

## Hybrid business offerings in small internationalisers

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DOI:

[10.1108/IMR-11-2021-0341](https://doi.org/10.1108/IMR-11-2021-0341)

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*Document Version*

Peer reviewed version

*Citation for published version (Harvard):*

Amoozad Mahdiraji, H, Abbasi-Kamardi, A, Jafari-Sadeghi, V, Razavi Hajiagha, SH & Castellano , S 2024, 'Hybrid business offerings in small internationalisers: a mixed-method analysis of internal capabilities through hesitant fuzzy information', *International Marketing Review*, vol. 41, no. 2, pp. 411-439.

<https://doi.org/10.1108/IMR-11-2021-0341>

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**Hybrid business offerings in small internationalisers: A mixed-method analysis of internal capabilities through Hesitant Fuzzy Information**

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### **Abstract**

**Purpose.** In this research, the initial list of internal capabilities in SMEs leading to success in international markets has been extracted. Then, the most relevant capabilities to international SMEs under servitisation and hybrid offerings have been screened. Next, the selected capabilities have been classified, and ultimately the relationship among the capabilities has been analysed. The conceptual model for SMEs participating in international markets with hybrid offerings has been illustrated.

**Methods.** A literature review has been employed to extract the initial list of internal capabilities to address the research objectives. Then, a novel Hesitant Fuzzy Delphi (HFD) method has been developed to select the most relevant capabilities for SMEs for hybrid offerings in international markets by using the experts opinions. Subsequently, a novel Hesitant Fuzzy Interpretive Structural Modelling (HFISM) has been developed to classify the capabilities, design a level-based conceptual model, and present the relationship among the prominent capabilities.

**Findings.** After the literature review, sixteen internal capabilities leading to success in the international market via hybrid offerings have been extracted. Then, eight selected capabilities were chosen for further investigation by applying 15 expert opinions and via the HFD approach. According to HFISM results, a level-based conceptual model was emanated, and “ability to take advantage of international opportunities”, “financial strength”, “technology level”, and “efficient innovation management” were considered as the most fundamental capabilities resulting in successful hybrid offerings in international markets.

**Originality.** Alongside the multi-layer decision-making approach developed in this manuscript to analyse the internal capabilities roles in hybrid offering success toward international markets, to the best knowledge of the authors, the hesitant fuzzy approaches developed in this article have not been previously presented by any other scholar. A novel hesitant fuzzy Delphi approach has been designed for consensus amongst the experts under uncertain circumstances. Furthermore, a novel hesitant fuzzy ISM has been suggested and employed in this research to comprehend the relationship among the internal capabilities.

**Keywords.** Servitisation; hybrid business offering; SMEs; international; mixed-method; Hesitant Fuzzy Information.

## **1. Introduction**

In recent years, the international business environment has emerged with revolutionary platforms, infrastructures, and technologies (Jafari-Sadeghi et al., 2021). As a result, firms have had to adapt their operations and processes with cutting-edge technologies and new trends (Tongur and Engwall, 2014) to satisfy the ever-evolving demands of their customers in national and international markets. This transformation has led to significant changes in firms' critical operations, such as offerings, processes, managerial decisions and practices, and marketing management (Raddats et al. 2019). Hence, innovativeness has become a fundamental characteristic of business models that provides a competitive advantage for international firms (Cassiman and Golovko, 2011) by increasing the firm's flexibility while reduction of financial production costs (Lefebvre et al., 1991). Literature builds on the dichotomy of product and process innovation and highlights that new knowledge and novel initiatives can uplift firms international operation and marketing performance (Alegre and Chiva, 2008; Raymond and St-Pierre, 2010; Vrontis and Christofi, 2021). Accordingly, contemporary business models have striven to enable manufacturing-centric firms to generate additional value by providing services (Baines et al., 2020).

This shift of traditional manufacturers toward the combination of goods and services refers to the notion of business 'hybrid offerings' (Ulaga and Reinartz, 2011), which is different from pure manufacturing or pure service offerings (Gebauer et al., 2011). Similarly, 'servitisation' refers to the extent to which good-oriented firms generate value and income through service (Baines et al., 2017). Indeed, a good-centric firm can provide various services such as maintenance, training, and customer support agreements to cover either products or customers (Baines and Lightfoot, 2013, Eggert et al., 2014). Consequently, hybrid offerings constitute a wide range of benefits, such as creating new streams of income generation and revenue growth (Baines and Lightfoot, 2013, Eggert et al., 2014; Vendrell-Herrero et al., 2018; Liu et al., 2019), enhancing the innovativeness of offerings (Eggert et al., 2011), addressing more responsively the needs of customers (Ostrom et al., 2010), improving the brand attractiveness and customer loyalty (Gaiardelli et al., 2014; Sacconi et al., 2014; Li et al., 2018), and increasing offering advantages in highly competitive markets (Oliva and Kallenberg, 2003; Durugbo, 2014).

This is particularly important for their international marketing activities since they can leverage different offerings not only to attract new consumers and open a niche market in foreign countries but also to retain less loyal consumers by providing better services related to their goods and differentiating themselves from other international competitors. Indeed, internationalisation is seen as an achievement that causes the corporate to operate much better and have a more desirable performance (Vendrell-Herrero et al., 2021). Although very little attention has been paid to this, the extent to which SMEs leverage servitisation to enter international markets is crucial to explore (Younis and Elbanna, 2022). Since international entrepreneurial SMEs usually start their activities using restricted resources, their internationalisation process is likely to be highly risky (Mostafiz et al., 2021). It is also a phenomenon affected by culture (Griffith et al., 2021); thus, it should be carefully studied, and the business model will play a significant role in this regard.

Literature has increasingly explored how organisations successfully deploy a combination of goods and services in their offerings (e.g., Tabares, 2021). For instance, focusing on the role of digital transformation, Tronvoll et al. (2020) and Kohtamäki et al. (2020) found that advanced technologies drive manufacturing firms toward offering new services. However, extant research has mainly disentangled the strategic organisational changes and antecedents of servitisation (Paschou et al., 2020; Rabetino et al., 2018), whereas limited studies have explored its international dimension (Baines et al., 2017). Moreover, the literature has been dominated by research on large and multinational enterprises (MNEs) (Bustinza et al., 2017). There is little known about small and medium-sized enterprises (SMEs), which suffer from limited access to resources (Jafari-Sadeghi, 2021) but strive to explore international opportunities by adapting hybrid business models and providing new offerings. Yet, small internationalisers must develop distinct capabilities to provide hybrid offerings for international markets, which have been under-investigated by literature. Therefore, this paper aims to explore and examine SMEs' internal capabilities contributing to their international hybrid business offerings and is set to propose a framework for appraising product-service adaption possibilities in new markets.

To address our objectives, the authors have employed a mixed qualitative-quantitative methodology to synthesise the findings on SMEs in Iran (as a representative of emerging markets). First, a set of internal capabilities affecting SMEs' hybrid offerings in international

markets is identified by systematically reviewing the literature. Then, using a novel and modified hesitant fuzzy Delphi (HFD) method, the most agreed factors amongst the international entrepreneurs are extracted. These factors are then evaluated, classified, and weighted. Furthermore, the relationship amongst these factors is achieved via a modified hybrid hesitant fuzzy Interpretive structural modelling (ISM) and “Matrice d'Impacts Croisés Multiplication Appliqué an Classement” (MICMAC) approach as HFISM-MICMAC for the first time. The realm of studies on product adaption is mainly based on the symmetric statistical correlation method. Thus, the main novelty of the current study is to provide an assessment tool considering the uncertainties of product adaption under hesitant fuzzy sets (HFs) theory to find a more granular evaluation of product adaption possibility.

The authors have explored SMEs' international hybrid offerings' most essential but inclusive internal capabilities in Section 2. This is followed by the methodology section highlighting the hybrid decision-making-mathematical modelling in Section 3. After presenting the research findings in Section 4, the authors discussed the contributions by detailing the theoretical and practical implications in Section 5. Subsequently, the last section concludes the paper, addresses the research's limitations, and proposes potential areas for further studies.

## **2. Literature Review**

### **2.1. Hybrid Offering vs. Pure Offerings**

In the past, firms were divided into two groups (i) manufacturing and (ii) service (Choo et al., 2021). Manufacturing firms are firms whose processes lead to the production of goods, while service firms afford services as a product to customers. Over time, manufacturing firms moved to furnish services additionally. This hybrid offering complemented the firms' production process in the first place. As an illustration, services such as transportation, installation, maintenance, repairs, etc., complete firms' production processes (Schaarschmidt et al., 2021). In the second place, these services and goods generated revenue for firms and consolidated their position in current emerging markets (Ulaga and Reinartz, 2011). Therefore, this combination of responses to the developing competitive markets satisfies customers' needs and increases the product's life (Schaarschmidt et al., 2017).

## 2.2. Servitisation

Servitisation refers to adding value to core corporate offerings by extending services in a manufacturing company (Vandermerwe and Rada, 1988). While Vandermerwe and Rada introduced it, it was globally known and employed by Baines et al., 2009. According to Davies's (2004) suggestion, to achieve an excellent solution for customers, the goods and services should be successfully combined (Davies, 2004). Thus, there is a definition for the present offered solution that emphasises this combination that leads to a more effective utility for customers instead of separated elements of solution such as product and service. The term “combined solution” illustrates the importance of integration toward servitisation (Valtakoski, 2017; Sawhney, 2006). The servitisation necessitates two central pillars, including (i) the customer firm, which looks for enhancement in operations and performance using an optimal solution, and (ii) the manufacturing partner who provides and presents the solution (Valtakoski, 2017). In essence, this means that manufacturers transform a product-based business model to a service-based business model to provide more added value for themselves and their customers (Paschou et al., 2020; Raddats et al., 2019). This term can be considered a competitive strategy for manufacturers (Baines et al., 2009). Some experts believe that service can provide more demand for related goods, and these two activities shouldn't be separated; hence, both are essential for well-known manufacturers to improve and succeed (Ariu et al., 2020). In recent decades, about 70% of manufacturers have employed new combined business models, and the innovativeness service behaviour caused almost 30% of their revenue. (Vendrell-Herrero et al., 2018). However, it is common to replace these two terminologies, (i) operations-led servitisation and (ii) marketing-led service infusion, to indicate the service transition marketing (Kowalkowski et al., 2017). Servitisation emphasises relationships and interactions (Liu et al., 2019). Zhang et al. (2022) found that servitisation increases the power of corporates in the market dimension. Offering the integration of products and services provides a long-term, specific, and convenient concept to deal with rivals in developing countries (Baines et al., 2009). Therefore, this subject is extensively noticed by practitioners and researchers for more debates and communications (Kowalkowski et al., 2017). Numerous actors play a crucial role in servitisation, as demonstrated in Figure 1.

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Please insert **Figure 1** here  
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Servitisation has been studied from various points of view, for instance, financial (Neely, 2008) consequences (Neely, 2008) and future challenges (Baines et al., 2009). Similarly, some scholars pinpointed the challenges of servitisation through a literature review methodology (Zhang and Banerji, 2017). They extracted five strings of challenges with negative and detrimental impacts on servitisation. Moreover, Rabetino et al. (2017) have drawn a strategy map of servitisation (Rabetino et al., 2017). On the other hand, in 2017, some scholars investigated the interrelated vital concepts, including (i) servitisation, (ii) service infusion, (iii) deservitisation, and (iv) service dilution (Kowalkowski et al., 2017). Digitalisation is also a highlighted topic studied by this concept (Kohtamäki et al., 2020; Paschou et al., 2020). Recently, some scholars studied the relationship between servitisation, sustainability, and customer satisfaction in B2Bs (Chaney et al., 2021). Recently, Davies et al. (2022) also presented a systematic review and future agenda for the supply chain and logistic systems roles in servitisation (Davies et al., 2022). Because globalisation is happening rapidly, servitisation in international markets is a significant issue to pay close attention to. In addition, servitisation is not limited to large companies. It also includes SMEs. In the following, these two views are discussed in more detail.

### **2.3. Servitisation in International Markets**

Companies have always focused on presence in international markets (Chatterjee et al., 2021; Martín Martín et al., 2021; Vrontis and Basile, 2022). Expanding the business beyond domestic borders brings unparalleled benefits to firms. In addition to leading to potential markets (Charitou and Panayides, 2009; Switzer and Tahaoglu, 2015), it also provides opportunities to build collaborative networks (Falahat et al., 2021) and ultimately increase competitiveness. In addition to the highlighted benefits of entering international markets, some major threats and challenges must be addressed (Oguji and Owusu, 2021; Vrontis et al., 2022). Solving these challenges requires focusing on the company's internal and external capabilities. A critical point that has not been considered in previous research is that the presence in international markets is not limited to pure offerings but includes hybrid offerings. Hence, servitisation in international markets has not been studied in detail.



### 3. Methodology

This research has been implemented in three phases: reviewing the literature, initial screening and relationship extraction. These phases and their appropriate steps are illustrated in Figure 2. The hesitant fuzzy approach developed for the Delphi and ISM is novel to the best knowledge of the authors. The preliminaries and basic operations are presented in Appendix A, and the basics of Delphi and ISM are explained in Appendix B.

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**Phase 1. Literature Review.** To identify the various capability dimensions, literature was reviewed. The results were elaborated in Table 4, demonstrating sixteen dimensions of capability for servitisation in international SMEs.

**Phase 2. Initial Screening via Hesitant Fuzzy Delphi (HFD).** Delphi is integrated with hesitant fuzzy sets to consider the uncertain condition of the international markets. The Delphi method has been widely used and employed by many scholars in different areas since 1975 (Linstone and Turoff, 1975). Since then, scholars have implemented many developments on the classical Delphi method to make it more practical and reliable for uncertain conditions. In this regard, Fuzzy Delphi (FD), Intuitionistic Fuzzy Delphi (IFD) (e.g., Roy and Garai, 2012), HFD (e.g., Liao et al., 2019), etc. were developed to use more reliable information while deciding unpredictable circumstances. Using experts' opinions while there are capable of sharing their opinion is attractive, especially if they can share their hesitation. For instance, if an expert determines the values of “X”, the following point is how much this expert is sure regarding their evaluation and how hesitant the expert is. Thus, developing the Delphi methodology while allowing experts to share their hesitation is essential for more reliable and robust results. Due to the high number of capability dimensions, experts were asked to select the most effective capability dimensions (Amoozad Mahdiraji et al., 2021). In this regard, a questionnaire is distributed among ten experts to collect their opinions on the effectiveness of 16 capabilities dimensions. According to the literature, the main point regarding selecting Delphi panel members is to select knowledgeable people in the field of study (Grisham, 2009).

Experts in this study have been elected by industry activists and academicians in the internationalisation of product-service hybrid offers. These experts have 5 to 20 years of experience in this area. In addition, they are at least 26 years old and have at least a bachelor's degree. The sample size and respondent numbers are the sources of debate amongst the decision-making and operations research experts (Kasanen et al., 2000). In a nutshell, there is no strict answer to this issue, and based on the type and scope of the research, the number of criteria and alternatives, the complexity of the problem, etc., the required sample size might change (Saaty and Ergu, 2015). Dealing with intangible and qualitative indicators, some researchers believe that due to critical enterprise decisions, opinions from a small group of key executives based on their experience and intuition are sufficient for generating reliable and valuable results (Chen et al., 2021).

Consequently, since 2000, many scholars have applied decision-Making approaches to their research with few participants (e.g., 2-4 experts (Du et al., 2022, five experts (Shih, 2008), six experts (Kasanen et al., 2000)). Contrary to statistical analysis and simultaneously dealing with uncertainty and intangible indicators, decision-making approaches are beneficial in areas such as entrepreneurship and international business (Carayannis et al., 2021). Some scholars believe that between 2-10 experts are sufficient as more than ten experts would result in inconsistency and disagreement as they are all executive and eligible experts in their field. While there is no agreement about panel size in Delphi, several studies used a panel size of 10 experts (De Vet et al., 2005; Eubank et al., 2016; Avella, 2016). The profile of the experts is illustrated in Table 1. Note that the scholars briefly introduced the approach, research objectives and how to complete the HF Delphi questionnaire. Each expert spent an average of 80 minutes completing the questionnaire. Then the following steps were implemented.

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**Step 1.** Experts evaluated the presence of each capability dimension by electing some of the linguistic terms in Table 2, designed by the authors. The experts were allowed to select one or more than one of these linguistic terms according to their personal preferences and intuition.

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**Step 2.** The score of each capability dimension for each expert was determined by Eq. (9) (Appendix A).

**Step 3.** The average and standard deviation (S.D.) of experts' scores for the  $i^{\text{th}}$  capability dimension were computed via Eqs. (1) and (2) according to hesitant fuzzy linguistic term sets (HFLTS) (Amoozad Mahdiraji et al., 2021).

$$M_i = \frac{1}{m} \sum_{k=1}^m s(h)_{ik} \quad (1)$$

$$\sigma_i = \sqrt{\frac{\sum_{k=1}^m (s(h)_{ik} - M_i)^2}{m}} \quad (2)$$

It is notable that in Eqs (1) and (2),  $s(h)_{ik}$  is the score of  $i^{\text{th}}$  capability dimension found on the opinion of the  $k^{\text{th}}$  expert. Additionally,  $m$  states the number of experts who participated in this research.

**Step 4.** To check the consensus of the opinions in each round of HFD, the average of the S.D.s was measured via Eq. (3) (Rezaei et al., 2021).

$$\sigma_M = \frac{1}{n} \sum_{i=1}^n \sigma_i \quad (3)$$

Note that in Eq. (3),  $n$  is the number of the capability dimensions. If this average is less than the threshold of 0.25 (distance between the values of two linguistic terms), then the consensus is achieved, and HFD is accomplished. Otherwise, experts are asked to express their modified opinions in another round.

**Step 4.** Eventually, the capability dimensions with an average score of 0.7 or more (threshold value) were screened and selected for further analysis.

**Phase 3. Hesitant Fuzzy Interpretive Structural Modeling (HFISM).** Many scholars have frequently used the ISM-MICMAC classical version to analyse the relationship amongst a group of elements and how to classify them (e.g., Iqbal et al., 2021). Furthermore, many scholars have developed this method to make it more practical and suitable for uncertain situations with non-deterministic values and numbers, such as Fuzzy ISM-MICMAC (e.g., Desingh, 2022). To the best knowledge of the authors, this research has applied the combination of the hesitant fuzzy sets with ISM for the first time. Hence, two panels of experts (the same members who participated in the HFD phase) have been elected to share their opinions. ISM is an expert-based sampling method to capture the casual relationship among a set of factors (Rahimi et al., 2020; Zarghamfard and Meshkini, 2022). No general criteria are proposed to select a group of experts for participating in the ISM process. The main point in selecting experts is their expertise in the field. Furthermore, different experts are used in various studies, with a median number of 11 experts (Ahmad and Qahmash, 2021). Considering the Delphi panel's expertise and the number of experts, the same panels are used to gather their opinion in this phase. They could select more than one relation in the condition of hesitation amongst the dimensions. In the following, the steps of HFISM are described. Similar to the first round of data gathering, in this phase, the scholars defined the process in 30 minutes, and each panel spent an average of two hours completing the HFISM questionnaire.

**Step 1.** The structural self-interaction matrix is formed with the opinions of two panels of experts (According to Table 1). In this regard, each panel determines the relationship between the two capability dimensions  $i$  and  $j$  based on the relationships in Table 3 (Appendix B). If in doubt, experts can select several relationships to evaluate the effectiveness of the capability dimension.

**Step 2.** The Initial Reachability Matrix (IRM) is formed according to the values indicated in Table 3 (last column) and Step 2 of the ISM method in Appendix B. It is noticeable that there can be more than one value in an array of the matrix due to the hesitation level of the experts.

**Step 3.** The score of each panel's matrix was computed by Eq. (9) (Appendix A). The final reachability matrix (FRM) was constructed on the two panels' average score (arithmetic mean).

Then, the transitivity analysis rule is implemented for the final check (Step 3 of the ISM method in Appendix B).

**Step 4.** The driving and dependence power of the dimensions were computed via Eqs. (10) and (11) (Step 4 of the ISM method in Appendix B).

**Step 5.** According to Step 5 of the ISM method in Appendix B, an ordered pair in this modified version was designed by the authors to determine the antecedent (input), and reachability (output) sets as follows  $ISM\ Pair\ (A\&R) = \{(capability\ dimension, degree\ of\ input\ or\ output\ from\ FRM)\}$ . Here, the first element presents the capability dimension ID, and the second is the degree of the output or input emanating from the FRM. However, the minimum degree of output and input was used for the intersection sets as  $ISM\ Pair\ (I) = \{(capability\ dimension, minimum\ degree\ of\ input/ output\ from\ FRM)\}$ . Note that A, R, and I stand for antecedent, reachability, and intersection sets.

**Step 6.** The dimensions were levelled, and the relationship between them was drawn according to the values of the FRM. Eventually, the MICMAC classification of the factors was achieved (according to the MICMAC method in Appendix B).

#### 4. Results

Servitisation is an efficient strategy for developing countries that has been neglected so far (Marjanovic et al. 2018). Paying attention to this sector can benefit these countries in the development path. In international markets, hybrid offerings can significantly improve the production performance gap and contribute to global growth (Baluch et al., 2017). The developing economies make up 82% of the world's population, raising their global output share from 20% in the 1990s to more than 30% in 2009 (European Central Bank, 2010). According to the World Bank, Iran's economy is emerging slowly (Khalil, 2022).

For this reason, this country is one of the economies whose study can become a benchmark for the study of other developing countries. In 2017, Iran's services exports amounted to \$9.8 billion, ranking 53<sup>rd</sup> among 145 countries (OEC). The sum of these reasons has caused Iran to be selected as a growing economy as the subject of the present study.

In the first step, by reviewing the literature, a list of firms' capabilities affecting SMEs' hybrid offerings in international markets was provided and mentioned in Table 4. SMEs, as well as

large companies, can benefit from servitisation. According to Aquilante and Vendrell-Herrero's study on over 4000 German SMEs, many selling a package of products and services operate more efficiently and productively (Aquilante and Vendrell-Herrero, 2021). Therefore, this issue should be considered in these companies. So far, preliminary research has investigated this area. Rapaccini et al. (2019) studied the role of strategic alliance in servitisation of SMEs (Rapaccini et al., 2019). Furthermore, Chalal et al. (2015) proposed a decision aid to offer operational support for the servitisation of industrial SMEs (Chalal et al., 2015). In addition, Peillon and Dubruc (2019) investigated the barriers to digital servitisation through the case study of French manufacturing SMEs (Peillon and Dubruc, 2019). It should be noted that the research gap in this field is quite apparent. In the current research, an attempt has been made to indicate some of its dimensions. Numerous types of research have been conducted on firms' internal capabilities (e.g., Coreynen et al., 2020; Salim et al., 2019; Tunyi et al., 2019), but restricted studies have been concentrated on these capabilities for servitisation such as (Agyei-Boapeah et al., 2019). Accordingly, literature has been studied to extract the SME's capabilities. The extracted capabilities are then justified with servitisation in international markets. Table 4 demonstrates the results of this review.

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As illustrated in Table 4, sixteen capability dimensions are extracted and asserted. These dimensions are an essential part of the capabilities discussed in this study. These capabilities are a highlighted actor in servitisation, as mentioned in Figure 1. various investigations have been implemented in servitisation. Some of these researches are presented in Table 5.

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From a technical point of view, analysing previous research demonstrates that most of them have been implemented qualitatively or statistically. A few types of research have applied a quantitative framework, for instance, Multiple criteria decision-making (MCDM) techniques, e.g. (Legault et al., 2019). In contrast, this research employs a hybrid literature review-MCDM framework to achieve accurate results and comprehensive achievement. The literature review

provides an initial list of SMEs' internal capabilities for servitisation in international markets. However, identifying which of these capabilities is relevant to SMEs, how they are interconnected, and what the importance and value of each capability are questions that require quantitative analytics to answer. As a result, the hybrid uncertain decision-making approach has been employed after the SLR to support and respond to research questions. Despite vast employment, this process is still complex and uncertain (Vendrell–Herrero et al., 2018). In addition, the proposed framework considers the condition of uncertainty using hesitant fuzzy values. The study of an issue related to international markets has various doubts that have been addressed in this way. HFD and HFISM approaches developed in this article are novel and have not been used previously to the best knowledge of the authors.

Moreover, previous researchers have not concentrated adequately on the actors of servitisation mentioned in Figure 1. In addition, large companies have been studied more than SMEs. Furthermore, servitisation has not been considered for international markets well. Current research reviewed the literature to extract the internal firms' capabilities and justified them for SMEs' servitisation in international markets.

**Hesitant Fuzzy Delphi.** In the second phase, experts described in Table 1 were asked to determine the effect of each firm's capability on SMEs' hybrid offerings in international markets by linguistic terms in Table 2. These terms were then transferred into numbers, as elaborated in Table 2. Due to hesitation, experts were allowed to select multiple terms to express their opinions. Subsequently, each expert's opinion score was calculated by Eq. (9) (Appendix A). In the following, the average and standard deviations of the scores were measured by Eqs. (1) and (2), respectively. The results are illustrated in Table 6.

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Out of the 16 identified capability dimensions extracted from the literature review, eight effective ones with a final score of greater than 0.7 are screened by HFD and highlighted in grey. The HFISM approach further investigated these selected factors/capabilities. However, to control the reliability of the screened factors and to measure the consensus amongst the experts, the

standard deviation of responses (SD) from the experts for each dimension was measured. As a result, the average SDs was nearly 0.23, less than the acceptable threshold (0.25). Hence, responses reached a consensus, and HFD obtained the list of required capabilities in the first round.

**Hesitant Fuzzy Interpretive Structural Modeling.** Hesitant ISM analysed the screened capability dimensions of Table 6 achieved by HFD. In this regard, two panels of experts determined the relationship between the capability dimensions (according to Table 3). Like HFD, each panel could have expressed their opinions through multiple relations. Each panel spent nearly two hours completing the HFISM questionnaire. The score of each panel was attained by Eq. (9) (Appendix A), and the average of the panels' opinions was measured by applying the arithmetic mean. Eventually, the FRM was constructed as in Table 7.

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In Table 7 and by implementing the ISM methodology (transitivity rule), the FRM has been achieved. The values of this table indicate that there are some strong relations between internal capabilities (value 1), some weak relations (value 0 and 0.25), and some moderate impact between capabilities (value 0.5). Next, the input, output, and intersection set with their degrees were obtained, as discussed previously in the methodology section (Step 5 of phase 3). Accordingly, the results are presented in Table 8.

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According to Table 8, five levels of the capability dimensions were emanated. This indicates that the HFISM algorithm was repeated five times until these levels emanated. The last column of Table 8 indicates in which run of the algorithm the dimension was allocated to a specific level. For instance, dimension 3, “financial strength” was allocated to level four in the fourth run of the algorithm. The reachability (output) indicates the values of 0.5 or above in a specific row of



FRM, and the antecedent (input) represents the factors that scored 0.5 or above in the columns of the FRM. The intersection degree also illustrates the minimum output/ input degree in reachability and antecedent sets. These levels are also depicted in Figure 3.

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Please insert **Figure 3** here  
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Notice that in Figure 3, the horizontal axis, vertical axis, and the size of bubbles indicate the level of the capability dimension, number of intersection elements, and shared degree of the dimensions according to HFISM methodology. As it is clear from Figure 3, C<sub>1</sub>, the “ability to take advantage of international opportunities” is the most fundamental dimension, and alongside the C<sub>2</sub> “efficient innovation management”, C<sub>5</sub> “technology level”, and C<sub>3</sub> “financial strength” results in C<sub>4</sub> “strong and efficient collaboration networks” and C<sub>7</sub> “highly competitive advantage”. Eventually, all together results in the primary target, which is more C<sub>8</sub> “experience of presence in international markets”. In addition, the relationships of the dimensions are elaborated in Figure 4. Tables 6 and 7 show that only relationships with the value of 1 have been used in level-based conceptual model design.

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Please insert **Figure 4** here  
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**MICMAC Analysis.** MICMAC analysis is implemented to classify the capability dimensions into four groups autonomous, dependent, linkage and independent. In this regard, each dimension's driving and dependence power is computed by Eqs. (10) and (11) (Appendix B). The results are described in Table 9.

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Please insert **Table 9** here  
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According to Table 9, the “ability to take advantage of international opportunities” scored the highest driving power. On the other hand, the “Capacity to respond to customer needs” and

“Experience of presence in international markets” received the highest dependence power. This indicates how reliable the findings are as the capabilities and abilities are the main drivers, and responding to customers is a dependent factor. Found on driving and dependence power mentioned in Table 9, the categories of capability dimensions were obtained as illustrated in Figure 5.

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Please insert **Figure 5** here  
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As depicted in Figure 5, four dimensions were independent, three dimensions were dependent, and one dimension was classified as autonomous. Notably, none of the dimensions were linkage factors.

## **5. Discussion and Implications**

In this research, a mixed qualitative-quantitative method has been provided to (1) identify the internal capabilities for servitisation of SMEs, (2) justify them with the condition of servitisation in international markets, (3) determine the most significant dimensions and (4) analyse the relationships between them. Therefore, a literature review was conducted to recognise the various capability dimensions of SMEs. The extant research (e.g., Tunyi et al., 2019; Salim et al., 2019) has explored the internal capabilities of the firms regardless of their impact on the international marketing perspectives or their role in the servitisation decision of the firms. However, the main contribution of this paper joins the pioneering research that investigates scant studies of what drives young and entrepreneurial SMEs to undertake servitisation strategies for their subsequent international market expansion successfully. The literature highlights that servitisation is a competitive strategy for manufacturers (Baines et al., 2009) to create demands for their novel services and increase those for their current related goods (Ariu et al., 2020). Hence, servitisation serves as a strategy that enhances the marketing capacities of firms, particularly in international operations. In this vein, the contribution of our research disentangles the largely ignored debate of what internal capabilities make SMEs servitise in their international marketing activities.

In exploring internal capabilities towards SMEs' servitisation, we identified sixteen dimensions tailored to the study area demonstrated in Table 4. As these dimensions have been taken from various sources, experts have been asked to finalise the most critical dimensions. Hence, a modified HFD was implemented to apply experts' opinions. Antecedently, Delphi was developed employing hesitant fuzzy sets (Amoozad Mahdiraji et al., 2021); nonetheless, using an average of SDs as an index to examine the consensus could simplify the computation and reduce the number of Delphi rounds. Following this, ISM was developed to analyse the relationships of the main capabilities with hesitant fuzzy information. As the study area is accompanied by high uncertainty, ISM has been combined with hesitant fuzzy to consider the doubts in experts' opinions. Earlier, ISM was developed employing fuzzy sets (Ragade, 2011; Yadav and Singh, 2020); however, to our knowledge, it is the first time hesitant fuzzy sets are employed in ISM methodology. Ultimately, MICMAC analysis was conducted to classify the dimensions. Therefore, the contribution of this paper proposes a novel method that international marketing scholars can employ to explore their niche marketing research questions via an expert-based and quantitative approach, mainly when the sample size is minimal.

Furthermore, the findings of this research offer a novel construct to measure SMEs' most pertinent internal capabilities for servitisation in international marketing activities. These measures are specifically crucial for understanding and actualisation the servitisation opportunities. In this regard, we confirm the findings of De Massis et al. (2018) to highlight that firms' ability to take advantage of international opportunities ( $C_1$ ) is a crucial factor that affects other dimensions. The other dimension that strongly contributes to the servitisation of international SMEs is Financial strength ( $C_3$ ). Extant research also highlights the relationship between financial performance and internationalisation (e.g., Wang et al., 2019). Moreover, efficient innovation management ( $C_2$ ) and technology level ( $C_5$ ) can also play a crucial role in international markets. In this vein, a line of research has explored innovation management in various international cases, such as the hotel (Pirnar, 2020) and the banking industry (Queiroz et al., 2020), which all included pure offerings and not hybrid offerings. Accordingly, our findings extend the significance of innovation management and technology in hybrid offerings. As follows, the robust and efficient collaboration networks ( $C_4$ ) and competitive advantages ( $C_7$ ) can strengthen the position of SMEs in international markets. From the customers' perspective,

servitisation should also be aligned with customers' requirements. Hence, the capacity to respond to these demands ( $C_6$ ) is a significant dimension.

Also, this research proposes a unique and integrative framework that maps the interrelationships among the most pertinent factors towards SMEs' servitisation. In this regard, as Figure 4 depicts, there is a reciprocal relationship between "efficient innovation management" and "strong and efficient collaboration networks", which was supported by other scholars (e.g., Garousi Mokhtarzadeh et al., 2020; Yao et al., 2020). Similarly, following Cortellazzo et al. (2020), the relationship between the "ability to take advantage of international opportunities" and "financial strength" is reciprocal. Therefore, our framework advances servitisation debates in international marketing research by highlighting that the success of international marketing is highly dependent on the interaction among internal capabilities that leverage the likelihood of SMEs towards servitisation.

Managers and entrepreneurs can also benefit from the results of this research. For instance, the fundamental drivers of young and entrepreneurial SMEs toward servitisation to participate in international markets were extracted in this research. As a result, managers should invest and strengthen their internal resources and capabilities in finance, innovation, technology, and capacity (Table 6-9). Consequently, these capabilities will increase the ability to take advantage of international opportunities and build efficient international collaboration networks (Figure 4). As a result, sustainable competitive advantage emanates for international entrepreneurial SMEs while focusing on servitisation. Considering the VRIO analysis (Value, Rarity, Inimitability, Organisational Support) model (David and David, 2017) and also the results of this research, the managers should remark that financial strength, technology readiness level (TRL), high capacity to respond to customer demands, and especially an efficient innovation system or culture, are essential factors to succeed in servitised international markets. These factors result in sustainable competitive advantage and act as winner attributes in international markets (Figure 3). Hence, allocating the budget, projects, plans, and strategies to these areas is recommended. Furthermore, managers should remember that building robust collaboration networks with other enterprises in the servitised international market depends on (i) their international experience and brand and (ii) the efficiency of their internal innovation processes (Figure 4-5). Thus, due to the lack of experience of young and entrepreneurial SMEs toward servitisation, creating an innovation

culture in international entrepreneurial SMEs and measuring the innovation process efficiency is indispensable.

## **6. Conclusion and Future Recommendations**

This article aimed to (i) extract the initial list of internal capabilities in SMEs leading to success in international markets, (ii) select the most relevant capabilities to international SMEs under the concept of servitisation and hybrid offerings, (iii) classify the selected capabilities, and ultimately (iv) analyse the relationship amongst the capabilities and illustrate the conceptual model for SMEs to participate in international markets with hybrid offerings. As the type of capabilities selected for this research was mainly qualitative and due to the vagueness of these capabilities, uncertain MCDM approaches have been applied. To this aim, to the best knowledge of the authors, a novel hesitant fuzzy approach has been developed in this research for Delphi, MICMAC and ISM classical methods. Thus, HFD was applied to select relevant internal capabilities, HF-MICMAC was used for classifying the capabilities, and HFISM was employed to analyse the relationship amongst the capabilities and illustrate the conceptual model of hybrid offerings for SMEs in international markets.

From the methodology perspective, this article develops a novel hesitant fuzzy approach in a multi-layer decision-making framework, including HFD, HF-MICMAC, and HFISM. Although the proposed framework is novel, other scholars could investigate some limitations in the future. For instance, a mean-variance-based approach was developed in this article for the hesitant fuzzy section; nevertheless, other HF approaches, such as bi-objective modelling (e.g., Hajiagha et al., 2018), are also applicable in the future. Besides, other uncertainty values or approaches, including intuitionistic fuzzy (IF), Pythagorean fuzzy (PF), Fermatean Fuzzy (F), interval values fuzzy (IVF), etc., are also applicable to consider the vagueness of environment and capabilities. Furthermore, to design the conceptual framework (Figure 4), other approaches such as decision-making trial and evaluation laboratory (DEMATEL) and its uncertain approaches such as FDEMATEL, IFDEMATEL, etc., statistical-based approaches such as principal component analysis (PCA), explanatory/confirmatory factor analysis (EFA/CFA), etc. are applicable. However, it is noticeable that robust data-oriented surveys are required to implement the statistical-based approaches.

From Other perspectives, this research and the selected capabilities and proposed conceptual model are all based on the experts' opinion and their participation in the research during completing the first questionnaire (HFD) and second questionnaire (HFISM). These experts were all selected from the emerging economy of Iran. However, in other countries and more developed economies, the same research could be applied and provide an apparent benchmarking reference to compare the superior capabilities in emerging and developed countries for hybrid offerings in international markets. Especially in the HFD phase, using experts and SME activists from different countries would have been valuable and could be included in the future.

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**Table 1.** Experts Profile (Source: Created by the authors)

Panel	Expert ID	Gender	Position	Age	Experience (years)	Education	Area/Sector
A	E <sub>01</sub>	F	Marketing Manager	40 <sub>s</sub>	16	MA	Service (Logistics)
	E <sub>02</sub>	M	Assistant Professor	40 <sub>s</sub>	15	PhD	Academia
	E <sub>03</sub>	M	CEO	40 <sub>s</sub>	20	MSc	Carpet
	E <sub>04</sub>	M	General Manager	50 <sub>s</sub>	20	MSc	Precious Stones
	E <sub>05</sub>	M	Managing Director	40 <sub>s</sub>	15	MSc	Nuts
B	E <sub>06</sub>	M	CEO	40 <sub>s</sub>	12	MSc	Fashion
	E <sub>07</sub>	M	Production Manager	40 <sub>s</sub>	20	MSc	Automotive
	E <sub>08</sub>	M	Managing Director	50 <sub>s</sub>	30	BSc	Service (Regulative)
	E <sub>09</sub>	M	Marketing Manager	50 <sub>s</sub>	23	PhD	Automotive
	E <sub>10</sub>	F	Marketing Manager	50 <sub>s</sub>	27	BSc	Tile



**Table 2.** The value of each linguistic term for HF-Delphi (Source: Yalchin et al., 2020)

<b>Linguistic Term</b>	No Effect	Slightly Effective	Fairly Effective	Very Effective	Absolutely Effective
<b>Value</b>	0	0.25	0.5	0.75	1

**Table 3.** Expressions evaluating the relations of criteria (Source: Created by the authors)

<b>Sign</b>	<b>Description</b>	<b>Value</b>
X	There is a two-way relationship between criterion <i>i</i> and criterion <i>j</i>	1
V	Criterion <i>i</i> leads to criterion <i>j</i>	1
A	Criterion <i>j</i> leads to <i>i</i>	0
O	There is no relationship between criterion <i>i</i> and criterion <i>j</i>	0

**Table 4.** SMEs' Internal Capabilities for Servitisation in the International Market (Source: Created by the authors)

<b>Capability Dimensions</b>	<b>Sample References</b>
Efficient management of human capital	(Minbaeva, 2018; Wang et al., 2012; Queiroz et al., 2020)
Ability to take advantage of international opportunities	(De Massis et al., 2018; Sisti et al., 2021)
Ability to use social fame and popularity	(Bhowmick and Mitra, 2019; Yaisawas et al., 2017)
Financial strength	(Babajide et al., 2021; Gamba et al., 2021)
Overall organisational performance	(Huang and Huang, 2020; Kolagar et al., 2021)
Efficient innovation management	(Rajapathirana and Hui, 2018; Queiroz et al., 2020)
High logistics capacity	(Joong-Kun Cho et al., 2008; Xiaoyu and Linzan, 2018; Queiroz et al., 2020)
Robust and efficient collaboration networks	(Najafi-Tavani et al., 2018; Baines et al., 2020)
Technology level	(Chen et al., 2021; Opazo-Basáez et al., 2021)
The efficiency of internal structures in the face of legal obstacles	(Mudalige et al., 2018; Kolagar et al., 2021)
Ability to adapt to different conditions	(Sabahi and Parast, 2019; Gamba et al., 2021)
Capacity to respond to customer needs	(Ravichandran, 2018; Yenziaras et al., 2021)
Experience of presence in international markets	(Tan and Sousa, 2019)
Highly competitive advantage	(Liu, 2017; Sisti et al., 2021)
Adequate infrastructure	(Dahiya and Mathew, 2018; Yenziaras et al., 2021)
High scalability	(Grabis and Kampars, 2018)

**Table 5.** Previous Relevant Research (Source: Created by the authors)

<b>Researcher/ Year</b>	<b>Research Objective(s)</b>	<b>Methods and Tools</b>
(Raddats et al., 2019)	Proposing a literature review on servitisation from 2005 and 2017 based on four major research streams, including general management, marketing, operations, and service management.	Thematic Review
(Sousa and da Silveira, 2019)	Investigating the relationship between product customisation and servitisation strategies	Partial Least Squares Path Modeling
(Calabrese et al., 2019)	Reviewing the literature on the measurement of the firm-level degree of servitisation	Systematic Literature Review
(Martín-Peña et al., 2020)	Offering an extensive framework to combine the growing trends of servitisation and digitalisation in manufacturing	Linear Regression
(Baines et al., 2020)	Proposing a model that enables a description of the servitisation processes as well as the principal steps of organisational change and the forces influencing these processes	Case Study
(Paschou et al., 2020)	Providing an understanding of the concept of digital servitisation	Systematic Literature Review
(Kamal et al., 2020)	Investigating the past trends and extant themes in the field of servitisation strategy	Systematic Literature Review
(Gebauer et al., 2021)	Reviewing crucial aspects of digital servitisation	Literature Review and Case Study
(Tian et al., 2021)	investigating how firms successfully leverage platforms for servitisation in an Industry 4.0 context.	Interpretive Research
(Gölgeci et al., 2021)	Studying the servitisation phenomenon in the context of global value chains	developing a multilevel conceptual framework

**Table 6.** HF-Delphi Results (Source: Created by the authors)

<b>Capability Dimensions</b>	<b>Final Score</b>	<b>S.D.</b>
Efficient management of human capital	0.650	0.234
Ability to take advantage of international opportunities	0.825	0.206
Ability to use social fame and popularity	0.675	0.214
Financial strength	0.800	0.188
Overall organisational performance	0.650	0.211
Efficient innovation management	0.813	0.159
High logistics capacity	0.625	0.289
Robust and efficient collaboration networks	0.788	0.187
Technology level	0.750	0.156
The efficiency of internal structures in the face of legal obstacles	0.625	0.289
Ability to adapt to different conditions	0.625	0.177
Capacity to respond to customer needs	0.738	0.279
Experience of presence in international markets	0.713	0.205
Highly competitive advantage	0.722	0.256
Adequate infrastructure	0.575	0.284
High scalability	0.538	0.344

**Table 7.** HF-Final Reachability Matrix (HF-FRM) (Source: Created by the authors)

<b>Capability Dimensions</b>		C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>	C <sub>7</sub>	C <sub>8</sub>
C <sub>1</sub>	Ability to take advantage of international opportunities	1	1	1	0.5	1	1	1	1
C <sub>2</sub>	Efficient innovation management	0.5	1	0.25	1	1	0.5	0.5	0.5
C <sub>3</sub>	Financial strength	1	0.5	1	0.25	1	1	0.75	1
C <sub>4</sub>	Robust and efficient collaboration networks	0.5	1	0	1	0.5	1	1	0.75
C <sub>5</sub>	Technology level	0	0.25	0.25	0.5	1	1	1	0.5
C <sub>6</sub>	Capacity to respond to customer needs	0.5	0	0	0	0	1	0	0.5
C <sub>7</sub>	Highly competitive advantage	0.5	0	0.25	0.5	0	1	1	1
C <sub>8</sub>	Experience of presence in international markets	0.5	0.75	0.25	1	0.25	0	0	1

**Table 8.** HF-ISM Leveling results (Source: Created by the authors)

ID	Capability Dimensions	Output (R)	Input (A)	Intersection	Level
C <sub>1</sub>	Ability to take advantage of international opportunities	(C <sub>2</sub> ,1)			5
		(C <sub>3</sub> ,1)	(C <sub>2</sub> ,0.5)	(C <sub>2</sub> ,0.5)	
		(C <sub>4</sub> ,0.5)	(C <sub>3</sub> ,1)	(C <sub>3</sub> ,1)	
		(C <sub>5</sub> ,1)	(C <sub>4</sub> ,0.5)	(C <sub>4</sub> ,0.5)	
		(C <sub>6</sub> ,1)	(C <sub>6</sub> ,0.5)	(C <sub>6</sub> ,0.5)	
		(C <sub>7</sub> ,1)	(C <sub>7</sub> ,0.5)	(C <sub>7</sub> ,0.5)	
		(C <sub>8</sub> ,1)	(C <sub>8</sub> ,0.5)	(C <sub>8</sub> ,0.5)	
C <sub>2</sub>	Efficient innovation management	(C <sub>1</sub> ,0.5)			4
		(C <sub>3</sub> ,0.25)	(C <sub>1</sub> ,1)	(C <sub>1</sub> ,0.5)	
		(C <sub>4</sub> ,1)	(C <sub>3</sub> ,0.5)	(C <sub>3</sub> ,0.25)	
		(C <sub>5</sub> ,1)	(C <sub>4</sub> ,1)	(C <sub>4</sub> ,1)	
		(C <sub>6</sub> ,0.5)	(C <sub>5</sub> ,0.25)	(C <sub>5</sub> ,0.25)	
		(C <sub>7</sub> ,0.5)	(C <sub>8</sub> ,0.75)	(C <sub>8</sub> ,0.5)	
C <sub>3</sub>	Financial strength	(C <sub>1</sub> ,1)			4
		(C <sub>2</sub> ,0.5)	(C <sub>1</sub> ,1)	(C <sub>1</sub> ,1)	
		(C <sub>4</sub> ,0.25)	(C <sub>2</sub> ,0.25)	(C <sub>2</sub> ,0.25)	
		(C <sub>5</sub> ,1)	(C <sub>5</sub> ,0.25)	(C <sub>5</sub> ,0.25)	
		(C <sub>6</sub> ,1)	(C <sub>7</sub> ,0.25)	(C <sub>7</sub> ,0.25)	
		(C <sub>7</sub> ,0.75)	(C <sub>8</sub> ,0.25)	(C <sub>8</sub> ,0.25)	
		(C <sub>8</sub> ,1)			
C <sub>4</sub>	Strong and efficient collaboration networks	(C <sub>1</sub> ,0.5)	(C <sub>1</sub> ,0.5)	(C <sub>1</sub> ,0.5)	3
		(C <sub>2</sub> ,1)	(C <sub>2</sub> ,1)	(C <sub>2</sub> ,1)	
		(C <sub>5</sub> ,0.5)	(C <sub>3</sub> ,0.25)	(C <sub>5</sub> ,0.5)	
		(C <sub>6</sub> ,1)	(C <sub>5</sub> ,0.5)	(C <sub>7</sub> ,0.5)	
		(C <sub>7</sub> ,1)	(C <sub>7</sub> ,0.5)	(C <sub>8</sub> ,0.75)	
		(C <sub>8</sub> ,0.75)	(C <sub>8</sub> ,1)		
C <sub>5</sub>	Technology level	(C <sub>2</sub> ,0.25)			4
		(C <sub>3</sub> ,0.25)	(C <sub>1</sub> ,1)	(C <sub>2</sub> ,0.25)	
		(C <sub>4</sub> ,0.5)	(C <sub>2</sub> ,1)	(C <sub>3</sub> ,0.25)	
		(C <sub>6</sub> ,1)	(C <sub>3</sub> ,1)	(C <sub>4</sub> ,0.5)	
		(C <sub>7</sub> ,1)	(C <sub>4</sub> ,0.5)	(C <sub>8</sub> ,0.25)	
		(C <sub>8</sub> ,0.5)	(C <sub>8</sub> ,0.25)		
C <sub>6</sub>	Capacity to respond to customer needs		(C <sub>1</sub> ,1)		2
			(C <sub>2</sub> ,0.5)		
		(C <sub>1</sub> ,0.5)	(C <sub>3</sub> ,1)	(C <sub>1</sub> ,0.5)	
		(C <sub>8</sub> ,0.5)	(C <sub>4</sub> ,1)		
			(C <sub>5</sub> ,1)		
			(C <sub>7</sub> ,1)		

**Table 8.** HF-ISM Leveling results (Source: Created by the authors)

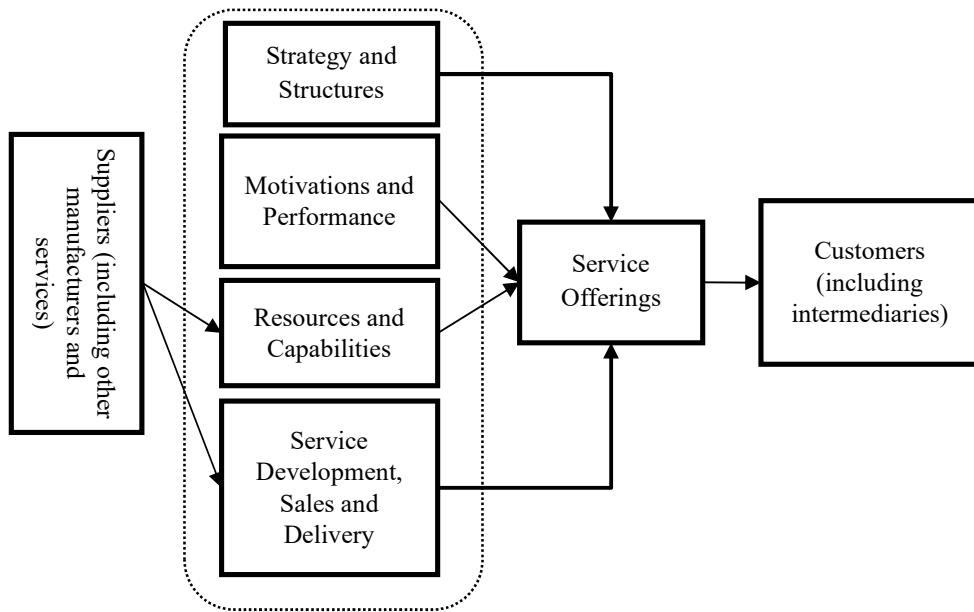
ID	Capability Dimensions	Output (R)	Input (A)	Intersection	Level
C <sub>7</sub>	Highly competitive advantage	(C <sub>1</sub> ,0.5)	(C <sub>1</sub> ,1)		3
		(C <sub>3</sub> ,0.25)	(C <sub>2</sub> ,0.5)	(C <sub>1</sub> ,0.5)	
		(C <sub>4</sub> ,0.5)	(C <sub>3</sub> ,0.75)	(C <sub>3</sub> ,0.25)	
		(C <sub>6</sub> ,1)	(C <sub>4</sub> ,1)	(C <sub>4</sub> ,0.5)	
		(C <sub>8</sub> ,1)	(C <sub>5</sub> ,1)		
C <sub>8</sub>	Experience of presence in international markets		(C <sub>1</sub> ,1)		1
		(C <sub>1</sub> ,0.5)	(C <sub>2</sub> ,0.5)	(C <sub>1</sub> ,0.5)	
		(C <sub>2</sub> ,0.75)	(C <sub>3</sub> ,1)	(C <sub>2</sub> ,0.5)	
		(C <sub>3</sub> ,0.25)	(C <sub>4</sub> ,0.75)	(C <sub>3</sub> ,0.25)	
		(C <sub>4</sub> ,1)	(C <sub>5</sub> ,0.5)	(C <sub>4</sub> ,0.75)	
		(C <sub>5</sub> ,0.25)	(C <sub>6</sub> ,0.5)	(C <sub>5</sub> ,0.25)	
		(C <sub>7</sub> ,1)			

Input: Reachability set; Output: Antecedent set

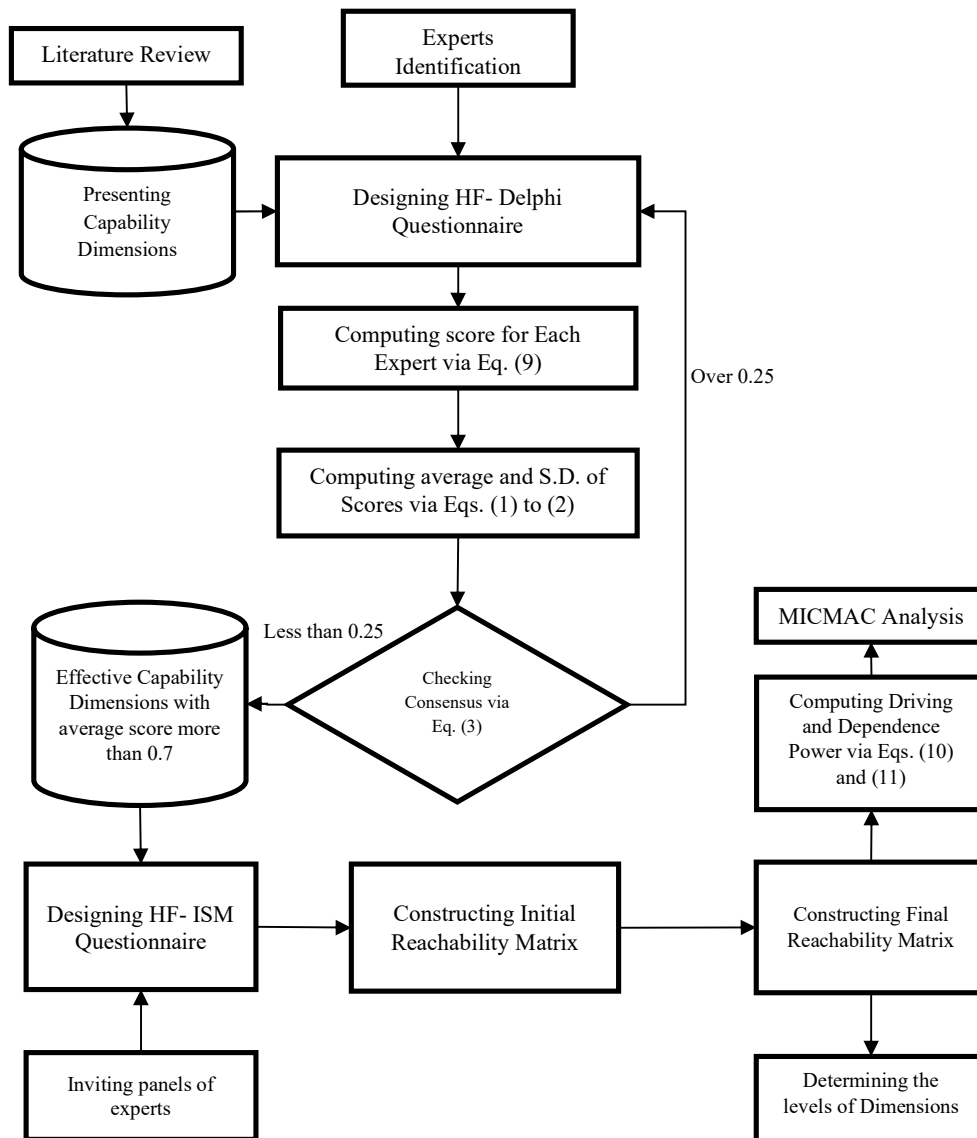


**Table 9.** Driving-Dependence Power of Capability Dimensions (Source: Created by the authors)

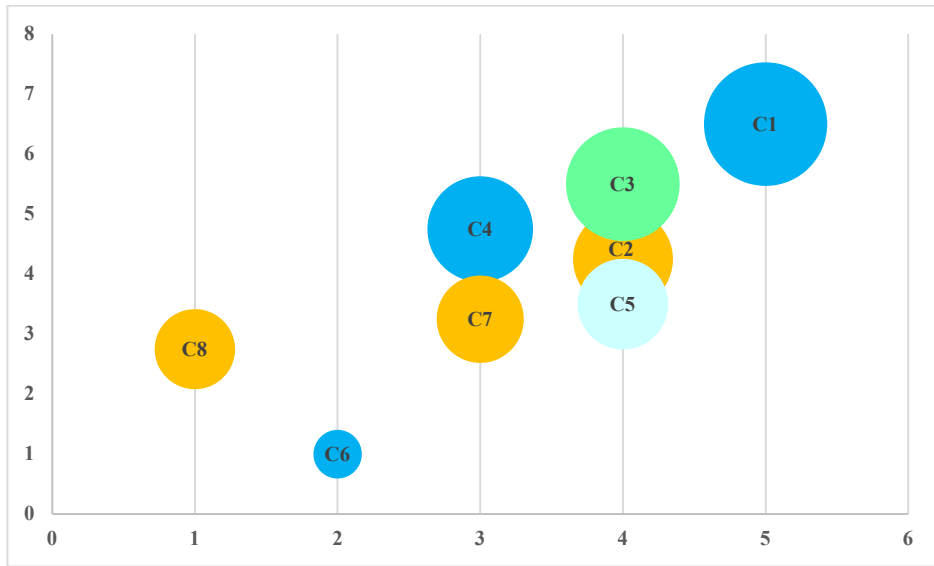
<b>ID</b>	<b>Capability Dimensions</b>	<b>Driving Power</b>	<b>Dependence Power</b>
C <sub>1</sub>	Ability to take advantage of international opportunities	6.5	3.5
C <sub>2</sub>	Efficient innovation management	4.25	3.5
C <sub>3</sub>	Financial strength	5.5	2
C <sub>4</sub>	Robust and efficient collaboration networks	4.75	3.75
C <sub>5</sub>	Technology level	3.5	3.75
C <sub>6</sub>	Capacity to respond to customer needs	1	5.5
C <sub>7</sub>	Highly competitive advantage	3.25	4.25
C <sub>8</sub>	Experience of presence in international markets	2.75	5.25



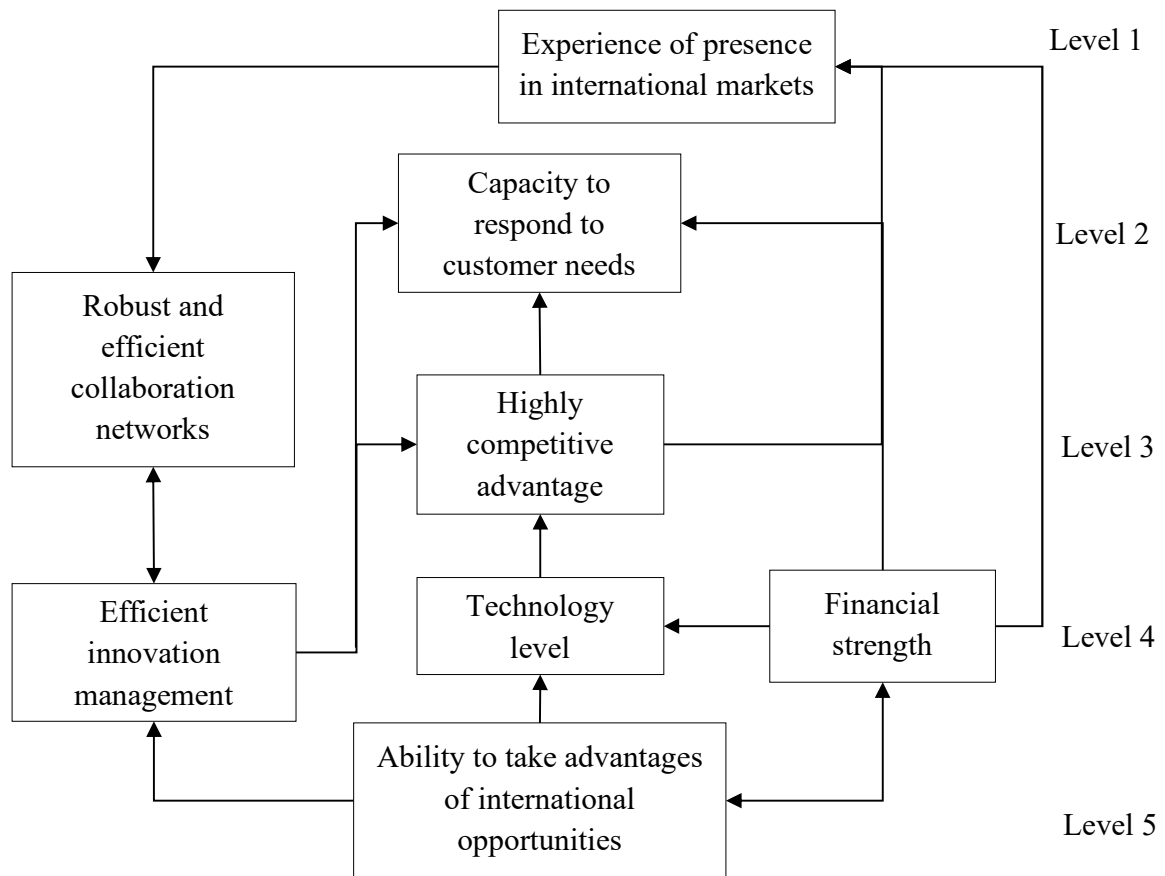
**Figure 1.** Actors Involved Servitisation (Source: Raddats et al., 2019)



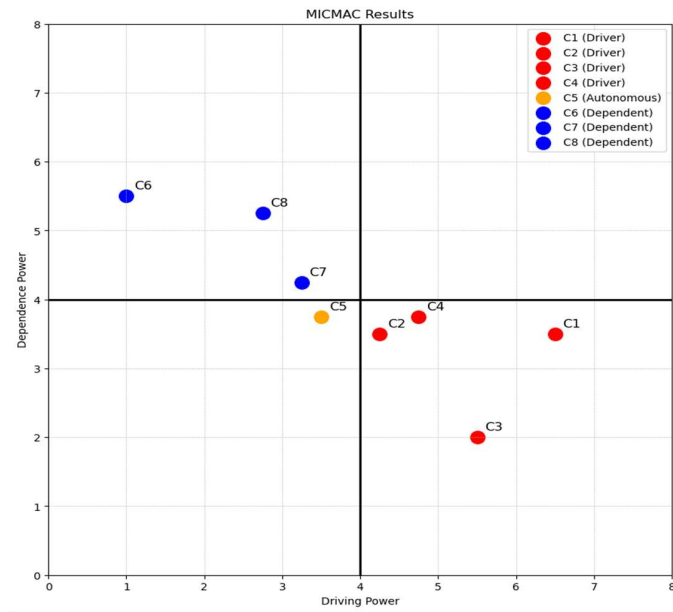
**Figure 2.** Research Framework (Source: Created by the authors)



**Figure 3.** Level of Capability Dimensions (Source: Created by the authors)



**Figure 4.** Level-Based Conceptual Model of HF-ISM (Source: Created by the authors)



**Figure 5.** Classification of Dimensions by MICMAC Analysis (Source: Created by the authors)

## Appendices.

### Appendix A. Preliminaries and Definitions

Zadeh introduced fuzzy sets to deal with uncertainty (Zadeh, 1965). Since then, numerous developments of fuzzy sets have been presented, e.g., intuitionistic fuzzy sets (Atanassov, 1986), type 2 fuzzy sets (Rickard et al., 2009), z-numbers (Zadeh, 2011), etc. Hesitant fuzzy sets have been proposed by Tora (Torra and Narukawa, 2009) to solve the problem of determining the membership of an element in the case that there is doubt as an illustration between two experts. First, the relevant definitions are introduced as follows.

**Definition 1.** Let  $X$  be a reference set, a hesitant fuzzy set on  $X$  is defined in the term of a function  $h$  that returns a subset of  $[0, 1]$  when applied to  $X$ .

**Definition 2.** Let  $h_1$  be a hesitant fuzzy set, the lower bound, upper bound and complement of  $h_1$  is defined as Eqs. 1 to 3.

$$h^-(x) = \min h(x) \quad (4)$$

$$h^+(x) = \max h(x) \quad (5)$$

$$h^c(x) = \bigcup_{\gamma \in h(x)} \{1 - \gamma\} \quad (6)$$

**Definition 3.** Let  $h_1$  and  $h_2$  be two hesitant fuzzy sets. Their union and intersection are defined as Eqs 4 to 5.

$$(h_1 \cup h_2)(x) = \{h \in (h_1(x) \cup h_2(x)) | h \geq \max(h_1^-, h_2^-)\} \quad (7)$$

$$(h_1 \cap h_2)(x) = \{h \in (h_1(x) \cup h_2(x)) | h \leq \min(h_1^+, h_2^+)\} \quad (8)$$

**Definition 4.** Let  $h$  be a set of hesitant fuzzy sets and  $\gamma_i \in h$  for  $i = 1, 2, \dots, l$ , the score function of  $h_1$  is defined via Eq. (6) (Farhadinia, 2014).

$$S(h) = \frac{1}{l} \sum_{i=1}^l \gamma_i \quad (9)$$

## Appendix B. Tools and Methods

**Delphi Technique.** The Delphi technique is a structured way to use experts' opinions (Linstone and Turoff, 1975). In this method, the opinion of experts is received by preparing a questionnaire, and then the consensus of these opinions is checked. If the consensus between the opinions is reached, then the Delphi round is stopped. Otherwise, the questionnaire is returned to them by presenting the averages and standard deviations of the opinions and asking experts to modify their opinions again. This process continues until opinions achieve consensus.

Additionally, there are several methods for evaluating the achievement of consensus (Kermanshachi et al., 2016). Scholars have widely investigated the development of the Delphi technique and the fuzzy Delphi (Mahdiraji et al., 2022), and the basic hesitant fuzzy approach of Delphi (Liao et al., 2019) have been presented by scholars since 1975. However, the authors have modified and presented a novel hesitant Fuzzy of the Delphi method in this article.

**Interpretive Structural Modeling.** Interpretive structural modelling (ISM) is one of the methods for analysing the relationships between capability dimensions. This method is so popular amongst scholars and has been widely employed with or without Decision Making Trial and Evaluation Laboratory method (DEMATEL) (Hashemi et al., 2022). The steps of this method are presented as follows (Iqbal et al., 2021; Jafari et al., 2021).

**Step 1.** A structural self-interaction matrix is formed by employing experts' opinions. In this regard, each expert determines the pairwise relationship between capability dimensions  $i$  and  $j$ , found in the expressions presented in Table 3.

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Please insert **Table 3** here  
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**Step 2.** The initial reachability matrix is constructed and found in Table 3 by applying (i) for  $X$  and  $V$  using the value 1 (ii) for  $A$  and  $O$  using the value 0 rules.

**Step 3.** Transitivity analysis rule. The general rule is that if capability dimension  $i$  leads to  $j$  and capability dimension  $j$  leads to  $k$ , then capability dimension  $i$  leads to  $k$ . This rule should be



tested for all possible situations, and the value of  $1^*$  should be replaced for all zero values in case this rule applies (Jafari-Sadeghi et al., 2021).

**Step 4.** Each capability dimension driving and dependence power is computed by row sum and column sum as in Eqs. (7) to (8).

$$\text{Driving Power} = \sum_{i=1}^n r_{ij} \quad (10)$$

$$\text{Dependance Power} = \sum_{j=1}^n r_{ij} \quad (11)$$

Notice that in Eqs. (7) to (8),  $r_{ij}$  is the cause-effect coefficient of capability dimension  $i$  on  $j$ . In addition,  $n$  is the total number of capability dimensions.

**Step 5.** Next to the formation of the FRM, distinct levels are introduced. Hence, for each capability dimension, the set of output capability dimensions that causes them to be realised, the input set of capability dimensions they cause, and the intersection of the input and output sets are specified. Then, capability dimensions are placed in each level whose intersection set and antecedent are equal. These capability dimensions are excluded from the analysis, and other levels are determined by the same process (Jafari-Sadeghi et al., 2021). Accordingly, the level-based conceptual model of the capabilities is designed.

**MICMAC Analysis.** ISM is mainly used with a dimension analysis technique called MICMAC. This analysis was presented in 1973 by Dugreen and Goodet. The purpose of this analysis is to categorise the dimensions based on their effectiveness into four categories of autonomous (low driving and dependence power), independent (high driving and low dependence power), dependent (low driving and high dependence power), and linkage (high driving and dependence power) according to equations (10) and (11) (Dhir and Dhir, 2020).