Investigating the Medical Tourism Supply Chain in Shiraz, Iran: A Hybrid Grounded Theory and Rough DEMATEL Method

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Investigating the Medical Tourism Supply Chain in Shiraz, Iran: A Hybrid Grounded Theory and Rough DEMATEL Method

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Abstract

Background: This study sought to provide a comprehensive analysis of the medical tourism supply chain (MTSC) in Shiraz, Iran, to improve the city's potential tourism market share in the post-COVID-19 future. In doing so, the study relied on a mixed research methodology. Primarily, interviews were conducted with 12 stakeholders involved in Shiraz's MTSC, including general policymakers, managers of private/public healthcare providers, travel agency managers, and managers of medical tourism companies. The data were collected through semi-structured interviews and were then analyzed according to the systematic approach of grounded theory (GT).

Results: The results helped to configure a model that analyzed Shiraz's MTSC, which included 6 main dimensions, 17 sub-dimensions, and 48 criteria. To detect any interrelationships among the criteria, the model was further analyzed quantitatively through the rough Decision making trial and evaluation laboratory (DEMATEL) method.

Conclusion: Proposing a novel methodology in medical tourism research, the study could practically contribute to different stakeholders in the medical tourism industry in Shiraz.

Keywords

Medical Tourism, Supply Chain, Grounded Theory, Rough DEMATEL, COVID-19

1. Introduction

Undeniably, 2020 was a tragic year for the tourism industry. Tourism, which was once one of the most lucrative industries in the service sector, underwent severe losses caused by the COVID-19 pandemic. Statistically speaking, around 1.5 billion international tourist arrivals occurred only in 2019, which generated a five-billion-dollar revenue for the tourism industry. Moreover, the tourism industry directly contributes about 2.9 trillion dollars to the global GDP (Lock, 2020). However, according to the UNWTO, the number of international tourists decreased by 65% only in the first half of 2020 (UNWTO, 2020), and the tourism industry witnessed a 42% decrease in 2020 due to the COVID-19 outbreak (Lock, 2020). At the moment, several effective COVID-19 vaccines have been developed (Knoll and Wonodi,

2021; Jones and Roy, 2021; Chagla, 2021), and the start of mass vaccination in various countries (McCarthy, 2021) could hopefully help to contain the ongoing pandemic. Following that, as Gössling et al. (2021) predict, global tourism activities can be finally resumed.

Of course, the coronavirus could leave long-term health effects on infected individuals (del Rio et al., 2020; Yelin et al., 2020). As a result, among different tourism types, medical tourism is likely to gain momentum in the post-COVID-19 period. This situation could bring about an opportunity for medical tourism destinations (e.g., Iran), and could contribute to the recovery of tourism in destinations that offer medical tourism in the post-COVID-19 future (Abbaspour et al., 2020). Iran possesses a high potential for medical tourism, although the Iranian medical tourism industry encountered numerous obstacles even before the COVID-19 outbreak. Some of these obstacles are a lack of a comprehensive information management system for medical tourists, inadequate marketing, underdeveloped infrastructure, a shortage of skilled human resources, and a lack of effective training programmes in this field (Momeni et al. 2018). Despite the losses that this industry incurred during the COVID-19 crisis, the industry found the opportunity to re-examine, re-evaluate, and re-structure itself entirely. As such, the industry could improve the situation and overcome the barriers mentioned above, while preparing itself to benefit from the potential market after the COVID-19 pandemic is fairly contained.

The purpose of this study is to conduct a comprehensive analysis of medical tourism supply chain (MTSC) in Shiraz city, one of Iran's most significant medical tourism destinations. The study draws on a mixed research methodology. First, in a qualitative investigation, the study uses the grounded theory (GT) methodology to identify the factors that could help analyze the MTSC in Shiraz. Then, in a quantitative analysis, the interrelationships among the factors identified are determined through the rough DEMATEL technique. As a result, the study makes two major contributions: (a) it tries to provide practical findings that could help improve the situation for different stakeholders engaged in the medical tourism industry in Shiraz; and (b) it uses a novel methodology, which, to the best of the authors' knowledge, has not been employed in the literature on the tourism industry. The following sections in the paper are as follows: in the next section, the relevant literature is reviewed. Section 3 substantially explains the context in which the study in conducted and the methodology utilized. In section 4, the results and discussion are presented, and finally, the conclusions are reported in section 5.

2. Literature Review

2.1. Medical Tourism and its Supply Chain

Traveling for medical and health-related purposes does not represent a new phenomenon. Historically speaking, people always traveled to find quality healthcare services (Reed, 2008). However, medical tourism became popular only in the late twentieth century (Connell, 2013), as a subset of health tourism, in addition to wellness tourism (Smith & Puczkó, 2008). Most studies define medical tourism as the process of traveling abroad to receive medical services to save money or reduce waiting time (De la Hoz-Correa et al., 2018; Heung et al., 2010; Chuang et al., 2014). Of course, some definitions (see Hudson & Lee, 2012) have also highlighted the domestic nature of medical tourism.

Medical tourism has recently gained momentum, particularly in Asian territories (including India, Thailand, Singapore, and Malaysia) and in other countries worldwide, such as the United States, Canada, Brazil, South Africa, Indonesia, Mexico, Cuba, and the Philippines (Crooks et al., 2010). Like other types of tourism, medical tourism has been also highly affected by the COVID-19 pandemic. Although medical tourist arrivals almost entirely disappeared during the COVID-19 crisis, medical tourism can potentially rebound in the post-crisis future (Oğuz et al., 2020; Sharma et al., 2020; Abbaspour et al., 2020).

Supply chain management, as a technical term, was first used in the literature in the 1980s, and it gained popularity in the 1990s, when many scholars tried offer clear definitions of the notion (Ellram & Murfield, 2019). Since then, supply chain management has been a topical concept in management research. A supply chain (SC) consists of different participants who seek to (in)directly fulfil customers' demands. Such participants may include manufacturers/producers, suppliers, transporters, warehouse managers, retailers, and even customers (Chopra & Meindl, 2007). Alford (2005) was among the first scholars who investigated the SC in the tourism context, followed by other researchers such as Ke (2006), Li et al. (2007), and Wan et al. (2007). However, Chen (2009) defined the tourism SC as a medium that connected all tourism activities performed through the flow of information, materials, and funds. According to Chen (2009), the tourism SC is meant to share resources, reduce costs, and generate customer value. In a more specific context, Lee and Fernando (2013) defined the MTSC for the first time as a complex network including at least five different sectors: accommodation, chemistry and pharmaceuticals, hospitals, transportation, and insurance.

2.2. Previous Research

A few studies have investigated the MTSC. Ferrer and Medhekar (2012) examined three main factors (cost, speed, and reliability) that could affect the global MTSC and the decision-making process for traveling to another country for treatment purposes. The results showed that low cost, no waiting time, and privacy (or reliability) of medical treatment could increase demand for medical tourism. Lee and Fernando (2015a) conducted one of the first investigations into the factors affecting the MTSC. As they explain, there are four effective factors in the MTSC: cooperation, coordination, information sharing, and integration. Their findings could raise practitioners' awareness in the medical tourism industry, especially in developing countries.

In another research, Lee and Fernando (2015b) developed a model analyzing the MTSC. The model was composed of three main dimensions: drivers, practices, and the MTSC performance. The drivers of the MTSC included trust, commitment, and mutual dependency, while practices encompassed collaboration, coordination, and information sharing. Similarly, MTSC performance was divided into financial and non-financial categories. The study then statistically investigated the relationships between the different elements of the MTSC. In the same vein, Rahman and Zailani (2017) examined the effectiveness and outcomes of Muslim-friendly medical tourism, determining the relationships among the determinants of the MTSC, including trust, commitment, mutual dependency, collaboration, coordination, information sharing, and performance.

Chung and Chang (2017) constructed a framework to measure the sustainability of the MTSC. The framework consisted of four main criteria (financial, customer, internal process, and growth perspectives) and 16 sub-criteria. The framework was analyzed using the analytical network process (ANP) technique. The results demonstrated that the *financial perspective* was the most significant element for integrating and improving the MTSC. As such, a healthy financial status would be essential to achieve stability in such SCs. Conducting an exploratory research, Kaewkitipong (2018) investigated the MTSC in Thailand, identified its stakeholders, and explored information flow in the chain. The results indicated that the lack of cooperation and integration among the SC stakeholders in the sector had led to limited information exchange.

Fongtanakit et al. (2019) statistically analyzed the factors affecting the MTSC in Thailand, using structural equation modeling (SEM). The results of this study suggested that mutual dependency, information sharing, and coordination were among the significant effective factors in improving the performance of the MTSC members. Furthermore, there

was a lack of commitment and trust among the members of the Thailand's MTSC. Karadayi-Usta and SerdarAsan (2020a) proposed a conceptual model of the MTSC to gain a clear understanding of its nature and business processes. The conceptual model identified seven business processes, namely service design, service recovery management, customer relationship management, supplier relationship management, demand management, capacity and resource management, and service delivery management. The model could help its users to internally shape their organization's SC. In addition, this model serves as the basis for SC collaboration decisions.

Similarly, Karadayi-Usta and SerdarAsan (2020b) built a collaborative framework for MTSC operations. More specifically, they concentrated on the collaboration between an assistance company and a medical institution, by developing a framework composed of steps, tools, and techniques, for SC operations in medical tourism services. Mekhum (2020) measured the impact of SC capabilities on health tourism performance by considering the mediating role of health care quality. The results revealed that SC capabilities, such as distribution channel, staff skills, and distribution time, positively affected the quality of health services and health tourism performance. The quality of health services also had a significant positive effect on health tourism and had a mediating effect on the distribution channel, time, and tourism performance.

Ahmadimanesh et al. (2019) designed a dental tourism SC model in Mazandaran province, Iran, employing mathematical modeling. This model could be used for strategic and effective planning in medical tourism. The SC model proposed consisted of three components: tourists, medical facilities, and accommodation. Its objective was to determine the optimal number of medical units, accommodation centers, and the final capacity of medical centers. Table 1 shows the core information of the important studies in the literature on the MTSC.

Table 1. Previous Research on MTSC

Study	Objective	Case	Methodology
Ferrer and Medhekar (2012)	Examining factors affecting the global medical tourism supply chain	Australia	Statistical analysis
Lee and Fernando (2013)	Identifying the factors influencing the medical tourism supply chain	Malaysia	Literature Review
Lee and Fernando (2015)	Developing a model for the medical tourism supply chain	Malaysia	Structural equation modeling (SEM)
Rahman and Zailani (2017)	Examining the effectiveness and outcomes of the Muslim-friendly medical tourism supply chain	Malaysia	Structural equation modeling (SEM)
Chung and Chang (2017)	Developing a framework to measure the sustainability of the medical tourism supply chain	Thailand	Analytical network process (ANP)

Study	Objective	Case	Methodology
Kaewkitipong (2018)	Investigating the medical tourism supply chain	Thailand	Thematic analysis
Ahmadimanesh et al. (2019)	Designing a dental tourism supply chain model	Iran	Mathematical Modeling
Fongtanakit et al. (2019)	Analyzing the determinants of medical tourism supply chain	Thailand	structural equation modeling (SEM)
Karadayi-Usta and SerdarAsan (2020)[A]	Presenting a conceptual model of the medical tourism supply chain	Turkey	Content analysis
Karadayi-Usta and SerdarAsan (2020)[B]	Developing a collaborative framework for medical tourism supply chain operations	Turkey	Statistical analysis
Mekhum (2020)	Measuring the impact of supply chain capabilities on the performance of health tourism	Thailand	Statistical analysis

3. Methodology

3.1. Place of Study

Located in the southwest of Iran, Shiraz is the fifth most populous city in Iran and the capital of Fars Province. Geographically speaking, Shiraz is located in a region conveniently close to the Arab States of Persian Gulf, which considerably invest in the medical market. The city benefits from a wide range of clinical and paraclinical services, qualified and renowned physicians, and latest medical equipment (Jabbari et al., 2013). According to the data provided on the website of Shiraz University of Medical Sciences and Health Services (2018), Shiraz hosts 31 public/private specialized hospitals.

Another issue, as observed by Lovelock and Lovelock (2018), is the possibility of providing leisure elements in medical tourism destinations. Shiraz, as a historically and culturally rich city (Manoukian, 2012), can offer many leisure facilities. Therefore, every year a significant number of tourists travel to this city to receive medical treatment, which shows the high potential of this city in attracting medical tourists as a “hub” in the south of Iran. The present study investigated the status of Shiraz’s medical tourism industry and explored previous research on the tourism SC. Following that, study identified different MTSC stakeholders in Shiraz, as illustrated in Figure 1.

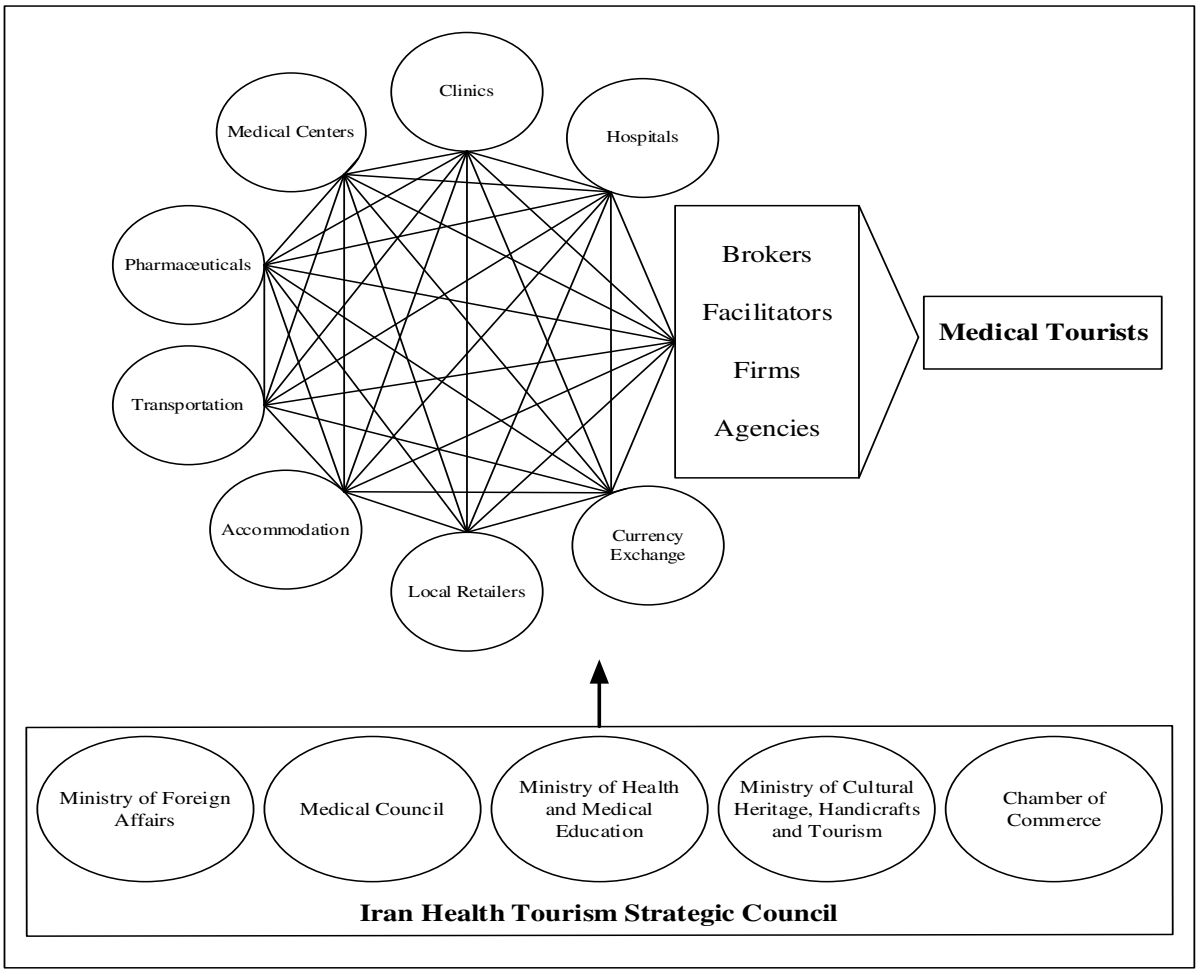

Figure 1. Shiraz MTSC Stakeholders

The Iranian medical tourism involves various official organizations responsible for general policymaking, including the Ministry of Health and Medical Education, the Ministry of Cultural Heritage, Handicrafts, and Tourism, the Ministry of Foreign Affairs, and the Chamber of Commerce and Medical Council, which have collectively founded the Iranian Health Tourism Strategic Committee. Moreover, the private sector, including travel agencies and medical tourism facilitators, is considered the most significant actor in Iran's medical tourism.

3.2. Research Process

This study sought to conduct a comprehensive analysis of the MTSC in Shiraz, using a mixed research methodology. First, in a qualitative investigation, the GT was used to frame a process analysis model. To accomplish this, in-depth face-to-face interviews were conducted with a panel consisting of 12 experts in Shiraz city's medical tourism. The experts were selected through purposive sampling from different MTSC stakeholders including general policymakers, managers of private/public healthcare providers, managers of tourism agencies and medical tourism firms, hotel managers, facilitators, and academics.

The interviews were structured and carried out from April to August 2020. Given the social distancing policy imposed following the COVID-19 outbreak, the interviews were conducted via online platforms. After an interview protocol was first formulated, the quality of its questions were evaluated by two experts. Moreover, several factors were taken into account in the interview process. First, the interviewers ensured that the interviewees were prepared in advance. Next, each interviewee orally expressed his/her consent, and the interview was carried out in a friendly and stress-free online environment. The purpose of the interview was fully explained to each interviewee. The qualities of the data analyzed and the model proposed were evaluated according to the nine criteria suggested in Flint's (2001) framework (See Flint, 2001 for further information)

Next, in the quantitative analysis stage, the interrelationships among the model criteria were determined using the rough-DEMATEL technique. In doing so, copies of a questionnaire regulated by pairwise comparison were submitted to three of the members of the expert panel who were more familiar with the purposes of the study. The panel included a member of Shiraz Health Tourism Committee in the Ministry of Health and Medical Education, a member of the International Air Transport Association, and a member of Shiraz Health Tourism Committee in the Ministry of Cultural Heritage, Handicrafts, and Tourism. The questionnaire was then analyzed according to the steps of rough-DEMATEL. The process of research is illustrated in Figure 2.

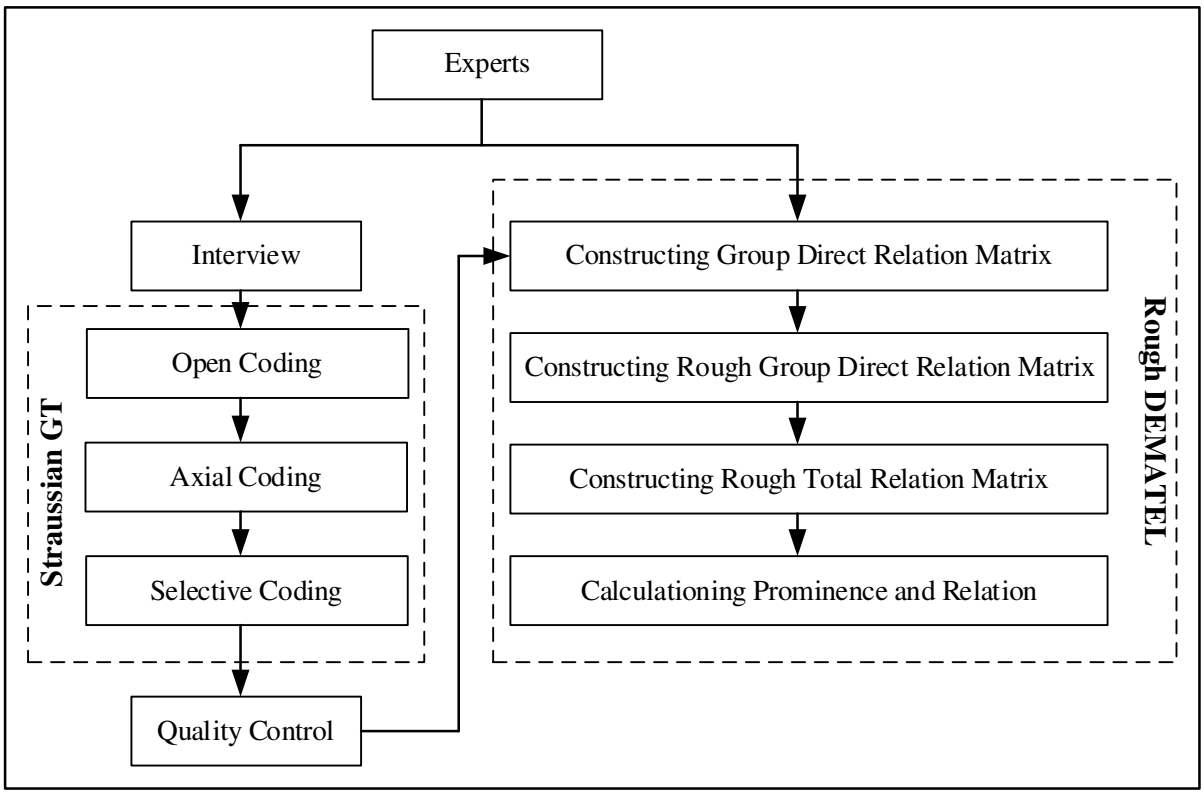

Figure 2. Research Process

3.2. Grounded Theory

As a research strategy used in social sciences, GT was first developed by Glaser and Strauss in 1967 (Kenny & Fourie, 2014). It can be simply defined as the process of constructing a theory from obtained data (Glaser and Strauss, 1967). To be more specific, according to Dunne (2011: p. 111): "in grounded theory, the researcher is not focused on testing hypotheses taken from existing theoretical frameworks, but rather develops a new theory grounded in empirical data collected in the field." Although Glaser and Strauss (1967) initially applied GT to nursing research, it has been successfully applied to numerous other contexts, such as SC risk management (Shojaei & Seyed Haeri, 2019), entrepreneurship and leadership (Maysami, Mohammadi Elyasi, 2020; Kownacki et al., 2020), and tourism research (Zeng and He, 2018; Momeni et al. 2018; Sun et al., 2019; Kornilaki and Font, 2019).

GT has undergone various changes throughout its development; however, currently there are three main streams using GT: The Straussian approach or the systematic approach (Strauss & Corbin, 1990), the Glaserian approach (Glaser, 1992), and the constructive approach (Charmaz, 2000). Researchers are advised to select one of these approaches depending on the purposes they pursue in their investigations (Heath and Cowley, 2004). Combining these approaches, however, does not seem to be an ideal option (Van Niekerk &

Roode, 2009). Given these issues, the present study relied on the Straussian approach to achieve its purposes because this approach provided more guidelines compared with the others (Heath & Cowley, 2004; Van Niekerk & Roode, 2009). According to Strauss and Corbin (1990), GT is accomplished through three core steps, namely open coding, axial coding, and selective coding (as elaborated on below).

The process of verbatim analysis of data for the purpose of discovering concepts, their specifications, and dimensions is called *open coding*. In this step, categories are constructed that encompass all objects, events, or actions/interactions related to the phenomenon under investigation (in this case, *MTSC*). When categories emerge, by comparing their subordinate members with each other, one learns the differences of such classified elements (objects, events, or actions/interaction) in terms of their properties and dimensions. Therefore, they are classified into sub-categories, after which this step in finalized.

"Axial coding" is conducted to construct a detailed description of the phenomenon. Thus, axial coding links categories with their sub-categories based on their properties and dimensions. This process occurs around the axis of a category, and that is why it is called *axial* coding. All concepts identified revolve around a main phenomenon. According to Strauss & Corbin (1990), axial coding is carried out based on the following categories:

1. Causal conditions (C): Categories related to conditions that affect the main phenomenon;
2. Intervening conditions (I): General conditions that affect the strategies;
3. Contextual conditions (G): Conditions that affect the strategies;
4. Strategies (S): Actions and reactions resulting from the main phenomenon;
5. Outcomes (O): The result of applying the strategies.

The last step of GT is "selective coding." In this step, the theory is refined and integrated. According to Strauss and Corbin (1990), at the selective coding stage, no new properties, dimensions, or relationships emerge through the analysis. The researcher selects the main category that encapsulates the central theme of the study and then integrates all other categories. The objective of this step is accomplished by reviewing technical memos collected through data analysis and interviews.

3.3. Rough Set Theory

Rough set theory was first introduced by Pawlak as a mathematical approach (1982); following that, Zhai et al. (2008) introduced *the rough number* concept. Since then, rough set theory has been incorporated into many decision-making techniques, such as TOPSIS (Stevic et al. 2018, Shojaei & Bolvardizadeh., 2020), AHP (Pamučar et al., 2018), ANP (Li and

Wang, 2018), DEMATEL (Song et al., 2020), and BWM (Liu et al., 2020). By aggregating group information, rough set theory can overcome the vagueness and subjectivity that arise from diverging judgments in a group decision-making process (Mao et al., 2020). Zhu et al. (2015) mention the following definitions regarding rough numbers:

Definition 1. Let U be the universe containing all objects and P be a random object of U, A be a set of n classes $\{A_1, A_2, \ldots, A_n\}$ that cover all the objects in U. Given that these classes are ordered as $\{A_1 \prec A_2 \prec \ldots \prec A_n\}$, then $\forall P \in U$, $A_k \in R$, $1 \leq k \leq n$ point to the class to which the object belongs. The lower approximation, upper approximation, and boundary region of the class A_k are defined as:

$$\underline{Apr}\ (A_k) = \{P \in U | R(P) \leq A_k\} \quad (1)$$

$$\overline{Apr}\ (A_k) = \{P \in U | R(P) \geq A_k\} \quad (2)$$

$$\text{Bnd}\ (A_k) = \{P \in U | R(P) \neq A_k\} = \{P \in U | R(P) > A\} \cup \{P \in U | R(P) < A\} \quad (3)$$

Definition 2. A_k can be shown as the rough number $RN(A_k)$, which is determined by its corresponding lower limit and upper limit:

$$\underline{Lim}\ (A_k) = \frac{1}{M_L} \sum \{P \in \underline{Apr}\ (A_k)\} \quad (4)$$

$$\overline{Lim}\ (A_k) = \frac{1}{M_U} \sum \{P \in \overline{Apr}\ (A_k)\} \quad (5)$$

$$RN\ (A_k) = [\underline{Lim}\ (A_k), \overline{Lim}\ (A_k)] \quad (6)$$

where M_L, M_U are the numbers of objects that are contained in Apr, respectively.

Definition 3. The difference between the lower limit and the upper limit is expressed as the rough boundary interval.

$$IRBnd\ (Ak) = \overline{Lim}\ (A_k) - \underline{Lim}\ (A_k)$$

Definition 4. The operations for the two rough numbers, $RN\ (\alpha) = [\underline{Lim}\ (\alpha), \overline{Lim}\ (\alpha)]$ and $RN\ (\beta) = [\underline{Lim}\ (\beta), \overline{Lim}\ (\beta)]$ are as follows:

$$RN\ (\alpha) + RN\ (\beta) = [\underline{Lim}\ (\alpha) + \underline{Lim}\ (\beta), \overline{Lim}\ (\alpha) + \overline{Lim}\ (\beta)] \quad (7)$$

$$RN\ (\alpha) - RN\ (\beta) = [\underline{Lim}\ (\alpha) - \underline{Lim}\ (\beta), \overline{Lim}\ (\alpha) - \overline{Lim}\ (\beta)] \quad (8)$$

$$RN\ (\alpha) \times RN\ (\beta) = [\underline{Lim}\ (\alpha) \times \underline{Lim}\ (\beta), \overline{Lim}\ (\alpha) \times \overline{Lim}\ (\beta)] \quad (9)$$

$$\frac{RN\ (\alpha)}{RN\ (\beta)} = [\frac{\underline{Lim}\ (\alpha)}{\underline{Lim}\ (\beta)}, \frac{\overline{Lim}\ (\alpha)}{\overline{Lim}\ (\beta)}] \quad (10)$$

$$\mu \times RN\ (\alpha) = [\mu \times \underline{Lim}\ (\alpha), \mu \times \overline{Lim}\ (\alpha)] \quad (11)$$

Definition 5. A rough number can be converted into a crisp number using the following equations:

$$W_k^e = \frac{\tilde{C}_k^e}{\sum_{k=1}^{n} \tilde{C}_k^e} \quad (12)$$

$$\tilde{C}_k^e = \min_k\{w_k^{e*L}\} + \chi_k^e \times (\max_k\{w_k^{e*U}\} - \min_k\{w_k^{e*L}\}), \text{ k = 1, 2, …, n} \quad (13)$$

$$\chi_k^e = \frac{w_k^{e*L} \times (1 - w_k^{e*L}) + w_k^{e*U} \times w_k^{e*U}}{1 - w_k^{e*L} + w_k^{e*U}} \quad (14)$$

3.4. Rough DEMATEL

Decision-making trial and evaluation laboratory (DEMATEL) is a useful technique to conceptualize the structure of cause-effect relationships among the elements in a complex system (Fontela and Gabus, 1976). DEMATEL offers an effective way of visualizing the structure of complex causal relationships, describing the relationships between different elements of a system (Song & Cao, 2017).

Step 1: Construct a group direct-relation matrix

m experts make pairwise comparisons for n criteria according to the crisp DEMATEL scale, where 0 indicates "No Influence" and 4 shows "Very Strong Influence" (Wu, 2008). The k-th expert's direct-relation matrix M_k is created via:

$$M_k = \begin{bmatrix} 0 & r_{12}^k & \cdots & r_{1n}^k \\ r_{21}^k & 0 & \cdots & r_{2n}^k \\ \vdots & \vdots & \ddots & \vdots \\ r_{n1}^k & r_{n2}^k & \cdots & 0 \end{bmatrix}, \text{ k = 1, 2, …,m} \quad (15)$$

where r^k_{ij} is the crisp judgment of the expert k regarding the influence of the i-th criterion on the j-th criterion.

Step 2: Determine the rough group direct-relation matrix

The crisp judgments are then converted into rough ones according to Definition 1. Then, the rough group direct-relation matrix R can be created through:

$$R = [\overline{RN\ (\tilde{r}_{ij}^k)}]_{n\times n} = \begin{bmatrix} [0,0] & [r_{12}^L, r_{12}^U] & \cdots & [r_{1n}^L, r_{1n}^U] \\ [r_{21}^L, r_{12}^U] & [0,0] & \cdots & [r_{2n}^L, r_{2n}^U] \\ \vdots & \vdots & \ddots & \vdots \\ [r_{n1}^L, r_{12}^U] & [r_{n2}^L, r_{12}^U] & \cdots & [0,0] \end{bmatrix} \quad (16)$$

Step 3: Create the rough total-relation matrix

The linear scale transformation is used as a normalization formula to transform the element scales into comparable scales. The normalized rough group direct-relation matrix R' is obtained as follows:

$$R' = [\overline{RN\ (r_{ij})'}]_{n\times n} = \begin{bmatrix} \overline{RN\ (\tilde{r}_{11})'} & \overline{RN\ (\tilde{r}_{12})'} & \cdots & \overline{RN\ (\tilde{r}_{1n})'} \\ \overline{RN\ (\tilde{r}_{21})'} & \overline{RN\ (\tilde{r}_{22})'} & \cdots & \overline{RN\ (\tilde{r}_{2n})'} \\ \vdots & \vdots & \ddots & \vdots \\ \overline{RN\ (\tilde{r}_{n1})'} & \overline{RN\ (\tilde{r}_{n2})'} & \cdots & \overline{RN\ (\tilde{r}_{nn})'} \end{bmatrix} \quad (17)$$

Additionally, the rough total-relation matrix (T) can be created via:

$$\overline{RN\ (r_{ij})'} = \frac{\overline{RN\ (\tilde{r}_{ij})}}{\tau} = [\frac{r_{ij}^L}{\tau}, \frac{r_{ij}^U}{\tau}],\ \tau = \max_{1\le i\le n}(\sum_{j=1}^{n} r_{IJ}^U) \quad (18)$$

$$T = [t_{ij}]_{n\times n},\ t_{ij} = [t_{ij}^L, t_{ij}^U] \quad (19)$$

$$T^S = [t_{ij}^s] = R'^S (1 - R'^S)^{-1},\ S = L, U \quad (20)$$

where t_{ij}^L and t_{ij}^U are the lower and upper limits of the rough interval t_{ij} in the total-relation matrix, and I is the unit matrix.

Step 4: Calculate the "prominence" and "relation" values

Next, the sum of the rows and the sum of the columns are showed by x_i and y_j, repressively, within the rough total-relation matrix using the following equations:

$$x_i = [x_i^L, x_i^U] = [\sum_{j=1}^{n} t_{ij}^L, \sum_{j=1}^{n} t_{ij}^U] \quad (21)$$

$$y_j = [y_j^L, y_j^U] = [\sum_{i=1}^{n} t_{ij}^L, \sum_{i=1}^{n} t_{ij}^U] \quad (22)$$

where x_i^L and x_i^U are the lower limit and upper limit of the rough interval x_i. Similarly y_j^L and y_j^U are the lower and upper limits of the rough interval y_j. In order to calculate the prominence and relation values, x_i and y_j should be converted into crisp values according to Definition 5. Finally, prominence and relation values are calculated through the following equation, where the vector (m_i) shows prominence and the vector (n_i) determines relation:

$$m_i = x_i + yj \quad (23)$$

$$n_i = x_i - yj \quad (24)$$

,i = j

4. Results

To accomplish the objectives of the study, first the transcripts of the interviews were analyzed according to the steps of the Straussian grounded theory (open coding, axial coding, and selective coding). Following that, "poor service delivery in Shiraz medical tourism" was extracted as the main phenomenon and the basis of the process model. As the interviewees stated, "poor service delivery" was the most significant threat and challenge facing medical tourism in Shiraz. According to Expert 9: "*The fact that a medical tourist enters Shiraz and we cannot provide a proper service to his/her is the most serious threat. Even though s/he*

finally receives the service in question, despite all shortcomings, this problem must be solved for the sake of development." Expert 11 also explained that: "*The mismatch between the price and the quality of the services provided is certainly a weakness of the medical tourism industry in Shiraz.*"

The other dimensions of the process model, including causal conditions, contextual conditions, intervening conditions, strategies, and outcomes, were determined based on the main phenomenon. The sub-dimensions and criteria of each dimension are shown in Table 2.

Table 2–The Process Model

Dimension	Sub-Dimension	Code	Criteria
Causal Conditions	Poor control and monitoring	C1	A lack of transparent pricing
		C2	Poor anti-corruption measures in medical tourism
		C3	Poor supervision over adherence to the rules and regulations
	Underdeveloped infrastructure	C4	Lack of internationally accredited hospitals
		C5	Shortage of infrastructures compatible with medical tourists' expectations in the tourism sector
		C6	No insurance provided
	Structural and managerial challenges	C7	A lack of specialization in the medical tourism industry
		C8	A lack of cooperation and coordination between the MTSC members
		C9	No organization designated for supervision over medical tourism
		C10	No strategic planning formulated in medical tourism
		C11	Weak marketing and branding
	The nascent structure of Shiraz's MTSC	C12	The infancy of modern medical tourism in Iran
		C13	Shortage of academic studies concerned with medical tourism in Iran
Contextual Conditions	Iran's international relations	G1	Ineffective international relations
		G2	Political fluctuations
		G3	Imposed international sanctions
	Economic conditions	G4	Economic fluctuations and devaluation of the Iranian currency
		G5	Low prices for medical and tourism services
	Sociocultural issues	G6	The special place of Shiraz in the tourism industry
		G7	Problems caused by cultural differences
		G8	Restrictive religious and state laws
	Shiraz's medical status	G9	High-quality and varied medical services in Shiraz
		G10	The long history of medical tourism in Shiraz
		G11	Availability of world-renowned doctors in Shiraz
	Shiraz's geographical conditions	G12	The strategic geographical location of Shiraz
		G13	The desirable ecosystem of Shiraz
Intervening Conditions	The important role of mediators	I1	Brokers who inevitably mediate the relationship between physicians and medical tourists
		I2	Medical tourists' poor knowledge and information
		I3	The importance of word-of-mouth advertising in target countries
	The role of government in medical tourism	I4	Problems medical tourists face in the medical visa application process
		I5	Moving beyond an oil-dependent economy
		I6	The expansion of the Cultural Heritage, Handicrafts and Tourism Organization into a ministerial organization

Table 2 – Continue

Dimension	Sub-Dimension	Code	Criteria
Intervening Conditions	Domestic/foreign professional competitors	I7	Foreign investment in the medical tourism industry of target countries
		I8	Domestic and foreign competitors
	Stakeholders' short-term approach	I9	The profit-oriented vision of different members in the medical tourism SC
		I10	Hospitals established in target countries by the Iranian Ministry of Health
Strategies	Improving medical tourism infrastructure	S1	The need to create an appropriate structure for organizing/ monitoring SC members
		S2	Using cyberspace to promote medical tourism
		S3	Operating domestic/international flights to Shiraz
	Gaining competitive advantage by focusing on products and the market	S4	Emphasizing domestic and regional tourism
		S5	Emphasizing beauty tourism
Outcomes	Reducing the market share of Shiraz in global medical tourism	O1	Inefficient solutions offered by the Iranian Health Tourism Strategic Council
		O2	The negative impact of brokers
		O3	Losses the private sector incurs
		O4	The small share of medical tourism in the economy
		O5	Medical tourists' increasing complaints about the services received in Shiraz
		O6	Building a brand and a negative image of Shiraz medical tourism
		O7	Loss of collective benefit of the MTSC members

As mentioned earlier, in the quantitative stage, the interrelationships among the criteria of the process model were identified using the rough DEMATEL methodology. Based on the steps of rough-DEMATEL, the rough group direct-relation matrix, the normalized rough group direct-relation matrix, and the rough total-relation matrix were calculated and shown in Tables 3-5, respectively.

Table 3 – Rough Group Direct-Relation Matrix

	M	C1	C2	⋯	O5	O6	O7
M	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]	…	[3.444,3.889]	[4.000,4.000]	[1.889,3.389]
C1	[0.000,0.000]	[0.000,0.000]	[3.444,3.889]	…	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]
C2	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]	…	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]
…	…	…	…	…	…	…	…
O5	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]	…	[0.000,0.000]	[4.000,4.000]	[0.000,0.000]
06	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]	…	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]
O7	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]	…	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]

Table 4 - Normalized Rough Group Direct-Relation Matrix

	M	C1	C2	⋯	O5	O6	O7
M	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]	…	[0.092,0.104]	[0.107,0.107]	[0.050,0.091]
C1	[0.000,0.000]	[0.000,0.000]	[0.920,0.104]	…	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]
C2	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]	…	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]
…	…	…	…	…	…	…	…
O5	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]	…	[0.000,0.000]	[0.107,0.107]	[0.000,0.000]
06	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]	…	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]
O7	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]	…	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]

Table 5 - Rough Total-Relation Matrix

	M	C1	C2	…	O5	O6	O7
M	[0.030,0.040]	[0.017,0.026]	[0.010,0.016]	…	[0.109,0.128]	[0.123,0.128]	[0.054,0.106]
C1	[0.010,0.013]	[0.007,0.012]	[0.094,0.107]	…	[0.002,0.003]	[0.003,0.005]	[0.001,0.002]
C2	[0.015,0.016]	[0.012,0.015]	[0.009,0.013]	…	[0.005,0.009]	[0.002,0.003]	[0.001,0.004]
…	…	…	…	…	…	…	…
O5	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]	…	[0.000,0.000]	[0.107,0.107]	[0.000,0.001]
06	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]	…	[0.000,0.000]	[0.000,0.000]	[0.002,0.008]
O7	[0.000,0.000]	[0.000,0.000]	[0.000,0.000]	…	[0.000,0.000]	[0.000,0.000]	[0.002,0.008]

Next, through the equations in Definition 5, the sum of the rows (X_i) and the sum of the columns (Y_j) in the rough total-relation matrix were converted into crisp values (x_i and y_j respectively) to determine the prominence (m_i) and relation (n_i) values. Needless to say, in the DEMATEL methodology, each criterion is categorized under one of the two main groups: cause and effect. The cause-type criteria refer to the factors that left an impact, whereas the effect-type criteria were the factors that received influence (Fontela & Gabus, 1976). The two groups can be identified according to the values of their prominence and relation; if the relation value is positive, the criterion in question falls under the cause group. However, a negative relation value would mean that the criterion is an effect. On the other hand, the higher the prominence value is, the more important the criterion in question is (Song and Sakao, 2018). Table 6 shows the prominence and relation values of the criteria of the model.

Table 6 – The Crisp Values

	Final Crisp Value		Prominence (mi)	Relation (ni)		Final Crisp Value		Prominence (mi)	Relation (ni)
	X	Y	X+Y	X-Y		X	Y	X+Y	X-Y
M	2.12	1.55	3.67	0.57	G12	0.00	0.13	0.13	**-0.13**
C1	0.97	0.33	1.30	0.64	G13	0.11	0.23	0.34	**-0.13**
C2	0.84	0.26	1.10	0.58	I1	0.21	0.32	0.54	**-0.11**
C3	0.34	1.05	1.39	**-0.71**	I2	0.15	0.31	0.46	**-0.16**
C4	0.11	0.63	0.75	**-0.52**	I3	0.18	0.36	0.54	**-0.18**
C5	0.10	0.57	0.68	**-0.47**	I4	0.29	0.22	0.51	0.08
C6	0.00	0.49	0.49	**-0.49**	I5	0.83	0.10	0.93	0.73
C7	0.00	0.57	0.57	**-0.57**	I6	0.00	0.31	0.31	**-0.31**
C8	0.58	2.14	2.72	**-1.56**	I7	0.00	0.12	0.12	**-0.12**
C9	0.00	0.75	0.75	**-0.75**	I8	0.00	0.12	0.12	**-0.12**
C10	0.21	1.38	1.60	**-1.17**	I9	0.15	0.83	0.97	**-0.68**
C11	0.49	0.78	1.27	**-0.29**	I10	0.22	0.30	0.52	**-0.09**
C12	0.00	0.56	0.56	**-0.56**	S1	1.05	1.83	2.88	**-0.78**
C13	0.32	0.24	0.55	0.08	S2	0.18	0.14	0.32	0.03
G1	0.00	0.34	0.34	**-0.34**	S3	0.12	0.23	0.35	**-0.11**
G2	0.21	0.22	0.43	**-0.01**	S4	0.77	0.95	1.72	**-0.18**
G3	0.00	0.66	0.66	**-0.66**	S5	0.11	0.06	0.18	0.05
G4	0.40	0.11	0.51	0.29	O1	0.57	0.84	1.41	**-0.27**
G5	0.13	0.13	0.26	0.00	O2	1.49	0.81	2.30	0.67
G6	0.12	0.16	0.28	**-0.04**	O3	2.80	0.22	3.02	2.58
G7	0.00	0.10	0.10	**-0.10**	O4	3.34	0.12	3.46	3.22
G8	0.00	0.16	0.16	**-0.16**	O5	1.01	0.13	1.14	0.87
G9	0.21	0.13	0.34	0.08	O6	1.68	0.25	1.93	1.43
G10	0.00	0.35	0.35	**-0.35**	O7	0.97	0.25	1.22	0.72
G11	0.10	0.26	0.35	**-0.16**					

5. Discussion

According to Table 6, "poor service delivery in Shiraz medical tourism" was the most significant cause, with a prominence value of 3.67 and a relation value of 0.57. As such, this criterion was justifiably selected as the main phenomenon in the process model. Moreover, "lack of transparent pricing" (C1) and "poor anti-corruption measures in medical tourism" (C2) were two other cause-type criteria of the model with prominence values less than that of the main phenomenon. In this regard, Expert 1 explained: "*A medical tourist can hardly find the exact prices of the services s/he wants to use through online platforms. We do not have medical tourism packages in which the final price is clearly defined. As such potential tourists remain uncertain about their decisions.*"

Moreover, “a lack of cooperation and coordination between the MTSC members” (C8) was the most crucial effect criterion and was influenced by the cause criteria. Expert 3 stated: “The confrontation between the stakeholders involved in Shiraz medical tourism has slowed down the industry’s cycle; they see themselves more as adversaries than allies. This lack of coordination is the most serious challenge to this industry.” Similarly, “economic fluctuations and devaluation of the Iranian currency” (G4) was the most critical cause in “contextual conditions”, whereas “imposed international sanctions” (G3) was the most important effect under the same sub-dimension. According to Expert 2, “*The most important stimulus for medical tourism is the price. For example, heart surgery procedures in the United States are much costlier than those in countries such as India or Singapore. As a result, the high cost of medical care in some countries has encouraged people to try countries that offer the same surgeries at a lower cost.*”

Furthermore, the studies unanimously mentioned price as an important motivation for medical tourists. Therefore, the devaluation of the Iranian currency can be the best opportunity for medical tourism development in Iran, and consequently in Shiraz, as emphasized by Expert 4, “The devaluation of our country's currency is unfortunate, yet it is an opportunity in international markets, especially tourism.” In terms of international sanctions, Expert 1 stated: “*Medical tourists know that if they travel to Iran for medical purposes, they have to pay the full cost of their treatment because there is no international insurance system available in Iran. Besides, they will have difficulties with transferring money because the sanctions have considerably affected Iran’s banking system on an international scale.*”

“Moving beyond an oil-dependent economy” (I5) was the most significant cause in the “intervening conditions.” As Expert 2 clarified: “*We have never taken tourism seriously as a channel for earning national revenue. We have always relied on oil revenues and did not find it necessary to make money from other sources. However, the situation has drastically changed because we restrictions caused by oil-related sanctions, and we have to consider alternative sources.*” Meanwhile, “the profit-oriented vision of different members in the MTSC” (I9) was the most critical effect in the “intervening conditions.” According to Expert 11, “*Stakeholders in the chain are not willing to think about the interests of society and the medical tourism industry; they only think about personal gain and interests. This is certainly an important weakness*.” Finally, “the small share of medical tourism in the economy” (O4) was the most significant “outcome”, as it displayed the highest prominence value and fell under the cause group with its positive relation value. Explaining the role of medical tourism

in the economy of Shiraz and Iran, Expert 11 shared the following comment: "*Tourism can be a panacea considering the current economic situation and problems such as inflation, lack of liquidity, sanctions, and unemployment. Under similar conditions, other countries faced with economic crises managed to save their country by having different types of tourism supported by their governments and the private sector.*"

"The need to create an appropriate structure for organizing/monitoring SC members" (S1) was also an essential effect-type strategy. As the experts confirmed, the transformation of the Cultural Heritage Organization into a ministry was a turning point in restructuring tourism in Iran. Moreover, to depict the interrelationships among the criteria, all the cells in the rough total-relation matrix were converted into crisp numbers using Definition 5. Then, a threshold (T) was calculated and implemented to eliminate the negligible relations in the rough total-relation matrix (Mao et al., 2020) (A= 0.0104, SD = 0.0346, and T = A+SD = 0.0450; A and SD represent the average and standard deviation of all the values in the rough total-relation matrix). Figures 3-6 illustrate the relationships in each dimension. Given the large number of the criteria and constraints of space, the criteria were separated into four figures for the sake of clarity.

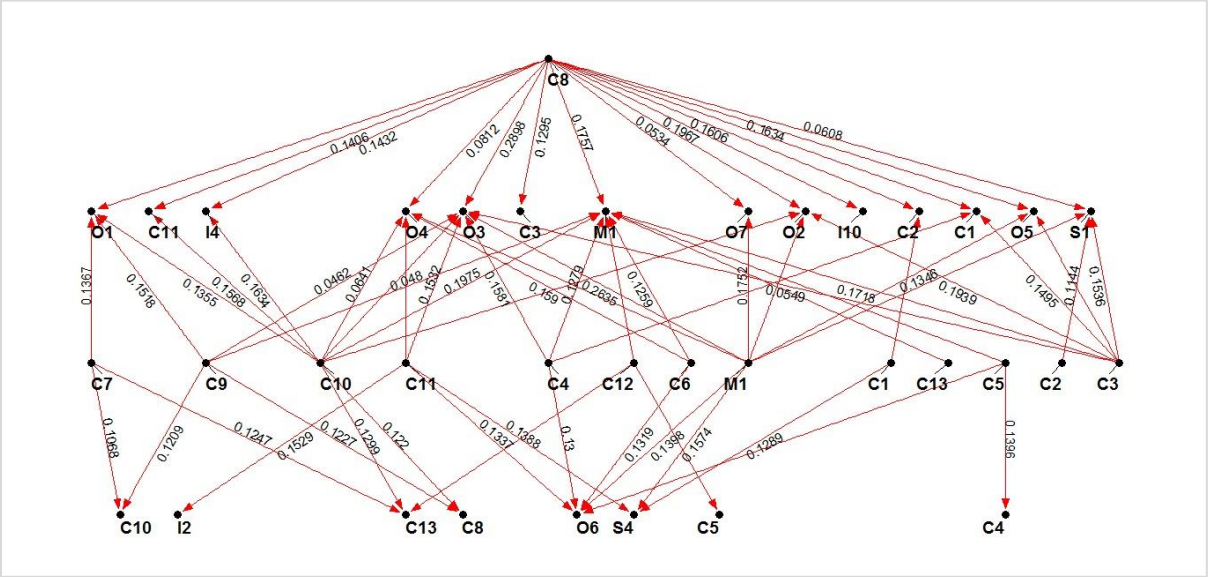

Figure 3 – The Main Phenomenon and Causal Conditions

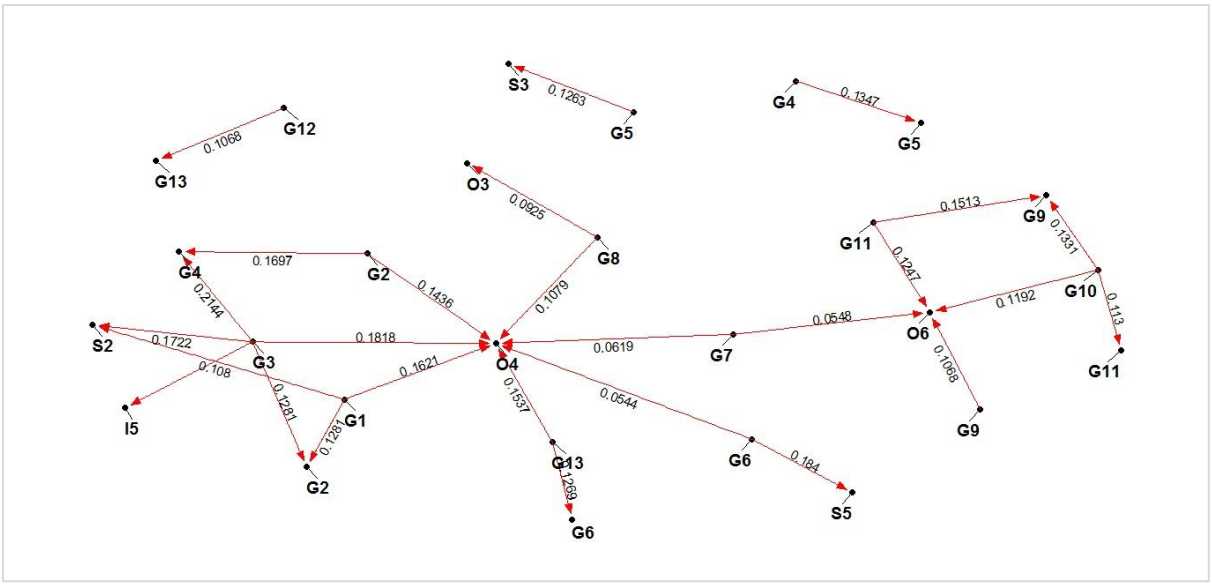

Figure 4 – Contextual Conditions

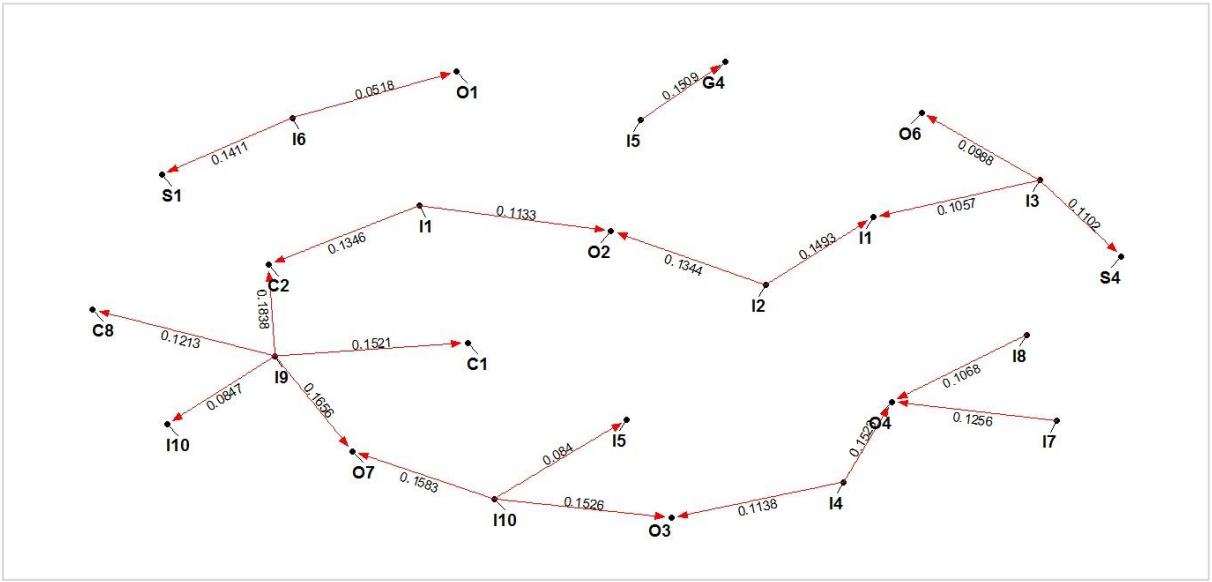

Figure 5 – Intervening Conditions

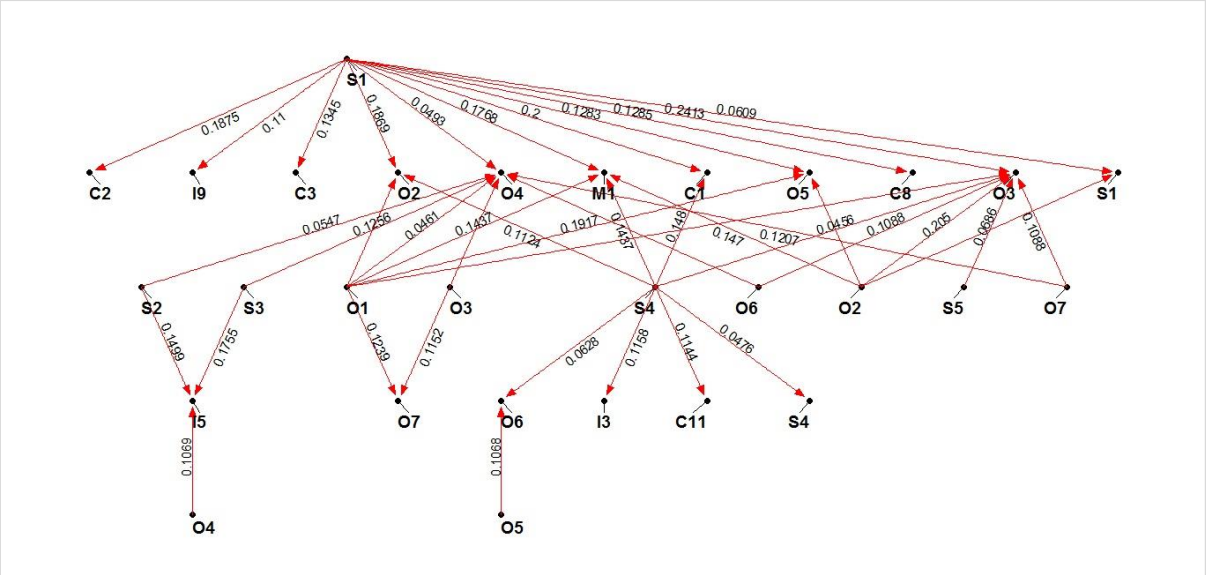

Figure 6 – Strategies and Outcomes

As mentioned earlier, Figures 3-6 illustrate the substantial interrelationships among the criteria in the model. More precisely, each node represents a criterion, and the arrow between them shows their relation. As an instance, in Figure 4, "economic fluctuations and devaluation of the Iranian currency" (G4) would cause "low prices for medical and tourism services" (G5) with an intensity of 0.1068. Similarly, Figure 5 shows that "the expansion of the Cultural Heritage, Handicrafts and Tourism Organization into a ministerial organization" (I6) would lead to "the need to create an appropriate structure for organizing/monitoring SC members" (S1) (with an intensity of 0.1411) and would help to revisit and refine "inefficient solutions offered by the Iranian Health Tourism Strategic Council" (O1) (with an intensity of 0.0518). Naturally, higher intensity values would indicate the higher importance and significance of the relationship between two criteria in the model.

To improve the situation of medical tourism in Shiraz and thus increase the market share of this city in global medical tourism, the following practical suggestions were raised during the interviews with the experts. The first solution is to strengthen the Iranian Health Tourism Strategic Council. In this regard, Expert 1 stated, "*The Iranian Health Tourism Strategic Council was meant to serve as an institution that would address problems of health and medical tourism in Iran, and it should be supported so that it can improve the status of the industry.*" The next solution is to create platforms to verify the qualifications of doctors, hospitals, hotels, firms, and facilitators, in line with medical tourists' opinions and expectations. Concerned with this issue, Expert 9 explained: "*The solution is to implement a verification system. If there was a strong platform to reflect medical tourists' voices and*

validate the qualities of service providers, the market would automatically ignore incompetent service providers. Validation leads to progress. Why did platforms such as TripAdvisor become so popular worldwide, and why does every hotel try to have a positive review in it? Because customers' voice and their experiences are heard there, and as a result, the overall level of quality can be raised. "

The next important suggestion is to empower the private sector and human resources in the field of medical tourism. Expert 1 stated: "*Most importantly, human resources in the medical tourism industry of Shiraz are not very competent. The officials did not provide enough training for human resources. Many of employees are not fluent in English or other languages, and cannot communicate well with medical tourists and handle their problems.*" Expert 3 also explained: "*Human resources serving medical tourism need to understand cross-cultural differences and behavioral habits that travelers may exhibit*." Moreover, some of the most critical solutions proposed by the experts were launching a comprehensive medical tourism portal, facilitating the medical visa issuance process, and paying attention to academic research in medical tourism.

Conducting face-to-face interviews under COVID-19 circumstances was a major challenge to this study and disturbed the research schedules. Furthermore, it was difficult to contact and interview more experts due to their busy schedules and management responsibilities. In two cases, the experts, for personal reasons, did not agree to have their voice recorded. Future investigations are strongly advised to probe into the relationships among the dimensions, sub-dimensions, and criteria, using various statistical methods/techniques.

6. Conclusion

This study conducted a comprehensive analysis of the MTSC in Shiraz, Iran, by employing a GT-rough DEMATEL approach. The analysis revealed that Shiraz's medical tourism suffered from shortcomings in its service delivery. Meanwhile, two groups of strategies, namely improving the medical tourism infrastructure and creating competitive advantage by focusing on the product and the market, was unfruitful and did not help to increase the market share of Shiraz in global medical tourism. Hence, to improve the situation of medical tourism in Shiraz and thus increase its market share, several solutions are possible, such as strengthening the Iranian Health Tourism Strategic Council, creating validation platforms, empowering the private sector and human resources in this industry, launching a comprehensive medical tourism portal, facilitating the medical visa issuance process, and

paying attention to academic research in medical tourism. Furthermore, the findings and results of this study could suggest important practical implications as they can help different stakeholders in Shiraz's medical tourism industry to improve their current status. The GT-rough DEMATEL methodology applied to a tourism context represented another innovation of the study.

Declarations

Ethical Approval and Consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of supporting data

The datasets supporting the conclusions of this article are included within the article and in supplementary file.

Competing interests

Not applicable.

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Authors' contributions

A. H.: Conceptualization, Data gathering and curation, Methodology, Writing the original manuscript; P. S.: Conceptualization, Methodology, Supervision, Editing and revising, M. H. R.: Conceptualization, Editing and revising, and O. F.: Industry Link, Industry expert.

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References

Abbaspour, F., Soltani, S., & Tham, A. (2020). Medical tourism for COVID-19 post-crisis recovery? *Anatolia*, 1-4. doi: https://doi.org/10.1080/13032917.2020.1815067

Ahmadimanesh, F., Paydar, M. M., & Asadi-Gangraj, E. (2019). Designing a mathematical model for dental tourism supply chain. *Tourism Management, 75*, 404-417. doi: https://doi.org/10.1016/j.tourman.2019.06.001

Alford P. (2005) A Framework for Mapping and Evaluating Business Process Costs in the Tourism Industry Supply Chain. In: Frew A.J. (eds) Information and Communication Technologies in Tourism. Springer, Vienna. doi: https://doi.org/10.1007/3-211-27283-6_12

Chagla, Z. (2021). The BNT162b2 (BioNTech/Pfizer) vaccine had 95% efficacy against COVID-19≥ 7 days after the 2nd dose. *Annals of Internal Medicine*. doi: https://doi.org/10.7326/ACPJ202102160-015

Charmaz, K. (2000). Grounded theory: Objectivist and constructivist methods. *Handbook of qualitative research, 2*, 509-535.

Chen, D. (2009). Innovation of Tourism Supply Chain Management. Paper presented at the 2009 International Conference on Management of e-Commerce and e-Government. Nanchang, China. doi: https://doi.org/10.1109/ICMeCG.2009.79

Chopra, S., Meindl, P. (2007). *Supply chain management: strategy, planning, and operation*: Pearson Boston, MA.

Chuang, T. C., Liu, J. S., Lu, L. Y. Y., & Lee, Y. (2014). The main paths of medical tourism: From transplantation to beautification. *Tourism Management, 45*, 49-58. doi: https://doi.org/10.1016/j.tourman.2014.03.016

Chung, K.-C., & Chang, L.-C. (2017). A Sustainability Strategy Assessment Framework Model for Medical Tourism Supply Chain in Asia. *Journal of Testing and Evaluation, 46*(2), 745-755. doi: https://doi.org/10.1520/JTE20160424

Connell, J. (2013). Contemporary medical tourism: Conceptualisation, culture and commodification. *Tourism Management, 34*, 1-13. doi: https://doi.org/10.1016/j.tourman.2012.05.009

Crooks, V. A., Kingsbury, P., Snyder, J., & Johnston, R. (2010). What is known about the patient's experience of medical tourism? A scoping review. *BMC Health Services Research, 10*(1), 266. doi: https://doi.org/10.1186/1472-6963-10-266

de la Hoz-Correa, A., Muñoz-Leiva, F., & Bakucz, M. (2018). Past themes and future trends in medical tourism research: A co-word analysis. *Tourism Management, 65*, 200-211. doi: https://doi.org/10.1016/j.tourman.2017.10.001

del Rio, C., Collins, L. F., & Malani, P. (2020). Long-term Health Consequences of COVID-19. *JAMA, 324*(17), 1723-1724. doi: https://doi.org/10.1001/jama.2020.19719

Dunne, C. (2011). The place of the literature review in grounded theory research. *International Journal of Social Research Methodology, 14*(2), 111-124. doi: https://doi.org/10.1080/13645579.2010.494930

Ellram, L. M., & Ueltschy Murfield, M. L. (2019). Supply chain management in industrial marketing–Relationships matter. *Industrial Marketing Management, 79*, 36-45. doi: https://doi.org/10.1016/j.indmarman.2019.03.007

Fernando, Y., Lee, K. (2015). Dive with the Sharks: A content analysis of the medical tourism supply chain. *Current Issues and Emerging Trends in Medical Tourism*, 31-43. doi: https://doi.org/10.4018/978-1-4666-8574-1.ch003

Ferrer, M., Medhekar, A. (2012). The factors impacting on the management of global medical tourism service supply chain. *GSTF Journal on Business Review (GBR), 2*(2). URL: http://dl6.globalstf.org/index.php/gbr/article/view/1255

Flint, D. J., Woodruff, R. B., & Gardial, S. F. (2002). Exploring the phenomenon of customers' desired value change in a business-to-business context. *Journal of marketing, 66*(4), 102-117. doi: https://doi.org/10.1509/jmkg.66.4.102.18517

Fongtanakit, R., Somjai, S., Prasitdumrong, A., & Jermsittiparsert, K. (2019). The Determinants of the Medical Tourism Supply Chain of Thailand. *Int. J Sup. Chain. Mgt Vol, 8*(6), 291. URL: http://ojs.excelingtech.co.uk/index.php/IJSCM/article/view/4149

Fontela, E., & Gabus, A. (1976). The DEMATEL observer: DEMATEL.

Glaser, B. G. (1992). Emergence vs forcing: Basics of grounded theory analysis: Sociology Press.

Glaser, B. G., & Strauss, A. L. (1967). The Discovery of Grounded Theory-Strategies for Qualitative Research (London, Weiderfeld and Nicolson).

Gössling, S., Scott, D., & Hall, C. M. (2021). Pandemics, tourism and global change: a rapid assessment of COVID-19. *Journal of Sustainable Tourism, 29*(1), 1-20. doi: https://doi.org/10.1080/09669582.2020.1758708

Heath, H., & Cowley, S. (2004). Developing a grounded theory approach: a comparison of Glaser and Strauss. *International Journal of Nursing Studies, 41*(2), 141-150. doi: https://doi.org/10.1016/S0020-7489(03)00113-5

Heung, V. C. S., Kucukusta, D., & Song, H. (2010). A Conceptual Model of Medical Tourism: Implications for Future Research. *Journal of Travel & Tourism Marketing, 27*(3), 236-251. doi: https://doi.org/10.1080/10548401003744677

Hudson, S., & Li, X. (2012). Domestic Medical Tourism: A Neglected Dimension of Medical Tourism Research. *Journal of Hospitality Marketing & Management, 21*(3), 227-246. doi: https://doi.org/10.1080/19368623.2011.615018

Jabbari, A., Zarchi, M. K. R., Kavosi, Z., Shafaghat, T., & Keshtkaran, A. (2013). The marketing mix and development of medical tourism in Shiraz. *Materia socio-medica, 25*(1), 32. doi: https://doi.org/10.5455/msm.2013.25.32-36

Jones, I., & Roy, P. (2021). Sputnik V COVID-19 vaccine candidate appears safe and effective. *The Lancet*. doi: https://doi.org/10.1016/S0140-6736(21)00191-4

Kaewkitipong, L. (2018). The Thai medical tourism supply chain: its stakeholders, their collaboration and information exchange. *Thammasat Review, 21*(2), 60-90. URL: https://sc01.tci-thaijo.org/index.php/tureview/article/view/161323

Karadayi Usta, S., & SerdarAsan, S. (2020). A conceptual model of medical tourism service supply chain. *Journal of Industrial Engineering and Management, 13*(2), 246-265. URI: http://hdl.handle.net/2117/328400

Karadayi-Usta, S., & Serdarasan, S. (2020). A Collaborative Framework for Medical Tourism Service Supply Chain Operations. *Global Developments in Healthcare and Medical Tourism*, 188-219. doi: https://doi.org/10.4018/978-1-5225-9787-2.ch011

Ke, L. (2006). An Initial Discussion on the New Pattern of the Supply Chain in Tourism Industry. *Tourism Tribune, 3*, 30-33. URL: http://en.cnki.com.cn/Article_en/CJFDTotal-LYXK200603010.htm

Kenny, M., & Fourie, R. (2014). Tracing the history of grounded theory methodology: From formation to fragmentation. *Qualitative Report, 19*(52). URL: https://nsuworks.nova.edu/tqr/vol19/iss52/1

Knoll, M. D., & Wonodi, C. (2021). Oxford–AstraZeneca COVID-19 vaccine efficacy. *The Lancet, 397*(10269), 72-74. doi: https://doi.org/10.1016/S0140-6736(20)32623-4

Kornilaki, M., & Font, X. (2019). Normative influences: How sociocultural and industrial norms influence the adoption of sustainability practices. A grounded theory of Cretan, small tourism firms. *Journal of Environmental Management, 230*, 183-189. doi: https://doi.org/10.1016/j.jenvman.2018.09.064

Kownacki, A., Barker, D., & Arghode, V. (2020). A grounded theory approach for exploring shared leadership: evidence from urban primary schools in Pennsylvania. *International Journal of Leadership in Education*, 1-22. doi: https://doi.org/10.1080/13603124.2020.1804622

Lee, H. K., & Fernando, Y. (2015). The antecedents and outcomes of the medical tourism supply chain. *Tourism Management, 46*, 148-157. doi: https://doi.org/10.1016/j.tourman.2014.06.014

Li, L., & Wang, H. (2018). A Green Supplier Assessment Method for Manufacturing Enterprises Based on Rough ANP and Evidence Theory. *Information, 9*(7), 162. doi: https://doi.org/10.3390/info9070162

Liu, L., Song, W., & Han, W. (2020). How sustainable is smart PSS? An integrated evaluation approach based on rough BWM and TODIM. *Advanced Engineering Informatics, 43*, 101042. doi: https://doi.org/10.1016/j.aei.2020.101042

Lock, S. (2020[A]). Global change in travel and tourism revenue due to COVID-19 2019-2020. Retrieved on January 10th from: https://www.statista.com/forecasts/1103426/covid-19-revenue-travel-tourism-industry-forecast

Lock, S. (2020[B]). Global tourism industry - statistics & facts. Retrieved on January 10th from https://www.statista.com/topics/962/globaltourism/#:~:text=Globally%2C%20travel%20and%20tourism's%20direct,at%20580.7%20billion%20U.S.%20dollars

Lovelock, B., & Lovelock, K. (2018). "We had a ball … as long as you kept taking your painkillers" just how much tourism is there in medical tourism? Experiences of the patient tourist. *Tourism Management, 69*, 145-154. doi: https://doi.org/10.1016/j.tourman.2018.05.015

Manoukian, S. (2012). *City of knowledge in twentieth century Iran: Shiraz, history and poetry* (Vol. 10): Routledge.

Mao, W., Wang, W., & Sun, H. (2020). Optimization path for overcoming barriers in China's environmental protection institutional system. *Journal of Cleaner Production, 251*, 119712. doi: https://doi.org/10.1016/j.jclepro.2019.119712

Maysami, A. M., & Mohammadi Elyasi, G. (2020). Designing the framework of technological entrepreneurship ecosystem: A grounded theory approach in the context of Iran. *Technology in Society, 63*, 101372. doi: https://doi.org/10.1016/j.techsoc.2020.101372

McCarthy, N. (2021). The Covid-19 Vaccination Race. Retrieved on January 13th from https://www.statista.com/chart/23833/covid-19-vaccination-doses-per-100-people/

Mekhum, W. (2020). Effect of Supply Chain Capabilities on Health Tourism Performance of Ranong Province, Thailand. *Talent Development & Excellence, 12*(2). URL: https://iratde.com/index.php/jtde/article/view/841

Momeni, K., Janati, A., Imani, A., & Khodayari-Zarnaq, R. (2018). Barriers to the development of medical tourism in East Azerbaijan province, Iran: A qualitative study. *Tourism Management, 69*, 307-316. doi: https://doi.org/10.1016/j.tourman.2018.05.007

Oğuz, B., Gordon; G., & Cruz, H. (2020). *Medical Tourism in the Time of COVID-19* (Policy Brief No.69). URL: https://www.jstor.org/stable/resrep25188

Pamučar, D., Stević, Ž., & Zavadskas, E. K. (2018). Integration of interval rough AHP and interval rough MABAC methods for evaluating university web pages. *Applied Soft Computing, 67*, 141-163. doi: https://doi.org/10.1016/j.asoc.2018.02.057

Pawlak, Z. (1982). Rough sets. *International Journal of Computer & Information Sciences, 11*(5), 341-356. doi: https://doi.org/10.1007/BF01001956

Rahman Muhammad, K., & Zailani, S. (2017). The effectiveness and outcomes of the Muslim-friendly medical tourism supply chain. *Journal of Islamic Marketing, 8*(4), 732-752. doi: https://doi.org/10.1108/JIMA-11-2015-0082

Reed, C. M. (2008). Medical Tourism. *Medical Clinics of North America, 92*(6), 1433-1446. doi: https://doi.org/10.1016/j.mcna.2008.08.001

Sharma, A., Vishraj, B., Ahlawat, J., Mittal, T., & Mittal, M. (2020). Impact of COVID-19 outbreak over Medical Tourism. doi: https://doi.org/10.9790/0853-1905145658

Shiraz University of Medical Science (2019). Shiraz Hospitals Information. Retrieved on 19th December 2020 from: https://sums.ac.ir/Index.aspx?page_=form&lang=1&PageID=768&tempname=Main&sub=0&methodName=ShowModuleContent

Shojaei, P., & bolvardizadeh, A. (2020). Rough MCDM model for green supplier selection in Iran: a case of university construction project. *Built Environment Project and Asset Management, 10*(3), 437-452. doi: https://doi.org/10.1108/BEPAM-11-2019-0117

Shojaei, P., & Haeri, S. A. S. (2019). Development of supply chain risk management approaches for construction projects: A grounded theory approach. *Computers & Industrial Engineering, 128*, 837-850. doi: https://doi.org/10.1016/j.cie.2018.11.045

Smith, M., & Puczkó, L. (2008). *Health and wellness tourism*: Routledge.

Song, W., & Cao, J. (2017). A rough DEMATEL-based approach for evaluating interaction between requirements of product-service system. *Computers & Industrial Engineering, 110*, 353-363. doi: https://doi.org/10.1016/j.cie.2017.06.020

Song, W., Zhu, Y., & Zhao, Q. (2020). Analyzing barriers for adopting sustainable online consumption: A rough hierarchical DEMATEL method. *Computers & Industrial Engineering, 140*, 106279. doi: https://doi.org/10.1016/j.cie.2020.106279

Stevic, Z., Badi, I., Tanackov, I., & Milicic, G. (2017). *Supplier selection in furniture production company using rough AHP and rough TOPSIS.* Paper presented at the VI International Symposium of Transport and Communications-New Horizons. doi: https://dx.doi.org/10.2139/ssrn.3191130

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research*: Sage publications.

Sun, H., Wu, S., Li, Y., & Dai, G. (2019). Tourist-to-Tourist Interaction at Festivals: A Grounded Theory Approach. *Sustainability, 11*(15), 4030. doi: https://doi.org/10.3390/su11154030

UNWTO. (2020). International Tourist Numbers Down 65% In First Half Of 2020, UNWTO Reports. Retrieved on January 10th from: https://www.unwto.org/news/international-tourist-numbers-down-65-in-first-half-of-2020-unwto-reports

Van Niekerk, J. C., & Roode, J. (2009). Glaserian and Straussian grounded theory: similar or completely different? Paper presented at the Proceedings of the 2009 Annual Research Conference of the South African Institute of Computer Scientists and Information Technologists. doi: https://doi.org/10.1145/1632149.1632163

Wan-Li, L., Hao-Peng, Y., & Ping, L. (2007). Several Problems regarding the Study of Tourism Supply Chain. *Tourism Tribune, 9*, 023. URL: http://en.cnki.com.cn/Article_en/CJFDTotal-LYXK200709023.htm

Wan-Li, L., Hao-Peng, Y., & Qing-Bin, M. (2007). A preliminary Research on Tourism Supply Chain in China. *Journal of Guilin Institute of Tourism, 2*. URL: http://en.cnki.com.cn/Article_en/CJFDTotal-GLGZ200702020.htm

Wu, W.-W. (2008). Choosing knowledge management strategies by using a combined ANP and DEMATEL approach. *Expert Systems with Applications, 35*(3), 828-835. doi: https://doi.org/10.1016/j.eswa.2007.07.025

Yelin, D., Wirtheim, E., Vetter, P., Kalil, A. C., Bruchfeld, J., Runold, M., . . . Pujol, M. (2020). Long-term consequences of COVID-19: research needs. *The Lancet Infectious Diseases, 20*(10), 1115-1117. doi: https://doi.org/10.1016/S1473-3099(20)30701-5

Zeng, B., & He, Y. (2019). Factors influencing Chinese tourist flow in Japan – a grounded theory approach. *Asia Pacific Journal of Tourism Research, 24*(1), 56-69. doi: https://doi.org/10.1080/10941665.2018.1541185

Zhai, L.-Y., Khoo, L.-P., & Zhong, Z.-W. (2008). A rough set enhanced fuzzy approach to quality function deployment. *The International Journal of Advanced Manufacturing Technology, 37*(5), 613-624. doi: https://doi.org/10.1007/s00170-007-0989-9

Zhu, G.-N., Hu, J., Qi, J., Gu, C.-C., & Peng, Y.-H. (2015). An integrated AHP and VIKOR for design concept evaluation based on rough number. *Advanced Engineering Informatics, 29*(3), 408-418. doi: https://doi.org/10.1016/j.aei.2015.01.010

Figures

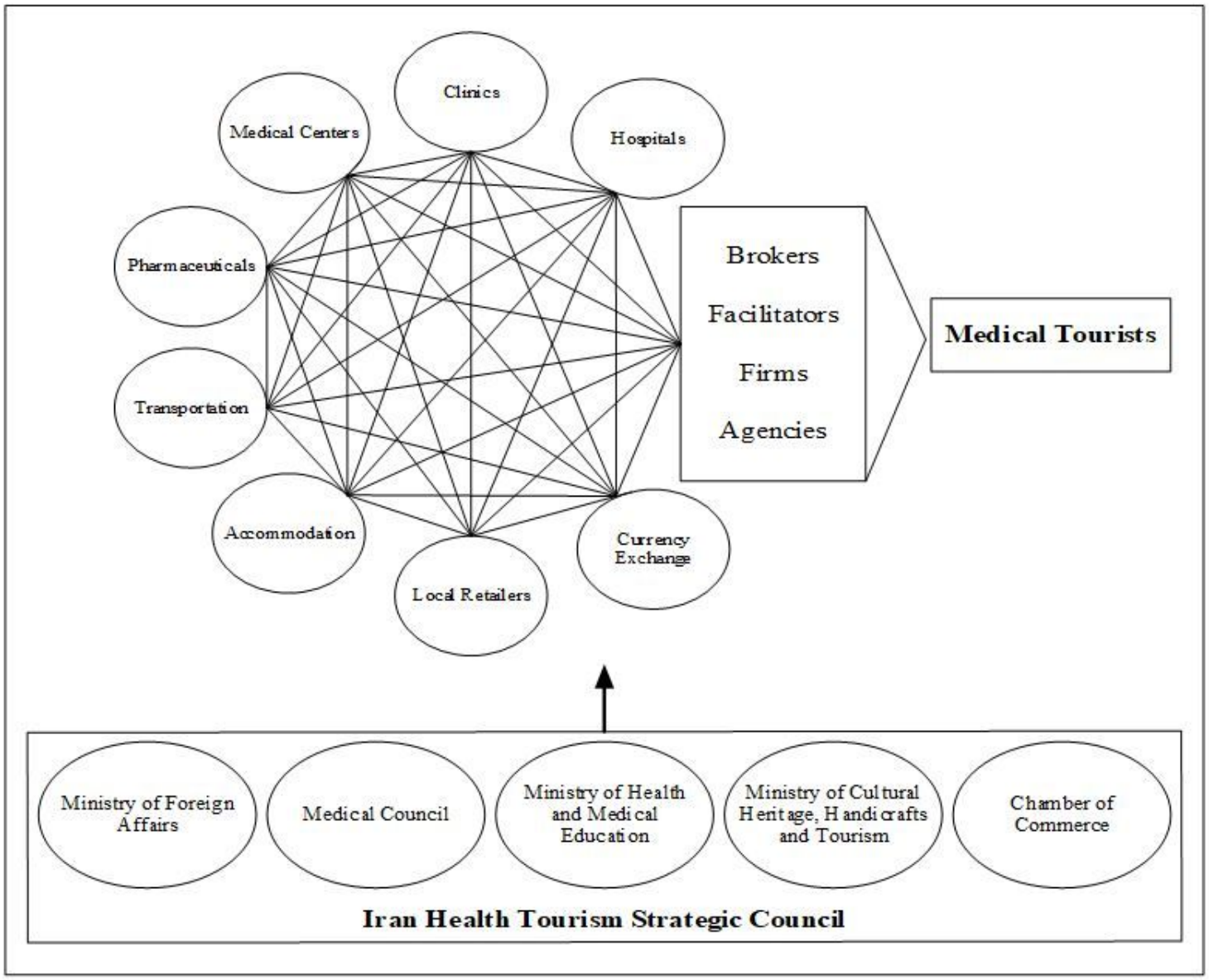

Figure 1

Shiraz MTSC Stakeholders

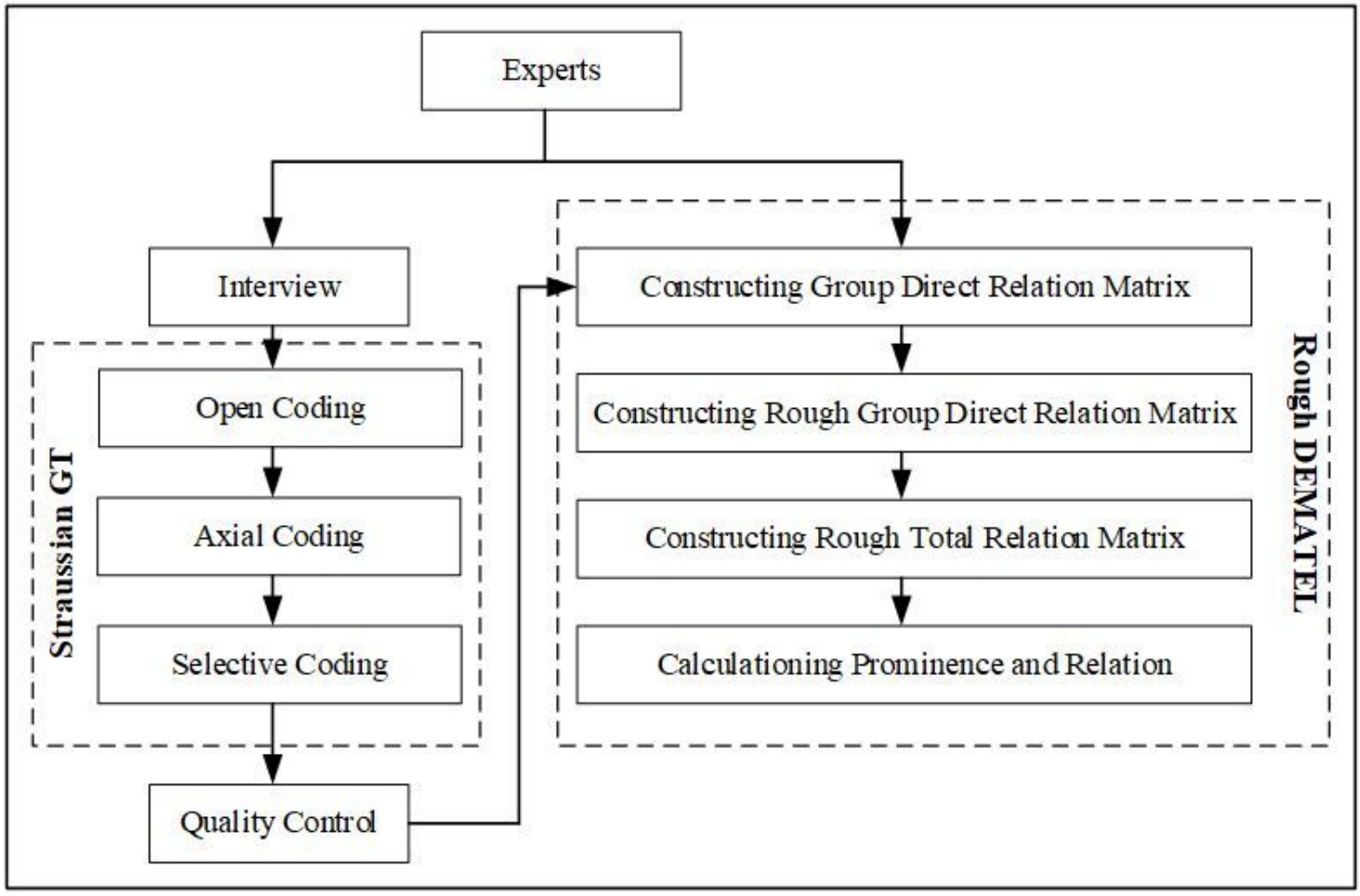

Figure 2

Research Process

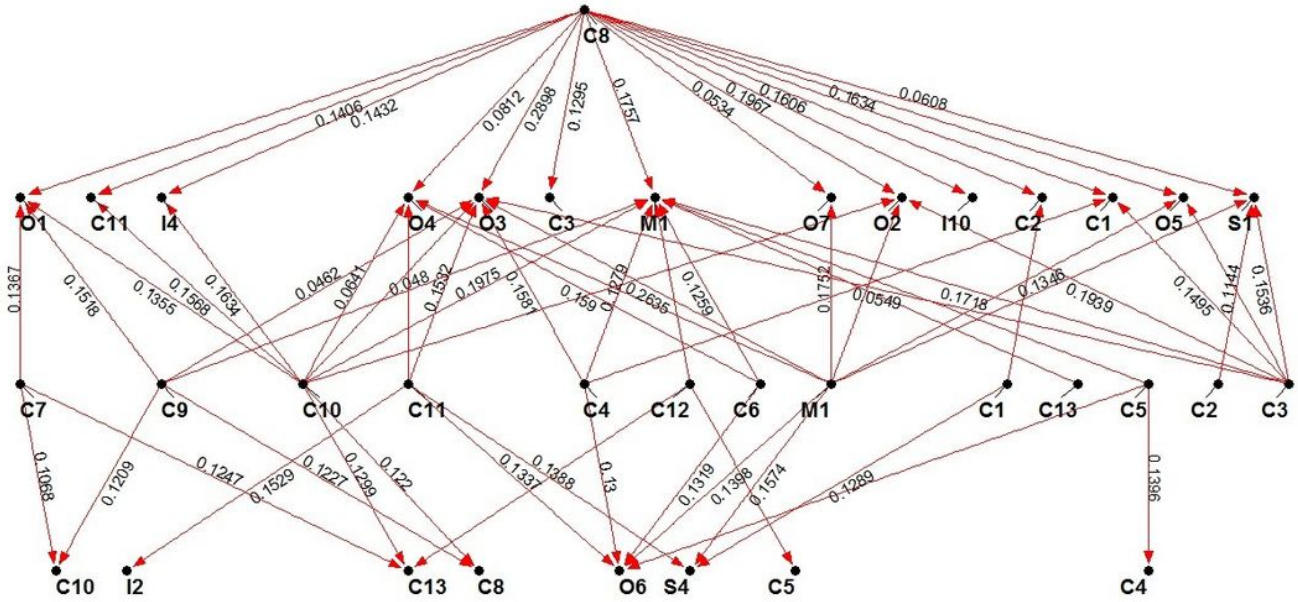

Figure 3

The Main Phenomenon and Causal Conditions

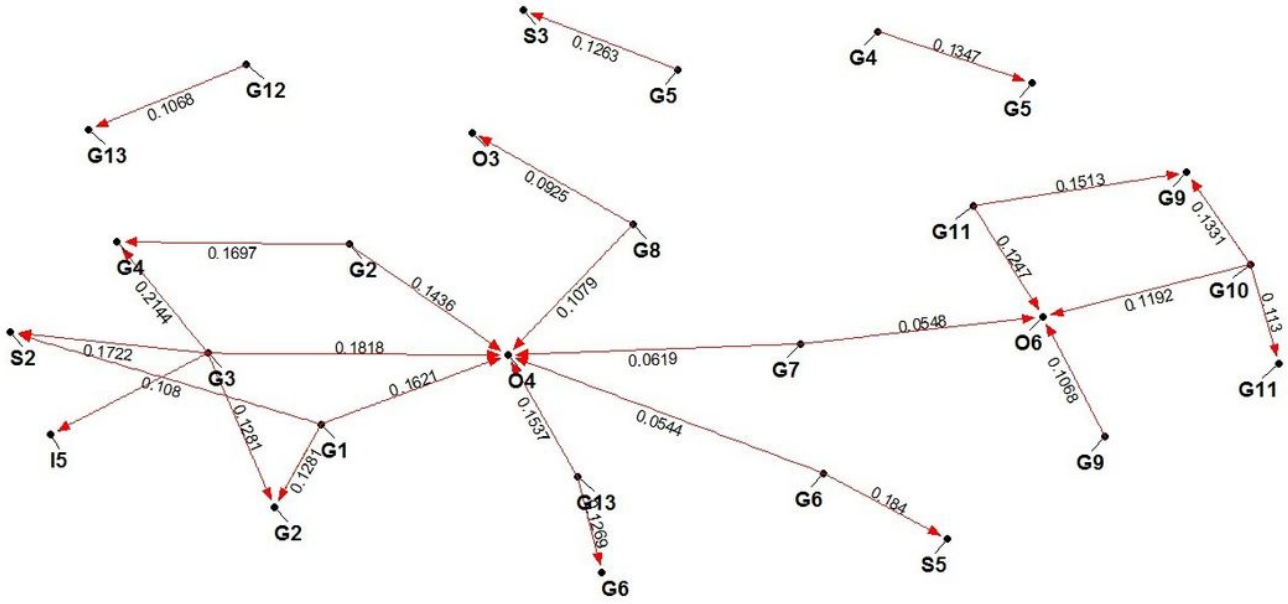

Figure 4

Contextual Conditions

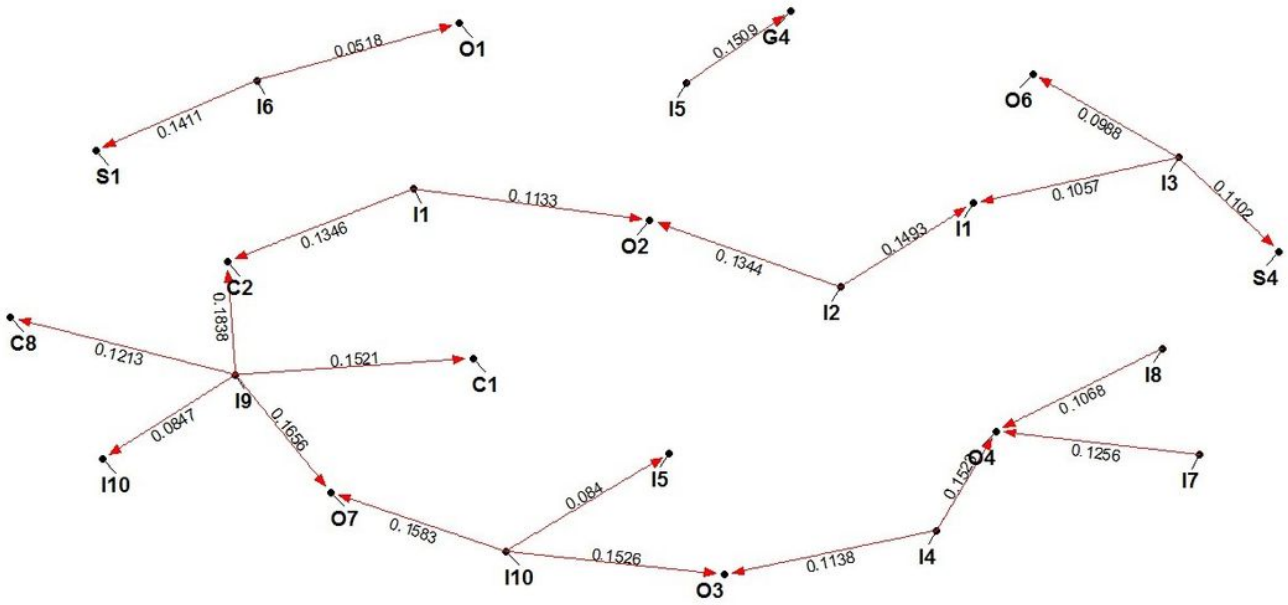

Figure 5

Intervening Conditions

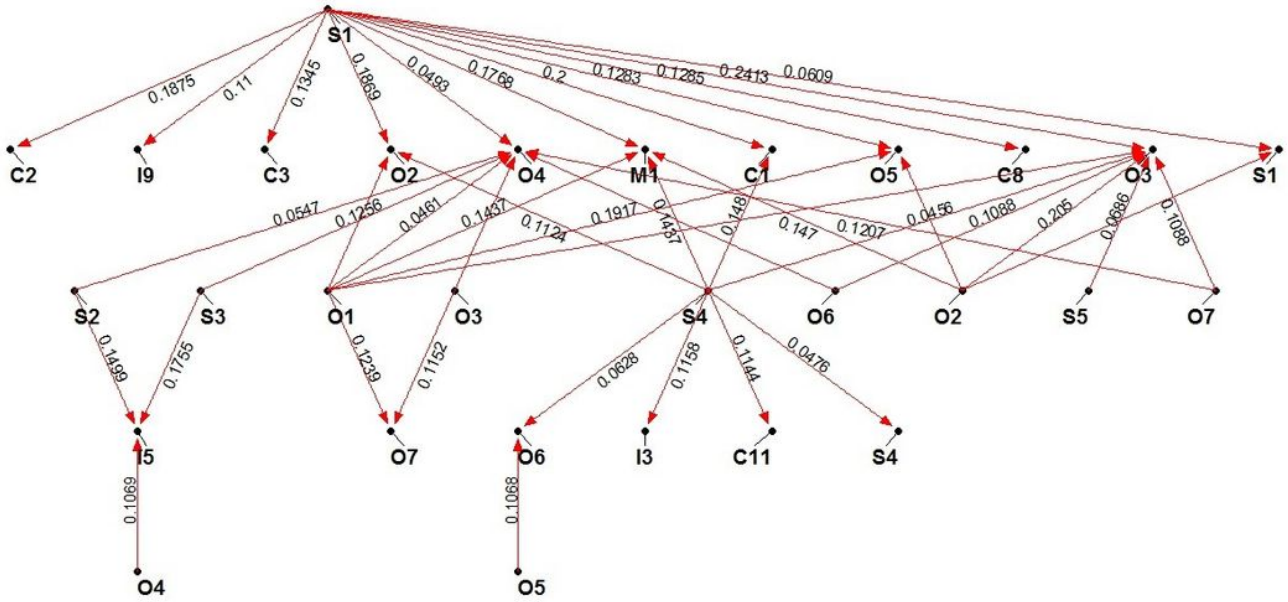

Figure 6

Strategies and Outcomes

Supplementary Files

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