and skills development skills (integrity and ability to inspire, facilitating training, mentoring, coaching, and providing feedback).

Based on the fuzzy TODIM inference matrix and the final weighting of each research criterion, and in accordance with the DEMATEL analysis, problem-solving skills are considered the most important factor to integrate into the model. The three other factors, in order of importance, are leadership and skills development, communication skills, and adaptability and flexibility. The results of this study are consistent with those of (Daouk-Öyry et al., 2021) and (Mohammadi et al., 2022). Therefore, it is recommended that managers in oil companies strengthen their problem-solving skills. It is also recommended that, when selecting candidates for management positions, they verify that they possess the criteria defined in the competency model. Future research is also encouraged to identify competency models in other sectors.

REFERENCE

Aidara, S., Mamun, A. A., Nasir, N. A. M., Mohiuddin, M., Nawi, N. C., & Zainol, N. R. (2021). Competitive advantages of the relationship between entrepreneurial competencies and economic sustainability performance. *Sustainability*, *13*(2), 864. https://doi.org/10.3390/su13020864

Al-lami, A., Shirkhodaie, M., & Safari, M. (2024). The digital transformation model for innovative marketing maturity in the oil companies. *Revista de Gestão Social e Ambiental*, *18*(9), 1-40. https://doi.org/10.24857/rgsa.v18n9-056

Al Fozaie, M. T., & Wahid, H. (2022). A guide to integrating expert opinion and fuzzy AHP when generating weights for composite indices. *Advances in Fuzzy Systems*, *2022*(1), 3396862. https://doi.org/10.1155/2022/3396862

Ali, Z., & Hussein, S. (2024). Economic Diversification in Iraq: Overcoming Oil Dependency and Building a Sustainable Future. *Business and Investment Review*, *2*(6). https://doi.org/10.61292/birev.143

Austin, A. A., Carpenter, T. D., Christ, M. H., & Nielson, C. S. (2021). The data analytics journey: Interactions among auditors, managers, regulation, and technology. *Contemporary Accounting Research*, *38*(3), 1888-1924. https://doi.org/10.1111/1911-3846.12680

Bawono, I., Maulina, E., Rizal, M., & Purnomo, M. (2022). The role of knowledge management capability, financial literacy, and problem-solving skills on organizational performance for SMEs. *Frontiers in Psychology*, *13*, 930742. https://doi.org/10.3389/fpsyg.2022.930742

Bhalaji, R. K. A., Sankaranarayanan, B., Alam, S. T., Ibne Hossain, N. U., Ali, S. M., & Karuppiah, K. (2022). A decision support model for evaluating risks in a collaborative supply chain of the medical equipment manufacturing industry. *Supply Chain Forum: An International Journal*, *23*(3), 227-251. https://doi.org/10.1080/16258312.2021.1989268

Bui, T. D., Ali, M. H., Tsai, F. M., Iranmanesh, M., Tseng, M.-L., & Lim, M. K. (2020). Challenges and trends in sustainable corporate finance: A bibliometric systematic review. *Journal of Risk and Financial Management*, *13*(11), 264. https://doi.org/10.3390/jrfm13110264

Daouk-Öyry, L., Sahakian, T., & van de Vijver, F. (2021). Evidence-based management competency model for managers in hospital settings. *British Journal of Management*, *32*(4), 1384-1403. https://doi.org/10.1111/1467-8551.12434

DeAngelo, H. (2021). Corporate financial policy: What really matters? *Journal of Corporate Finance*, *68*, 101925. https://doi.org/10.1016/j.jcorpfin.2021.101925

Funke, J. (2025). Critical Thinking: A Key Competency in the Twenty-First Century to Deal with Uncertainty and Complexity. In R. J. Sternberg & W. Niu (Eds.), *Critical Thinking Across Disciplines, Vol. 2: Applications in the Digital Age* (pp. 109-123). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-82640-5_5

Gamso, J., Inkpen, A., & Ramaswamy, K. (2024). Managing geopolitical risks: the global oil and gas industry plays a winning game. *Journal of Business Strategy*, *45*(3), 190-198. https://doi.org/10.1108/JBS-04-2023-0081

Hajiyev, N., Abdullayeva, S., & Abdullayeva, E. (2024). Financial stability strategies for oil companies amidst high volatility in the global oil products market. *Energy Strategy Reviews*, *53*, 101377. https://doi.org/10.1016/j.esr.2024.101377

Han, X., Xiao, S., Sheng, J., & Zhang, G. (2025). Enhancing Efficiency and Decision-Making in Higher Education Through Intelligent Commercial Integration: Leveraging Artificial Intelligence. *Journal of the Knowledge Economy*, *16*(1), 1546-1582. https://doi.org/10.1007/s13132-024-01868-2

Hashemi, R., Kamranrad, R., Bagheri, F., & Emami, I. (2020). A fuzzy DEMATEL–Fuzzy Binary Logistic Regression approach to evaluate and prioritize risks and simulated annealing optimization algorithm (an empirical study in energy projects). *International Journal of Managing Projects in Business*, *13*(5), 1025-1050. https://doi.org/10.1108/IJMPB-04-2019-0089

Innola, N., Roman, C., Nelia, C., Mykola, M., & Andrii, R. (2021, 2023//). Ensuring of Financial Stability of the Enterprise by Financial Management Tools. Sustainable Finance, Digitalization and the Role of Technology, Cham. https://doi.org/10.1007/978-3-031-08084-5_56

Janeček, V., Williams, R., & Keep, E. (2021). Education for the provision of technologically enhanced legal services. *Computer Law & Security Review*, *40*, 105519. https://doi.org/10.1016/j.clsr.2020.105519

Koca, G., Egilmez, O., & Akcakaya, O. (2021). Evaluation of the smart city: Applying the dematel technique. *Telematics and Informatics*, *62*, 101625. https://doi.org/10.1016/j.tele.2021.101625

Kuckertz, A., Leicht, T., Scheu, M., da Silva Wagner, I., & Ebersberger, B. (2024). Architecture of the Venture: Understanding Business Modeling. In A. Kuckertz, T. Leicht, M. Scheu, I. da Silva Wagner, & B. Ebersberger (Eds.), *Mastering Your Entrepreneurial Journey: From Vision to Venture* (pp. 63-73). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-71064-3_6

Lumanauw, B., & Lolowang, I. R. A. (2024). Exploring Strategic Financial Management Techniques in Entrepreneurship: A Detailed Literature Review on Practices That Drive Business Sustainability and Growth. *Atestasi: Jurnal Ilmiah Akuntansi*, *7*(2), 1111-1132. https://doi.org/10.57178/atestasi.v7i2.900

Makri, C., & Neely, A. (2021). Grounded Theory: A Guide for Exploratory Studies in Management Research. *International Journal of Qualitative Methods*, *20*, 16094069211013654. https://doi.org/10.1177/16094069211013654

Migdadi, M. M. (2021). Organizational learning capability, innovation and organizational performance. *European Journal of Innovation Management*, *24*(1), 151-172. https://doi.org/10.1108/EJIM-11-2018-0246

Mohammadi, S. M. H., Taftiyan, A., Heirani, F., & Eslami, S. (2022). Developing and explaining a comprehensive competency model of financial managers in a professional and forward-looking manner with grounded theory method. *International Journal of Nonlinear Analysis and Applications*, *13*(1), 3405-3425. https://doi.org/10.22075/ijnaa.2021.25414.3011

Morrison, L. J., Alshamari, A., & Finau, G. (2024). Interrogating the environmental accountability of foreign oil and gas companies in Basra, Iraq: a stakeholder theory perspective. *Meditari Accountancy Research*, *32*(1), 207-233. https://doi.org/10.1108/MEDAR-08-2021-1425

Muhsen, Y. R., Husin, N. A., Zolkepli, M. B., & Manshor, N. (2023). A systematic literature review of fuzzy-weighted zero-inconsistency and fuzzy-decision-by-opinion-score-methods: assessment of the past to inform the future. *Journal of Intelligent & Fuzzy Systems*, *45*(3), 4617-4638. https://doi.org/10.3233/JIFS-230803

Padilla-Rivera, A., do Carmo, B. B. T., Arcese, G., & Merveille, N. (2021). Social circular economy indicators: Selection through fuzzy delphi method. *Sustainable Production and Consumption*, *26*, 101-110. https://doi.org/10.1016/j.spc.2020.09.015

Peng, Y., Chen, K., Nie, F., Lu, B.-L., & Kong, W. (2022). Two-dimensional embedded fuzzy data clustering. *IEEE Transactions on Emerging Topics in Computational Intelligence*, *7*(4), 1263-1275. https://doi.org/10.1109/TETCI.2022.3221135

Wang, L., Wang, Y.-M., & Martínez, L. (2020). Fuzzy TODIM method based on alpha-level sets. *Expert Systems with Applications*, *140*, 112899. https://doi.org/10.1016/j.eswa.2019.112899