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A Fuzzy Hybrid Approach to Prioritizing Transnational Capabilities for International Markets Entry

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Highlights

- Identifying the causal relationships among the main criteria (transnational capabilities) and their subcriteria for the steel pipe manufacturing companies in Iran's oil and gas industry using fuzzy decision-making trial and error laboratory (FDEMATEL);
- Determining priorities of the main criteria (transnational capabilities) and their subcriteria for the steel pipe manufacturing companies in Iran's oil and gas industry using the fuzzy analytic network process (FANP).

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Abstract

Considering the limited resources available, firms must rank their most distinctive capabilities to succeed in entering international markets. This research aimed at prioritizing transnational capabilities, including marketing, managerial, human resources, production, financial, logistics, research and development, quality and standards, and consultation and interaction with the government affecting the entry of the Iranian steel pipe manufacturers producing gas and oil transit steel pipes into international markets. The study population comprised experts, procurement, and business and marketing managers of Iran's eight most significant oil and gas steel pipe manufacturers. Two pair-wise comparison questionnaires were employed to collect the required data. Fuzzy decision-making trial and error laboratory (FDEMATEL) and fuzzy analytic network process (FANP) techniques were used to analyze the data. The results revealed that the marketing (net weight = 0.225) and human resources (net weight =0.035) capabilities attained the highest and lowest priorities, respectively. The paper shares the value creation by presenting a potential process, including systematic techniques for ranking transnational capabilities to enter the international markets while considering the competitive environment.

Keywords: Capabilities, Transnational Capabilities, International Markets, FANP, FDEMATEL

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1. Introduction

The investment prospects created a globalization trend through FDI and strengthened capital markets through financial liberalization (Adebayo and Acheampong, 2021). Globalization plays a critical role

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in countries' economic growth and development. It adjusts trade and economic development, influencing economic growth (Ling et al., 2021). On the other hand, globalization has also caused significant concerns because it is the main reason for intense competitiveness. This happened because a firm could be competitive in entering new markets. Ehsani and Mehrmanesh (2020) stated that competitive advantage develops and vivifies companies over time and can be considered corporate success or failure compared to competitors. Therefore, globalization has caused increasing competition, so firms have to gain capabilities to achieve competitive advantages, and their future will dramatically depend on their efforts to create competitive advantages.

One of the critical issues concerning manufacturers' and firms' survival and profitability is finding new markets. Intense competition, saturation of local markets, and customers' requirements are essential reasons for firms to extend their markets. One appealing and tempting choice for such firms is to choose the international markets. Therefore, firms ought to provide the related infrastructures to enter such markets. This will be procured by constructing and or strengthening the required capabilities. The Iranian companies manufacturing gas and oil steel pipes are no exception. They must inevitably implement a scientific and operational approach to international market entry from survival and growth perspectives; in a qualitative article on the transnational capabilities required for the international market's entry studied by Ashtari et al. (2022), nine transnational capabilities were identified: marketing, managerial, human resources, production, financial, logistics, research and development, quality and standards, and consultation and interactions with the government.

This article aimed to rank these nine capabilities. This is important because these companies must determine which capabilities to focus on, allocate more time and energy, and invest more if they intend to succeed in the international market's entry.

Some researchers have studied the interrelations between the criteria and subcriteria and their priorities using FDEMATEL and FANP techniques in different industries.

Khalilzadeh et al. (2021) on risks on oil and gas projects, Yadegari and Avakh Darestani (2021) on orders to suppliers, Abikoja (2020) on determining a suitable location for refugee camps, Govindan et al. (2020) on circular supplier selection, Gharanfoli and Valmohammadi (2019) risks on construction projects, Hatefi and Tamošaitienė (2019) on risk factors, and Perçin (2018) on airline service quality.

According to Nguyen and Fayek (2022), multi-criteria decision-making (MCDM) techniques have been playing brilliant roles in the implementation of construction problems by helping decision-makers in different ways like identification, classification, selection, and ranking a set of decision options while balancing conflicting criteria to lead to optimal decisions. Due to the strengths of MCDM techniques, FDEMATEL was used to determine the interdependencies among the criteria (transnational capabilities) and subcriteria, and FANP was employed to prioritize the requirements and subcriteria.

The hybrid fuzzy MCDM approach considered the contribution of this study in applying an innovative combination of FDEMATEL–FANP methods for decision-making, which had never been conducted before on prioritizing the transnational capabilities for the international market's entry.

Regarding difficulties and limitations on international market entry, lack of knowledge on ranking the transnational capabilities of the Iranian steel pipe manufacturing companies, and the importance of recognition of priorities in terms of their establishment or improvements by the companies mentioned above could be called the research gap and the main reason for doing the research. An important motivation for doing the study was the high attractiveness of international markets, mostly in terms of profitability and making top foreign currencies into the country, especially regarding the unstable economic situation of the country. This could lead to reduced saturation of the domestic markets as

well. The following section, the literature review, focused on resources, capabilities, competitive advantage, and strategy. Issues such as population, sampling, data gathering tools, consistency ratio, and methods to prioritize study variables drew attention in the section. At the same time, FDEMATEL and FANP were employed for the data analysis in the findings section. Finally, the discussion and conclusions section outlines several research, theoretical, and managerial suggestions.

2. Literature review

Grant's practical framework (1991), as illustrated in Figure 1, argues that resources are the basic foundation of competitive advantage for organizations so that they create or improve capabilities, and then capabilities establish the competitive advantages. The competitive advantages make organizations select appropriate strategies to overcome their rivals, especially when going for the international markets. Therefore, components of the model, including resources, capabilities, competitive advantage, and strategy, will be explained for the issue's significance.

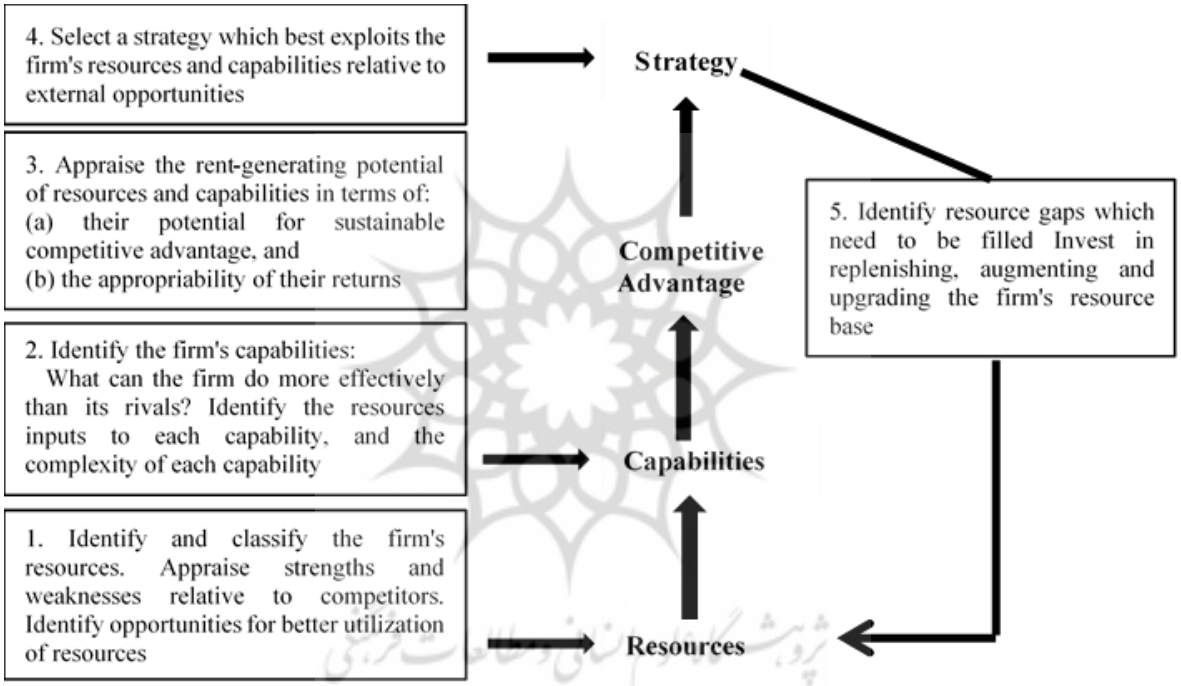

Figure 1

A resource-based approach to strategy analysis, a practical framework (Source: Grant, 1991, p. 115)

2.1. Resources

The idea that firms are bundles of resources and capabilities is the starting point of resource-based theory. It includes particular hypotheses proposing why it is sometimes challenging for a company to gain the same prominent economic value created by another, even when those firms function in nearly the same markets or industries (Barney et al., 2021). Bhandari et al. (2022) defined firms' resources based on improving efficiency and effectiveness by mentioning assets, capabilities, organizational processes, firm attributes, information, and knowledge, serving the great goal of efficiency and effectiveness of the firm called resources. The relationship between a firm's resources and sustained competitive advantage will be conceivable for the valuable, rare, inimitable, non-sustainable, and organized (VRIN-O) resources (Barney et al., 2021). Dorsche et al. (2016) stated resource theories and their contributions, as in Table 1.

Table 1

Summary of resource theories and the source of their contributions (Dorsche et al., 2016, p. 10)

Resource theory	Contribution
1. Key resource and multiple-component resource theories	Identify psychological resources people use to manage stress while achieving physical and mental well-being within a dynamic environment
2. Resource-based theory of the firm	Identifying resource characteristics that increase resource value (strength) and the potential to accomplish personal goals within a dynamic environment
3. Conservation of resources (COR) theory	A resource-adaption framework that describes how people maintain, protect, and retain their resources
4. Theory of selective optimization with compensation (SOC)	A resource-adaptation framework that describes how life stage influences the way people manage their resources
5. Resource exchange theories	Identifying resource exchange rules that govern the exchange of similar resources, including protecting economic and social resources during market transactions
6. Social resource theory	Proposes a framework for understanding the exchange rules that govern the interchange of economic and social resources

2.2. Capabilities

According to Konopik et al. (2022), organizations should gain the ability to represent their position in the value network and verify the value of co-creation and perfected assets that associates in the ecosystem can provide. Simplifying the distribution of knowledge in the organization and the value network to accredit the proper function of capabilities is done by capabilities in the organizational design theme. Resources and ability are required to create and conduct technical change, covering skills, knowledge, experience, and institutional structure; the connection is Wu and Wahlne's (2020) definition of capability. Resources and capabilities are only strategic and fundamental if they engender superior performance (Lorenzo et al., 2018).

By combining several economic and organizational theories, Kapoor and Aggarwal (2020) categorized the four theories to nominate the firm's efficiency to describe how firms in the current world obtain competitive advantages in turbulent, changing, and globalized markets.

A. Transaction-cost theory (1930s–1990s): Ronald Coase (1937), the forefather of transaction-cost theory, explained why firms create the inter-relationship between economic activities and their necessary related imperative costs.

B. Resource-based view (1980s–1990s): the supposition of the view was based on the fact that firm performance, competitive advantage, and growth are joined, and the founder of the view, Barney, defined the firm's resources as the sum of all assets, organizational processes, attributes, capabilities, information, and knowledge so that the efficiency and effectiveness can be led to.

C. Knowledge-based view (around 1996–2009): It was introduced by Robert Grant for the first time. The principal background of this theory is based on a firm's RBV, which means resource- and capability-based competitive advantages.

D. Dynamic capabilities theory (late 1990s–Now): The theory enlarged by David J. Teece at first unifies distinct substantial features of the economy of the current globe, including innovation, competition, and cooperation. The rational structure of the theory stands on the RBV because its central part is resources and capabilities.

According to the abovementioned, capabilities are considered valuable factors for contemporary firms' success because they can become competitive advantages.

2.3. Competitive advantage

By creating value and exposing itself to the same customers as competing firms, a firm's positional advantage (low-cost advantage, differentiation, and focus strategy) in the market will result in outstanding performance (Ofori and Appiah-Nimo, 2021). Fatonah and Haryanto (2022) argued that the index to motivate attaining noticeable performance is a competitive advantage, and the company improvement occurs with the acquired performance attained by a noted level of competitive advantage. Laari et al. (2017) explained that expanding different resources and capabilities is considered considerable support for companies to achieve competitiveness through operational efficiency and scaling down costs by integrating sustainability goals into corporate and operational strategies in manufacturing areas.

2.4. Strategy

Strategy can be defined differently. Strategy generally refers to the long-term activities of the organization to achieve the prearranged goals (Falahatgar et al., 2021). It is commonly created successively, concentrating on predictable and well-determined time visions (Schultz and Hernes, 2019). Referring to Porter's theory, Yazdani et al. (2022) declared that businesses must have a strategy to "survive" in a changing competitive world. Freedman (2013) argues that strategies can only exist if there is competition, since the core of any strategy lies in the interaction between synergy and tension. The fundamental role of strategy is to change the balance of power, and power creation is the primary probe of strategy (Khalifa, 2020).

3. Research methods

The research type is classified as descriptive, and the quantitative data are gathered for the analysis. In the meantime, it is an applied study. To discover which criteria will have the most significant impact on the international market's entry, a dual fuzzy DEMATEL–ANP method was implemented to calculate the significance. FDEMATEL was used to determine interrelations among the criteria, and the subcriteria and FANP were applied to prioritize the criteria and subcriteria, respectively.

3.1. Population and sampling

The population includes practitioners, experts, sales, business, and procurement managers in the eight Iranian steel pipe manufacturing companies producing gas and oil transit pipes. There were 13 individuals, at least 35, with 15 years of industry-related work backgrounds.

The non-probability judgmental sampling technique was used to identify the experts of the study because of the complicated and technical aspects of the issue.

3.2. Data-gathering tools

The pair-wise comparison questionnaires were designed for both study sections: FDEMATEL and FANP.

3.3. Consistency ratio

The critical point about the pair-wise comparison questionnaires is the consistency of every two-pair comparison to be recognized as acceptable. Calculations for the consistency ratio (CR) of the pair-wise matrices determine this. The CR represents to what extent the gathered data from the experts could be

reliable. To have acceptable pair-wise comparisons, the CR values should be ≤ 0.1. It is worth noting that the calculated values for all the criteria (transnational capabilities) and subcriteria of the research were ≤ 0.1.

3.4. DEMATEL

To rank or prioritize a limited number of options in light of criteria that may be incompatible with one another, multi-attribute decision-making (MADM) methods were developed (Estiri et al., 2021). DEMATEL was one of these techniques. DEMATEL, proposed by Gabus and Fontela through Geneva Research Center in 1972–1973 (Chen et al., 2015), has been recognized as a partially viable methodology for prioritizing criteria related to causal interrelationships between criteria (Zakeri et al., 2022).

In this study, fuzzy logic was intended to be used because the environment was uncertain, vague, and changing rapidly. In other words, fuzzy set theory eliminates ambiguity from the decision-maker's preferences (Taghavi et al., 2021). Therefore, FDEMATEL was used to determine the causal relationships between the criteria and subcriteria.

3.4.1. Fuzzy DEMATEL

In this research, a two-stage approach (FDEMATEL–FANP) was used to analyze the causal relationship and prioritize the transnational capabilities of the steel pipe manufacturers needed for the transit of gas and oil purposes. Before applying the two-stage approach, nine transnational capabilities had been identified using a grounded theory approach by Ashtari et al. (2022) based on experts' group opinions in a previous qualitative work.

DEMATEL transforms the interdependencies into a cause-and-effect group by using matrices. It also determines the critical factors of a complex structure system by an impact relation diagram. Thus, there exists a spectrum of linguistic expressions from "no influence" to "very high influence", as presented in Table 2 (Yadegari and Avakh Darestani, 2021). The fuzzy DEMATEL is used to inspect infixing for the vagueness of human judgments and expressions (Rostamnezhad et al., 2020).

Consider *m* criteria and *n* dimensions of criteria. Each dimension *k*, where $k = 1, 2, n$, consists of *mk* number of criteria as follows:

$$D_k = \{C_{k1}, C_{k2}, \dots, C_{k,mk}\}$$

The total number of criteria is $m1 + m2 + \dots + mn = m$. The inputs of the FDEMATEL are pairwise comparisons *of k* experts regarding the different degrees of "influence". The criteria/subcriteria are presented in Table 3.

3.4.1.1. Steps of Fuzzy DEMATEL

For complicated structures inspecting the model of relationships between influencing parameters and presenting a visual structural model as a cause-and-effect graph, DEMATEL is considered an appropriate technique (Yadegari Taheri et al., 2021). Based on those mentioned above, the practicability of the DEMATEL for our study in a fuzzy environment was applied by using the following steps taken from Razavi Hajiagha et al. (2021).

Table 2
Fuzzy linguistic scale (Kim et al., 2021)

Linguistic terms	Influence score	Triangular fuzzy numbers
No influence	0	(0,0,0.25)
Low influence	1	(0,0.25,0.50)
Medium influence	2	(0.25,0.50,0.75)
High influence	3	(0.50,0.75, 1)
Very high influence	4	(0.75,1.00,1.00)

Step 1: Designing appropriate fuzzy linguistic scale

A linguistic scale is given in Table 2, established for pairwise comparisons to define the different degrees of "influence" between criteria/subcriteria. Accordingly; the criteria/subcriteria indices are presented in Table 3.

Table 3

Criteria title, criteria index, and subcriteria index

Criteria (capabilities)	Criteria index	Subcriteria index
Marketing	C_1	C_{101}–C_{115}
Managerial	C_2	C_{21}–C_{29}
HR	C_3	C_{31}–C_{34}
Financial	C_4	C_{41}–C_{42}
Production	C_5	C_{51}–C_{52}
Standards and quality	C_6	C_{61}–C_{63}
R&D capabilities	C_7	C_{71}–C_{72}
Logistics capabilities	C_8	C_{81}–C_{83}
Interactions and counseling with government	C_9	C_{91}–C_{94}
Sum	9	44

Step 2: Extracting the fuzzy initial direct relation matrix

First, the arithmetic mean for all experts' opinions of the study was calculated by Equation (1):

$$Z = \frac{x^1 + x^2 + x^3 + \cdots + x^p}{p} \quad (1)$$

where p is the number of the experts and x^1, x^2, and x^p are the pair-wise matrices for the expert No. 1, No. 2, and No. p, respectively. Then, applying the sum of experts' opinions regarding the value of direct influences, which was determined in the previous steps, the fuzzy direct-relation matrix $\widetilde{D}$ is obtained by Equation (2) (Rostamnezhad et al., 2020):

$$\widetilde{D} = [\tilde{d}_{ij}]_{n\times n} \ , \quad where \ \tilde{d}_{ij} = (d_{ij}^{l} \ , \ d_{ij}^{m} \ , \ d_{ij}^{u}) \quad (2)$$

Note: The importance of criteria or subcriteria is determined, and the given values of the Saaty 1–9 scale are presented in Table 4.

Step 3: Defuzzification of the fuzzy initial direct relation matrix

Defuzzification is conducted using techniques such as Minkofsky's, center of gravity, and center of area. The center of area technique was used to defuzzify the fuzzy initial direct-relation matrices through Equation (3), presented in Table 5.

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

Step 4: Normalizing the defuzzied initial direct relation matrix

The defuzzified direct-relation matrices are normalized using Equations (4) and (5), as presented in Table 6. It is used in DEMATEL and other techniques to uniform the experts' responses based on the total mean of the data using Equation (6).

$$\tilde{N} = [\tilde{n}_{ij}]_{n \times n} \qquad i, j = 1, \ldots . n \tag{4}$$

$$\tilde{n}_{ij} = \tilde{d}_{ij} / \max_{1 \le i \le n} \sum_{j=1}^{n} u_{ij} \tag{5}$$

$$\bar{X} = K.\bar{A}$$

$$k = min\left[\frac{1}{max_{1 \le i \le \sum_{j=1}^{n} \bar{A}ij}} + \frac{1}{max_{2 \le i \le \sum_{i=1}^{n} \bar{A}ij}}\right] \quad i, j = 1,2 \ldots n \tag{6}$$

Step 5: Calculating the defuzzified total relation matrix

The defuzzified total relation matrix $\tilde{T}$ is obtained through Equation (7), where *N* represents the normalized matrix of the previous step, and *I* is the identity matrix.

$$\tilde{T} = N \times (I - N)^{-1} \tag{7}$$

On the other hand, the reverse of the normalized matrix is calculated first. Then, it is subtracted from the identity matrix. Finally, the normalized matrix was multiplied by the resulting matrix, and the defuzzified total-relation matrix was obtained, as shown in Table 7.

Before the next step is performed, sum of the rows and columns for the total matrix (*T*) is calculated by Equations (8) and (9):

$$\left(\tilde{D}_i\right)_{n \times 1} = \left[\sum_{j=1}^{n} T_{ij}\right] n \times 1 \tag{8}$$

$$\left(\tilde{R}_i\right)_{1 \times n} = \left[\sum_{i=1}^{n} T_{ij}\right] 1 \times n \tag{9}$$

Step 6: Constructing cause-effect diagram (causal diagram)

The causal diagram is calculated by mapping the dataset of the (R+C, R–C), supplying some understanding to make a decision. The horizontal axis (R+C) concludes sum of the influences on other factors and those received from other factors. The vertical axis (R–C) shows the subtraction of the influences on other factors and those received from other factors. A higher (R–C) value represents that

this factor has a more substantial influence on other factors than the influence it receives. The factor is an impact (cause) factor in case (R–C) > 0; thus, R > C. The factor will be an influence (effect) factor if (R–C) < 0, so R < C. Finally, the identified influencing factors are prioritized by applying the two-dimensional grid. The complexity of the problem will be easier to capture where the critical decisions should be made by employing the two-dimensional grid.

3.5. ANP

The ANP is a generalization of the AHP. Therefore, ANP is represented by a network rather than a hierarchy (Saaty and Vargas, 2006). Applying the multi-criteria decision-making is primarily incorrect and qualitative because it covers language preferences. The fuzzy logic was applied because of uncertainty, ambiguity, and rapid environmental changes. In the case of determining KSFs' weight and priorities according to experts' opinions, the ANP will be a well-designed technique for DEMATEL. Moreover, fuzzy numbers could be replaced by crisp numbers to handle the ambiguity and uncertainty of human judgments (Razavi Hajiagha et al., 2021). Using DEMATEL, in which interdependencies between groups (sets) of factors are determined more objectively, removed the lack of factors' interdependences in the ANP approach. A specified verbal comparison for decision-makers addresses another shortcoming of the ANP method prepared by the combined Fuzzy DEMATEL–ANP method, which is studying a large number of pairs for calculating the relative importance of those criteria with interdependencies to each other (Taghavi et al., 2021).

3.5.1. Fuzzy ANP

As explained earlier, ANP is recognized as a perfect technique for DEMATEL to determine KSF weights and priorities based on experts' ideas. The fuzzy numbers also fix the uncertainty of human judgments (Razavi Hajiagha et al., 2021). That is why the FANP technique was applied to prioritize the criteria and subcriteria of the study.

3.5.1.1. Steps of Fuzzy ANP

The ANP method prioritizes the elements, considering the dependence and independence between them (Yadegari Taheri et al., 2021). The influential weights of the criteria and subcriteria of the study were calculated by the following steps extracted from Cheng et al. (2021):

Step 1: Obtaining the relative importance of the criteria

Presuming that there are *N* element groups in the network layer, first take *eik* (*i*=1…*N*; *k*=1… *n*) in the element group *Ci* as the subcriteria to construct the element *ejl* (*j*= 1…*n*; *l* =1…*m*) to compare the relative importance of *eik*, that is, the judgment matrix, and the ranking vector $\left(W_{j1}^{(ik)}, W_{j2}^{(ik)}, \ldots, W_{jl}^{(ik)}, \ldots, W_{jm}^{(ik)}\right)$ calculated by the characteristic root method, and $\sum W_{ji}^{(ik)} = 1$. By analogy, the ranking vector of the elements in the element group *Cj* to all the elements in *Ci* can be obtained, so that the ranking matrix W_{ij} is calculated. W_{ij}= 0, in case the elements in the element group *Ci* are not affected by *Cj*, then:

$$W_{ij} = \begin{bmatrix} W_{j1}^{(i1)} & W_{j1}^{(i2)} & \ldots & W_{j1}^{(ik)} & \ldots & W_{j1}^{(in)} \\ W_{j2}^{(j1)} & W_{j2}^{(i2)} & \ldots & W_{j2}^{(ik)} & \ldots & W_{j2}^{(in)} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ W_{jl}^{(i1)} & W_{jl}^{(i2)} & \ldots & W_{jl}^{(ik)} & \ldots & W_{jl}^{(in)} \\ \vdots & \vdots & \vdots & \vdots & \ldots & \vdots \\ W_{:}^{(j1)} & W_{:}^{(i2)} & W_{:}^{(i2)} & W_{:}^{(ik)} & & W_{:}^{(in)} \end{bmatrix}$$

The importance of criteria or subcriteria is determined, and the given values of the Saaty 1–9 scale (or the reverse numerical value) as the control criterion using the experts' opinions are tabulated in Table 4.

Table 4
Saaty 1–9 scale table (Cheng et al., 2021)

Serial number	Importance level	Value
1	*i* and *j* are equally important.	1
2	The *i* element is slightly more important than the *j* element.	3
3	The *i* element is more important than the *j* element.	5
4	The *i* element is more important than the *j* element.	7
5	The *i* element is highly more important than the *j* element.	9
6	The *i* element is slightly less important than the *j* element.	1/3
7	The *i* element is less important than the *j* element.	1/5
8	The *i* element is less important than the *j* element.	1/7
9	The *i* element is much less important than the *j* element.	1/9

The fuzzy triangular linguistic scale for fuzzy ANP is used in Table 5 because of the fuzzy logic applied in this stage.

Table 5
Fuzzy triangular linguistic scale for fuzzy ANP (Zhang et al., 2021)

Saaty scale	Definition	Fuzzy ANP scale
1	Equal important	(1,1,1)
3	Weakly important	(1,3/2,2)
5	Fairly important	(3/2,2,5/2)
7	Strongly important	(2,5/2,3)
9	Important	(5/2,3,7/2)

Then, the inconsistency value of the judgments is calculated by the consistency ratio (CR). CR values smaller than 0.1 show reliability for consistency of the decisions; otherwise, the decision should be reviewed. The index and CR values are calculated by Equations (10) and (11).

$$CI = \frac{\lambda_{max} - n}{n - 1} \tag{10}$$

$$CR = \frac{CI}{RI} \tag{11}$$

The significant coefficients of the criteria were calculated after ensuring the consistency of the judgments. A method called "eigenvector" was applied for the calculations.

$$AW = \lambda_{MAX} W \tag{12}$$

where W represents the eigenvector, A is the pair-wise comparison matrix of the criteria, and λ_{MAX} is the maximum eigenvalue for the judgment matrix, calculated based on Equation (12) (Abedi Gheshlaghi et al., 2019).

Step 2: Obtaining the initial or unweighted supermatrix

The super-matrix *W* obtained by forming sub-blocks of the sorting matrix, where there are *N*×*N* such sorting matrices. Now, the core work of ANP is to solve the supermatrix:

$$W = \begin{bmatrix} W_{11} & W_{12} & \dots & W_{1N} \\ W_{21} & W_{22} & \dots & W_{2N} \\ \vdots & \vdots & \vdots & \vdots \\ W_{N1} & W_{N2} & \dots & W_{NN} \end{bmatrix}$$

Step 3: Obtaining the weighting supermatrix

Then, the weighting processing of the supermatrix is required to be performed, that is, comparing the element groups in pairs to obtain the judgment matrix. Then, the consistency test should be passed, and the normalized method obtains the eigen-root eigenvector.

Step 4: Obtaining the limit supermatrix:

The weighted hypermatrix (*W*) is obtained by $W=A\times W$. Finally, when; $W^{\infty} = \lim_{t\to\infty} - W^{t}$ exists, the limit supermatrix (W^{∞}) is obtained. Indeed, the limit matrix is obtained when the weighting matrix is multiplied by the limit. This limit matrix has the same values as the rows, and its best criteria or subcriteria have the most considerable final weight.

The stages of the research are shown in Figure 2.

Figure 2

Stages of the research

4. Findings

As discussed earlier, pair-wise comparison questionnaire 1 was used to collect data related to the causal relationships between the criteria and subcriteria for the first section of the study, DEMATEL (Software: Excel 2010). The pair-wise comparison questionnaire 2 was employed as a means of ranking the criteria and the subcriteria for the second section of the study, ANP (Software: Super decision Ver.: 2.1). Further, the logic fuzzy used for all calculations of both sections because of uncertainty, turbulence, and competitiveness of the environment. As the steps of FDEMATEL and FANP are discussed in detail, the research findings will be presented in this section based on the above steps.

4.1. FDEMATEL findings

Step 1: Designing an appropriate fuzzy linguistic scale. This step is conducted based on the related values, as discussed earlier in the research methods section.

Step 2: Extracting the fuzzy initial direct relation matrix. Table 6 presents the fuzzy initial direct-relation matrices of the criteria (capabilities) obtained by Equations (1) and (2).

Step 3: Defuzzification of the fuzzy initial direct relation matrix. Table 7 lists the defuzzified matrices of the fuzzy initial direct-relation matrices of the criteria by Equation (3).

Step 4: Normalizing the defuzzied initial direct-relation matrix. Table 8 tabulates the normalized defuzzified direct-relation matrices of the criteria calculated by Equations (4)–(6).

Step 5: Calculating the defuzzified total-relation matrix. Table 9 presents the normalized defuzzified direct-relation matrices of the criteria computed using Equation (7).

Table 6

Fuzzy initial direct-relation matrices of the criteria

	C_1	**C_2**	**C_3**	**…**	**C_8**	**C_9**
C_1	0,0,0	0.25, 0.50,0.75	0.25, 0.50,0.75	…	0.25, 0.50,0.75	0.25, 0.50,0.75
C_2	0.75, 1,1	0,0,0	0.75, 1,1	…	0.5, 0.75,1	0.75, 1,1
C_3	0.5, 0.75,1	0.25, 0.50,0.75	0,0,0	…	0.25, 0.50,0.75	0.5, 0.75,1
C_4	0.5, 0.75,1	0.5, 0.75,1	0.5, 0.75,1	…	0.25, 0.50,0.75	0.5, 0.75,1
C_5	0.25, 0.50,0.75	0.25, 0.50,0.75	0.5, 0.75,1	…	0.25, 0.50,0.75	0.5, 0.75,1
C_6	0.5, 0.75,1	0.5, 0.75,1	0.5, 0.75,1	…	0.25, 0.50,0.75	0.5, 0.75,1
C_7	0.5, 0.75,1	0.5, 0.75,1	0.5, 0.75,1	…	0.25, 0.50,0.75	0.5, 0.75,1
C_8	0.25, 0.50,0.75	0.25, 0.50,0.75	0.25, 0.50,0.75	…	0,0,0	0.25, 0.50,0.75
C_9	0.5,0.75,1	0.5, 0.75,1	0.25, 0.50,0.75	…	0.5, 0.75,1	0,0,0

Note: The initial direct-relation matrices for the subcriteria are obtained similarly.

Table 7

Defuzzified matrices of the fuzzy initial direct-relation matrices of the criteria

	C_1	**C_2**	**C_3**	**C_4**	**C_5**	**C_6**	**C_7**	**C_8**	**C_9**
C_1	0.000	2.632	2.913	2.449	2.711	3.000	3.000	2.711	2.711
C_2	4.000	0.000	4.000	3.722	3.224	2.449	2.449	3.464	4.000
C_3	3.720	2.449	0.000	2.711	4.000	3.000	3.224	2.000	3.464
C_4	3.000	3.000	3.224	0.000	4.000	3.224	3.224	2.913	3.000
C_5	2.711	2.711	3.000	3.464	0.000	3.224	2.711	2.213	3.224
C_6	3.464	3.464	3.000	3.464	3.722	0.000	3.464	2.711	3.000
C_7	3.224	3.000	3.000	3.000	3.130	3.464	0.000	2.632	3.224
C_8	2.000	2.213	2.213	2.449	2.060	1.682	1.682	0.000	2.000
C_9	3.224	3.722	2.711	3.464	3.224	2.711	2.711	3.130	0.000

Note: The defuzzification of the initial direct-relation matrices for the subcriteria was obtained similarly.

Table 8

Normalized defuzzified initial direct-relation matrices

	C_1	**C_2**	**C_3**	**C_4**	**C_5**	**C_6**	**C_7**	**C_8**	**C_9**
C_1	0.000	0.096	0.107	0.090	0.099	0.110	0.110	0.099	0.099
C_2	0.146	0.000	0.146	0.136	0.118	0.090	0.090	0.127	0.146
C_3	0.136	0.090	0.000	0.099	0.146	0.110	0.118	0.073	0.127
C_4	0.110	0.110	0.118	0.000	0.146	0.118	0.118	0.107	0.110
C_5	0.099	0.099	0.110	0.127	0.000	0.118	0.099	0.081	0.118
C_6	0.127	0.127	0.110	0.127	0.136	0.000	0.127	0.099	0.110
C_7	0.118	0.110	0.110	0.110	0.115	0.127	0.000	0.096	0.118
C_8	0.073	0.081	0.081	0.090	0.075	0.062	0.062	0.000	0.073
C_9	0.118	0.136	0.099	0.127	0.118	0.099	0.099	0.115	0.000

Note: The normalization for the initial direct-relation matrices of the subcriteria is obtained similarly.

Table 9

Defuzzified normalized total-relation matrix

	C_1	**C_2**	**C_3**	**C_4**	**C_5**	**C_6**	**C_7**	**C_8**	**C_9**
C_1	–0.0335	0.0621	0.1513	0.1144	0.0915	0.0106	0.0584	0.1378	0.1190
C_2	0.0074	–0.8360	0.0987	0.0682	0.0439	0.1216	0.1099	0.1018	0.1241
C_3	–2.6800	0.0367	–0.0178	–0.0139	0.0824	0.0371	0.0314	0.0439	–0.0048
C_4	0.1224	0.0654	0.0439	–0.0428	0.0992	0.0168	0.0614	0.1469	0.0656
C_5	0.0702	0.0241	0.0558	0.0814	–0.0314	0.0370	0.0691	–0.0359	–0.0251
C_6	0.1061	0.1120	0.0749	0.0556	0.1493	–0.0329	0.0939	–0.0061	0.0079
C_7	0.0969	0.0355	0.1215	–0.0151	–0.0244	–0.0152	–0.0135	0.0188	0.0301
C_8	–0.0171	0.0370	–0.0150	0.0344	0.0805	0.0373	–0.0184	–0.0078	–0.0067
C_9	–0.0088	–0.0114	–0.0040	0.0418	–0.0186	0.0428	–0.0054	0.0852	–0.0027

Note: The matrices for the subcriteria are obtained the same way using Equation (7).

The impact and influence values of the main criteria (capabilities) calculated by Equations (8) and (9) are listed in Table 10.

Table 10

Impact and influence values for criteria (capabilities)

Criteria	**D**	**R**	**D–R**	**D+R**
Marketing	0.429	0.499	–0.070	0.927
Managerial	0.546	0.451	0.094	0.997
HR	0.479	0.470	0.009	0.949
Financial	0.504	0.485	0.019	0.989
Production	0.447	0.514	–0.066	0.961
STD and QULY	0.517	0.440	0.077	0.956
R&D	0.481	0.434	0.047	0.915
Logistics	0.306	0.422	–0.116	0.728
Interactions and counseling with the government	0.488	0.482	0.006	0.970

The criteria with positive D – R are considered impactable on other criteria, and those with negative D – R values are recognized as impressible criteria from those listed in Table 10. Therefore, managerial, human resources, financial, standard and quality, R&D, and interactions and consultations with the government capabilities were considered impactable capabilities, and marketing, production, and logistics were recognized as impressive capabilities. Accordingly, the impact and influence values for the subcriteria are listed in Table 11.

Table 11

Impact and influence values for the subcriteria

Subcriteria	**D**	**R**	**D–R**	**D+R**
Marketing Capabilities				
Local and foreign demand management for gas and oil pipes	0.420	0.501	–0.081	0.920

Subcriteria	D	R	D–R	D+R
Market development	0.472	0.500	–0.028	0.973
Brand equity	0.504	0.464	0.040	0.967
Scientific and professional approach to marketing	0.492	0.485	0.007	0.977
After-sales services	0.456	0.445	0.010	0.901
The need to watch the competitors	0.498	0.483	0.016	0.981
The need for monitoring the customers' needs	0.481	0.485	–0.004	0.966
The necessity for knowing the customers' characteristics and situations	0.518	0.492	0.027	1.010
The necessity for recognition and features of the target markets	0.493	0.497	–0.004	0.990
Using services of professional brokerages in markets of the target countries	0.488	0.487	0.001	0.975
Marketing information system (MIS)	0.482	0.451	0.031	0.933
Product offerings	0.467	0.460	0.007	0.927
Cost-leading pricing strategy	0.504	0.499	0.005	1.003
To be robust and reliable enough to conclude an international contract	0.506	0.512	–0.007	1.018
Optimizing the export potential	0.487	0.507	–0.020	0.994
Managerial Capabilities				
The need for export strategic planning	0.9555	0.4598	0.4957	–0.036
Developing managers' communicative skills	0.8557	0.3925	0.4632	–0.071
Integrated management in the piping industry	0.9562	0.5179	0.4383	0.0796
Top management's positive attitude toward export	1.595	0.5316	0.528	0.0036
Top management stability	0.983	0.5283	0.4546	0.0737
External risk management	0.979	0.4943	0.4846	0.0097
Organizational structure reform	0.9386	0.432	0.5065	–0.075
Role of influential legal stakeholders for export	0.8747	0.4359	0.4388	–0.003
Coordination between human resources (HR) strategies and organizational strategies	0.934	0.4756	0.4583	0.0173
Human Resources Capabilities				
The necessity for paying much attention to HR	0.1347	0.1208	0.013896	0.255577
Using a suitable system for recruitment	0.104	0.1511	–0.04712	0.255154
HR training and development	0.1468	0.1135	0.033362	0.260337
Knowledge management database	0.1134	0.1136	–0.00013	0.226986
Financial Capabilities				
The need to reduce the total price of the products	0.305	0.179	0.126	0.484
Financing	0.179	0.305	–0.126	0.484
Production Capabilities				
Using modern technologies in production processes	0.265	0.230	0.035	0.495
Importance of nominal capacity in production	0.230	0.265	–0.035	0.495
Standards and Quality Capabilities				
American Petroleum Institute (API) standard	0.152	0.160	–0.008	0.312

Subcriteria	D	R	D–R	D+R
Quality management of raw materials and products	0.173	0.164	0.008	0.337
Importance of standards in the industry	0.173	0.173	0.000	0.345
Research and Development Capabilities				
Importance of research and development	1	0	1	1
Upgrading the technical knowledge industry	0	1	–1	1
Logistics Capabilities				
Optimization of transportation systems	0.323	0.594	–0.271	0.917
Supply chain management	0.507	0.302	0.205	0.809
Identifying suppliers for the raw materials and spare parts	0.551	0.486	0.065	1.037
Capabilities for interactions and counseling with the government				
Counseling with the government for export support happens	0.442	0.503	–0.061	0.945
Counseling the government to reform export regulations	0.397	0.456	–0.590	0.853
Counseling with the government to facilitate international barriers concerning financial transfers	0.555	0.475	0.079	1.030
Counseling with the government to find reasonable solutions for reducing the political barriers to export	0.491	0.451	0.040	0.941

Step 6: Constructing cause-effect diagram (causal diagram)

Calculating R, C, R – C, and R + D values aims to attain graphic causal diagrams. In this diagram, the horizontal axis shows D+R values, and the vertical axis presents the D – R values. Accordingly, the causal diagram for the criteria is presented in Figure 3. The arrows indicate the relationships between the capabilities. For instance, a two-way arrow shows a bilateral relationship between the two capabilities, e.g., managerial and financial capabilities. In this regard, the two capabilities are considered impactable since they mutually impact. Contrary to this, a one-way arrow represents a unilateral relationship, such as production and logistics capabilities, in which production is impactable, and logistics is considered impressible as it is affected by production. In addition, the related causal diagrams were created separately for all subcriteria of the capabilities in the same way.

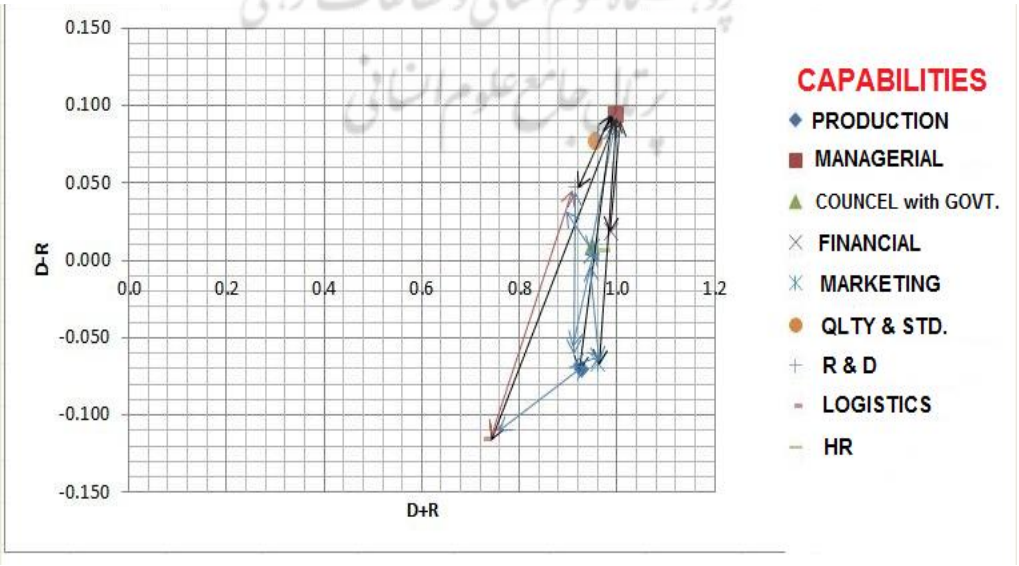

Figure 3

The causal diagram of the research criteria

4.2. FANP findings

Step 1: Obtaining the relative importance of the criteria. The importance of criteria or subcriteria is determined based on the values of the Saaty 1–9 scale, and the fuzzy triangular linguistic scale is used to obtain values of fuzzy ANP.

Consistency ratio: the CR values calculated by Equations (10) and (11) for all the criteria and subcriteria of the study were below 0.01, indicating an acceptable consistency for the judgment of the pair-wise comparisons.

Step 2: Obtaining the initial or unweighted supermatrix. The supermatrices were computed using the values obtained from the experts' questionnaires normalized and formed the fuzzy unweighted supermatrix listed in Table 12.

Table 12

Fuzzy unweighted supermatrices

	C_1	**…**	**C_9**	**…**	**C_{91}**	**C_{92}**	**C_{93}**	**C_{94}**
C_1	(0,0,0)	…	(0,0,0)	…	0.25,0.5,0.75	0.5,0.75,1	0.5,0.75,1	0.25,0.5,0.75
…	...	…	...	…	…	…	…	…
C_9	(0,0,0)	…	(0,0,0)	…	0.5,0.75,1	0.5,0.75,1	0.5,0.75,1	0.5,0.75,1
…	...	…	...	…	…	…	…	…
C_{91}	0.35,0.85,1	…	0.35,0.85,1	…	(0,0,0)	(0,0,0)	(0,0,0)	(0,0,0)
C_{92}	0.342,0.75,1	…	0.342,0.75,1	…	(0,0,0)	(0,0,0)	(0,0,0)	(0,0,0)
C_{93}	0.5,0.342,1	…	0.5,0.342,1	…	(0,0,0)	(0,0,0)	(0,0,0)	(0,0,0)
C_{94}	0.342,1,1	…	0.342,1,1	…	(0,0,0)	(0,0,0)	(0,0,0)	(0,0,0)

Note: After the fuzzy supermatrix is obtained, it will be defuzzified to simplify the following calculations.

Step 3: Obtaining the weighting supermatrix. the weighting supermatrix is calculated based on the matrix A' as follows:

$$A' = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1N} \\ a_{21} & a_{22} & \dots & a_{2N} \\ \vdots & \vdots & \vdots & \vdots \\ a_{N1} & a_{N2} & \dots & a_{NN} \end{bmatrix}$$

Step 4: Obtaining the limit supermatrix. The limit supermatrix (W^{∞}) is calculated by the relationships $W=A\times W$ and $W^{\infty} = \frac{lim}{t\to\infty} - W^{t}$. Then, the weighting supermatrices are multiplied seven times to compute the limit supermatrix. The final limit supermatrices are presented in Table 13.

Finally, the defuzzified weights of the criteria and subcriteria are calculated after the limit supermatrices are obtained. As shown in Table 14, the final weight of the criteria and subcriteria is calculated.

Table 13

Limit supermatrix

	C_1	**...**	**C_9**	**...**	**C_{91}**	**C_{92}**	**C_{93}**	**C_{94}**
C_1	0.012	...	0.012	...	0.012	0.012	0.012	0.012
…	...	...	...	...	...	...	...	...
C_9	0.043	...	0.043	...	0.043	0.043	0.043	0.043
…	...	...	...	...	...	...	...	...
C_{91}	0.026	...	0.026	...	0.026	0.026	0.026	0.026
C_{92}	0.019	...	0.019	...	0.019	0.019	0.019	0.019
C_{93}	0.027	...	0.027	...	0.027	0.027	0.027	0.027
C_{94}	0.042	...	0.042	...	0.042	0.042	0.042	0.042

Table 14

Final weights and priorities of the criteria and subcriteria

Criteria	**Weight**	**Priority**	**Subcriteria**	**Weight to Criteria**	**Priority to Criteria**	**Final Weight**	**Final Priority**
Marketing	0.225	1	Local and foreign demand management for gas and oil pipes	0.042	14	0.0393	5
			Market development	0.077	4	0.0465	1
			Brand equity	0.037	15	0.0195	23
			Scientific and professional approach to marketing	0.045	13	0.0256	13
			After-sales services	0.065	6	0.0105	44
			Need to watch competitors	0.058	8	0.0213	20
			Need to monitor the customers' needs	0.068	5	0.0165	31
			The necessity for knowing customers' characteristics and situations	0.046	12	0.0132	35
			The necessity for recognition and features of the target markets	0.056	10	0.0214	19
			Using services of professional brokerages in markets of the target countries	0.078	3	0.0393	6
			Marketing information system	0.054	11	0.0398	3
			Product offerings	0.063	7	0.0217	18
			Cost-leading pricing strategy	0.056	9	0.0131	36
			To be robust and reliable enough to conclude an international contract	0.164	1	0.0459	2
			Optimizing export potentials	0.091	2	0.0398	4

Criteria	Weight	Priority	Subcriteria	Weight to Criteria	Priority to Criteria	Final Weight	Final Priority
Managerial	0.073	8	Need for export strategic planning	0.093	8	0.0165	32
			Developing managers' communicative skills	0.055	9	0.0193	25
			Integrated management in the pipe manufacturing industry	0.117	3	0.0121	39
			Top management's positive attitude toward export	0.111	6	0.0115	42
			Top management stability	0.114	4	0.0109	43
			External risk management	0.169	1	0.0121	38
			Organizational structure reform	0.121	2	0.0146	34
			Role of influential legal stakeholders for export	0.112	5	0.0186	28
			Coordination between HR strategies and organizational strategies	0.108	7	0.0131	37
HR	0.035	9	Necessity to pay much attention to HR	0.201	4	0.0221	17
			Using a suitable system for recruitment	0.245	3	0.0186	29
			HR training and development	0.298	1	0.0234	16
			Knowledge management database	0.256	2	0.0299	10
Financial	0.081	7	Need for reducing the total price of the products	0.545	1	0.0241	15
			Financing	0.451	2	0.0193	24
Production	0.115	4	Using modern technologies in production processes	0.671	1	0.0276	12
			Importance of nominal capacity in production	0.329	2	0.0119	41
Standard and Quality	0.149	2	API standard	0.342	2	0.0193	26
			Quality management of raw materials and products	0.375	1	0.0361	8
			Importance of standards in industry	0.283	3	0.0174	30
R&D	0.123	3	Importance of research and development	0.578	1	0.0313	9
			Upgrading the technical knowledge industry	0.422	2	0.0285	11
Logistics	0.095	6	Optimization of transportation systems	0.365	2	0.0195	22
			Supply chain management	0.375	1	0.0199	21
			Identifying suppliers for raw materials and spare parts	0.260	3	0.0760	33

Criteria	Weight	Priority	Subcriteria	Weight to Criteria	Priority to Criteria	Final Weight	Final Priority
Interactions and consultations with	0.104	5	Counseling with the government for export support happens	0.208	4	0.0133	27
			Counseling with the government to reform export regulations happens	0.201	3	0.0121	40
			Counseling with the government to facilitate international barriers concerning financial transfers	0.279	2	0.0365	7
			Counseling with the government to find suitable solutions to reducing the political barriers to export	0.312	1	0.0251	14

5. Discussion

Although our study had no hypotheses, the main question was the order of priorities for transnational capabilities on international market entry. As considered in the findings (Table 14), the criterion of marketing capabilities (0.225) attained the top priority for the Iranian steel pipe manufacturers. The priorities included the following: the standard and quality, R&D, production, interactions, and consultation with the government, logistics, financial, managerial, and human resources capabilities. Marketing capabilities were expected to be one of the highest rankings because of their relationship to the central issue of international markets and exports, and they did so. Standards and quality capabilities were the second priority after marketing capabilities were explained briefly because of the significant impact of standards on steel pipes of gas and oil. The most critical sections included American Petroleum Institute (API) standards and quality management of raw materials and products. American Petroleum Institute is an American organization that issues standards related to gas and oil pipes. Gas and oil manufacturers need its certificate if their infrastructures are run based on API. This is recognized as a significant obstacle for a firm not having a valid certificate because customers mainly ask for it to ensure the quality of the products. Iranian pipe manufacturers are not updated with the API certificate because of international sanctions, which can be called a severe barrier to their exports. Quality management of raw materials and products plays a vital role in the quality of raw materials, considering quality standards in production, quality of products conformity with global/international classes, an improvement on competitive capabilities by promoting quality of the products, and so on.

On the other hand, other capabilities were expected to have better rankings, but the results showed contrariwise. Managerial and HR capabilities were the examples with the final weights of 8 and 9 out of 9, respectively. When it turns into a discussion about management or managerial capabilities, everyone confirms top management's crucial impact on firms' successes. Based on the results of our research for international markets, it appears slightly different than what can be seen in the country's domestic markets. The required improvements should include external risk management, management stability, lack of top management's positive attitudes toward export, and management's communicative skills. Human resources capabilities are considered the main assets of organizations around the world. Nevertheless, in the context of our research, it did not achieve a very high grade because it lacked the technical knowledge and work experience in international markets that we were looking for. It is worth noting that 6 out of 10 topmost subcriteria pertain to marketing capabilities, and of the 44 subcriteria, the top 10 received 40% of the total weight.

5.1. Managerial implications

Considering the limited resources and budgets of the organizations and severe emphases for cost reductions, one brilliant advantage for the top management level using the results of the research is the

ability to make better decisions on what extent the capabilities can be improved in the organization and if entering international markets is possible by recognizing priorities of transnational capabilities. Other important managerial implications could be as follows:

- Companies must identify and determine their priorities for marketing strategies before entering international markets.
- Firms must have been assessed by internationally known reliable companies from the quality and standards perspectives because the two factors play a vital role in their successful entry into the international markets.
- More budgets must be allocated for research and development as the critical innovation factors are required for success in the transnational markets.
- Upgrading the equipment and machinery must receive serious attention since they are crucial to fortifying the production capabilities as the frontline of the battlefield with the competitors.

5.2. Theoretical implications

The perceptual map technique is highly recommended to determine a firm's position in its industry. Indeed, this stage must be employed after prioritizing criteria and subcriteria. Further, the identification and prioritization of transnational capabilities are highly appreciated by future researchers in different industries such as airplane, vehicle, and service industries. Turn-key projects could be an excellent example of an operational case.

5.3. Limitations and suggestions for future research

Selecting experts was a significant limitation of the study because we needed qualified and experienced ones with access to updated information about the industry. Although it was done, it was difficult, time-consuming, and energy-intensive

International sanctions were another limitation, so researching outside could influence the results.

Nowadays, start-ups are used in a modern way to enter international markets, and it is highly recommended that the transnational capabilities of Iranian start-ups be prioritized in future research. Identifying and prioritizing transnational capabilities for service or technical/engineering sectors can be another suggestion for future research.

6. Conclusions

The most important priority was given to marketing capabilities, as discussed earlier. Our study included 15 subcriteria for marketing capabilities, with the 6 topmost out of 44 included in "market development" as the priority. It is the essence of marketing and is earned by factors such as the severe focus on export and product portfolio development. The second priority is "to be powerful and reliable enough to conclude an international contract". This is evident since the ultimate goal of marketing capabilities can be achieved when a marketing team wins a contract or project internationally.

Consequently, this will result in profitability, fame, and brand equity for the company. The third top priority was the "marketing information system", which can be covered by doing field studies before exportation, marketing research before entering international markets, paying accurate attention to information infrastructures, and preparing a comprehensive business package from the target markets. The fourth top-ranking subcriteria was "optimizing export potentials", which can be covered using interactive potentials of chambers of commerce, international exhibitions, and formal export channels. "Local and foreign demand management for gas and oil pipes" was the fifth. The subordinate factors to achieve this included anticipating the required international pipelines, monitoring the neighboring

countries' demands for gas and oil pipes, and considering the neighboring countries with the aim of solid exportation. The last subcriteria was recognized as "using services of professional brokerages in markets of the target countries". Using marketing companies in the target countries to present the firm and products and employing marketing consulting companies to accelerate sales affairs. Therefore, the top ranking of the marketing capabilities and its 6 subcriteria out of 10 top subcriteria are considered an undeniable confirmation expressing their need to pay more attention to marketing capabilities as the most brilliant and influential factor in the international market's entry by the Iranian manufacturers of gas and oil steel pipes.

Nomenclature

AHP	Analytic hierarchy process
ANP	Analytic network process
API	American Petroleum Institute
CR	Consistency ratio
FANP	Fuzzy analytic network process
FDEMATEL	Fuzzy decision making trial and error laboratory
FDI	Foreign direct investment
GOVT.	Government
HR	Human resources
KSF	Key success factor
MADM	Multi-attribute decision making
MCDM	Multi-criteria decision making
QLTY	Quality
R & D	Research and development
RBV	Resource-based view
SOC	Selective optimization with compensation
STD	Standard
VRIN-O	Valuable, rare, inimitable, non-sustainable and organized

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