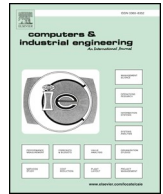




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Factors influencing medical tourism adoption in Malaysia: A DEMATEL-Fuzzy TOPSIS approach

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ABSTRACT

Tourism is one of the biggest competitive industries in the world. Nowadays, medical tourism is quickly developing as a part of tourism for health and wellness care. There are many factors influencing the development of medical tourism in developing countries. This research aims to identify those factors for medical tourism development in Malaysia. We investigate the factors from the literature to develop a new decision-making model. We use two multi-criteria decision making techniques, Decision Making Trial and Evaluation Laboratory (DEMATEL) and Fuzzy Order of Preference by Similarity to Ideal Solution (Fuzzy TOPSIS), to reveal the inter-relationships among the factors and to find the relative importance of these factors in the decision making model. The results showed that human and technological factors are the most important factors for medical tourism adoption in Malaysia. The results of this study will enable key players in the medical tourism industry to potentially assign investments for medical tourism in the developing countries.

1. Introduction

Tourism is one of the fastest growing industries in the world (Ahani, Nilashi, Ibrahim, Sanzogni, & Weaven, 2019; Nilashi, Ahani et al., 2019; Nilashi, Yadegaridehkordi et al., 2019). As a new form of tourism, health tourism has become one of the fastest growing international businesses in the tourism industry for developing countries. Medical tourism is defined as “the act of traveling abroad to obtain medical care” (Keckley, 2008, p. 4). Medical tourism has been emerging as a particularly lucrative sector, potential tourist market and global phenomenon in health care. The evidence shows that many developing countries such as Thailand, Malaysia and India attracted more than two and a half million medical tourists in 2005 (Heung, Kucukusta, & Song, 2011). In Asia, Singapore, Thailand, and Malaysia, India, the Philippines, South Korea and Taiwan have been the major countries for international medical travelers for medical tourism services.

Readiness is defined as the “people’s propensity to embrace and use

new technologies for accomplishing goals in home life and at work” (Parasuraman, 2000). In another definition cited by Shea, Jacobs, Esserman, Bruce, and Weiner (2014), organizational readiness refers to “the extent to which organizational members are psychologically and behaviorally prepared to implement organizational change” (Weiner, Lewis, & Linnan, 2008). To be new innovation in organizations savvy, the organizations need to be ready from different aspects to employ it for their competitive advantage in the business (Parasuraman & Colby, 2015). It has been shown that establishing sufficient organizational readiness is an essential step of implementing new programs, practices, or policies in organizations (Asadi et al., 2019; Shea et al., 2014). In addition, it has been found that there is a positive relationship between the organizational readiness and the willingness of members to initiate change, exert greater effort and cooperative behaviour (Weiner et al., 2008), which accordingly will result in more effective and successful implementation of the proposed new innovation.

Although there have been several attempts for medical tourism in

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Malaysia, however, according to Malaysia Healthcare Travel Council (MHTC), the medical tourism industry in this country still needs a lot of improvements in order to be the regional hub for the international tourist medical services. In addition, there are many barriers in Malaysia which still need to be overcome to foster medical tourism growth and compete in this field (Sarwar, 2013). Furthermore, to achieve a high success rate, improve the country ranking in medical tourism and compete in this field, many Malaysian medical tourism stakeholders need to provide a world class service with effective information services and adopt a different strategy for medical tourists. The evidence shows that many stakeholders are not yet capable of providing medical tourist services for the shortage of human resource in the health sector (Manaf & Hazilah, 2010). In fact, they are not able to take fully the advantages of medical tourism because of several environmental, technological, organizational and human issues to meet this sector of tourism.

In this research, we develop a decision making model and propose by four readiness factors which are all essential for the adoption of medical tourism in developing countries. We then use two multi-criteria decision making techniques, Decision Making Trial and Evaluation Laboratory (DEMATEL) and Fuzzy Order of Preference by Similarity to Ideal Solution (Fuzzy TOPSIS), to reveal the interrelationships among the factors and find their ranks in the decision making model. We show that if tourism companies are not ready from those aspects of readiness, they may become hesitant to adopt medical tourism in their organizations. Accordingly, the main research question which this study investigates is: what factors influence medical tourism adoption in Malaysia? Overall, the contributions of this research are as follows:

- (i) We develop a new model for medical tourism adoption through Human, Organization and Technology fit (HOT-fit) and Technology, Organization and Environment (TOE) framework. These organizational theories have been widely used in healthcare management studies (Ahmadi, Ibrahim, & Nilashi, 2015; Ahmadi, Nilashi, & Ibrahim, 2015; Ahmadi, Nilashi, Shahmoradi, & Ibrahim, 2017; Nilashi, Ahmadi, Ahani, Ravangard, & bin Ibrahim, 2016).
- (ii) In contrast with the previous studies which are from the customers' perspectives, the proposed model is based on hotel managers' perspectives in Malaysia. Accordingly, the data is collected from the managers of major hotels who had experiences in hotel management and operations.
- (iii) This study uses two multi-criteria decision making techniques, DEMATEL and Fuzzy TOPSIS, for analysis the data collected from the managers of hotels. As effective multi-criteria decision making techniques, DEMATEL and Fuzzy TOPSIS are widely used in a variety of decision-making problems (Fu & Liao, 2019; Zhu, Luo, Liao, Zhang, & Shen, 2019).

This research is organized as following. Section 2 presents the proposed framework. A brief description of the methods used for data analysis is presented in Section 3. Discussions on the results are provided in Section 4. Finally, the conclusions and future study are presented in Section 5.

2. Model development

In the following sections, the previous studies on medical tourism are discussed. In addition, the proposed model for medical tourism adoption is presented.

2.1. Previous work on medical tourism

In a study by Tham (2018), the authors explored the domestic medical tourism developments in Australia. The findings of this research showed that lack of cooperation, residents' access to hospital

facilities and hostile attitudes between practitioners are the main barriers for the domestic medical tourism development. Their findings were obtained from seven different stakeholder groups. de la Hoz-Correa, Muñoz-Leiva, and Bakucz (2018) conducted a study on Web of Science and Scopus databases to investigate the evolution of medical tourism from the longitudinal perspective. Six clusters of themes were found in their study which are: "health-related issues, medical treatments and tourism"; "medical tourism destinations and marketing"; "sensitive practices in medical tourism"; "globalization, policies"; "ethical implications", "trust and accreditation"; "health, wellness, spa tourism and service quality and the effect on international patients".

Ganguli and Ebrahim (2017) conducted a qualitative approach for the identification and analyzing the factors for medical tourism destination in Singapore. They found seven pillars for Singapore's medical tourism competitiveness, "an enabling tourism sector", "strategic planning", "PPPS frameworks", "marketing and branding strategies", "marketing and branding strategies", "accreditation & governance", "accreditation & governance" and "human capital development". Esiyok, Çakar, and Kurtulmuşoğlu (2017) investigated the effect of cultural distance on medical tourism. Their study measured cultural distance based on Hofstede's cultural framework, used panel data, included neighbouring countries in the sample, and aggregated the data at the specialty level. Their empirical findings provided by the baseline model indicated that the incorporation of cultural distance is important in policy planning in medical tourism.

Majeed, Lu, and Javed (2017) conducted a scoping review on health systems and medical tourism. They included 112 papers in their review. Fetscherin and Stephano (2016) presented a medical tourism index to evaluate the attractiveness of a country to be a host for medical tourists. Using a rigorous multi-steps scale, they conducted the work from four empirical studies which included 4995 respondents. Beladi, Chao, Ee, and Hollas (2015) focused on medical tourism and investigated the income distribution effects of medical tourism in developing countries. They found that an expansion of medical tourism in the countries can have favorable and unfavorable economic implications. Lunt, Horsfall, and Hanefeld (2016) conducted a review on medical tourism. They used WoS and British Library Search in their review. The search terms were: Cosmetic tourism, Medical tourism, Treatment abroad, Treatment overseas, Cosmetic surgery, Cross-border fertility, abroad, Dental tourism, Medical vacation and Cross-border health, Cosmetic surgery overseas, Surgery abroad, Transplant tourism, Fertility tourism and Medical travel.

Two areas of medical tourism (i.e., cosmetic and dental procedures), were investigated by Rodrigues, Brochado, Troilo, and Mohsin (2017). They used Leximancer software to analysis the postprocedural experiences of 603 medical tourists. The medical tourists were from different countries between 2008 and 2016. Chuang, Liu, Lu, and Lee (2014) developed a study on medical tourism and used the main path analysis to analyze active research areas in medical tourism, literature, and the development trajectories. Runnels and Carrera (2012) enhanced the knowledge on medical tourism and proposed a sequential decision making process. They found that the identification of need is the first step in the sequence of a typical decision making process to engage in medical tourism. In medical tourism, the experiences of informal caregivers were investigated by Whitmore, Crooks, and Snyder (2015) through a semi-structured interview with 20 Canadians who their family members or friends had experiences in abroad surgery as medical tourist. They asked the questions regarding the members experiences prior to, during and after travel in their surgery. From the thematic analysis by the use of NVivo software, they found three themes central to an ethics of care: mutuality, responsibility and vulnerability. Frederick and Gan (2015) investigated the East-West differences among the websites of medical tourism facilitators. They used logistic regressions in their data analysis. In medical tourism, Mohamad, Omar, and Haron (2012) investigated the moderating impact of medical travel facilitators. They found the important role of medical travel facilitators

for prospective patients and hospital providers.

[Crush and Chikanda \(2015\)](#) investigated the South-South medical tourism and the quest for health in Southern Africa. [Connell \(2013\)](#) found the culture, quality and availability of care influence medical tourism behaviour. [Sarantopoulos, Vicky, and Geitona \(2014\)](#) investigated the tourist executives' opinions, beliefs and aspects in medical tourism in Greece. They examined the factors which impact the tourist potential investments on medical tourism. They focused on two types of medical tourism, non-cosmetic surgery and medical treatment. They used logistic regression in their data analysis. [Lee and Fernando \(2015\)](#) focused on medical tourism supply chain by investigating the antecedents and outcomes. Accordingly, they proposed a theoretical model and evaluated the model through PLS-SEM. They selected 133 organizations as medical tourism providers in Malaysia and collected the data using a self-administered questionnaire. They investigated financial and non-financial organizational performance in their study. The results of their work revealed the importance of mutual dependency on antecedent variables.

[Heung et al. \(2011\)](#) determined the factors impacting on the development of medical tourism in Hong Kong. They identified the costs, expertise/manpower, infrastructural and super-structural factors, policies and regulations, promotion, facilities and attractions, government attitude, communication, and investment potential as the main barriers to medical tourism development. Their data collection was from the medical institutions, the government bodies, and the representatives of private and public hospital. They used a qualitative research technique for data collection. Costs, capacity problems, government support, policies and regulations and the healthcare needs of the local community were the most important barriers of developing the medical tourism in Hong Kong. [Moghavvemi et al. \(2017\)](#) examined the private hospitals websites which aimed to promote medical tourism in Thailand, India and Malaysia. The authors analysed the content and format of webpages of 51 hospitals through five factors: interactive online services, admission and medical services, technical items, external activities and hospital Information and facilities. Offering interactive online services was the most important weakness of hospital websites across the three countries to provide medical tourism services.

[Bies and Zacharia \(2007\)](#) developed an Analytic Network Process (ANP) model to determine how medical tourism services can be effectively encouraged. The strategic criteria in their ANP model were: "Condition of Domestic Health Care System", "Universality of Access of Health Care" and "Quality of Healthcare". They also considered "Benefits", "Opportunities", "Costs" and "Risks Analysis" with the strategic criteria. They found that self-selected medical tourism is preferred in relation to the employer- or government-sponsored programs and over the status quo, as it involves lower cost. They also found government-encouraged medical tourism as the least preferred option. In the Canadian healthcare system, [Sheppard, Lester, Karmali, de Gara, and Birch \(2014\)](#) investigated the cost of bariatric medical tourism. They selected 62 patients who had been medical tourists, between February 2009 and June 2013. [Khan and Alam \(2014\)](#) investigated the medical tourism in Saudi Arabia. They emphasized that Saudi Arabia has significant capability to become a hub of medical tourism in the region. [Buzinde and Yarnal \(2012\)](#) investigated the therapeutic landscapes and postcolonial theory in medical tourism. They showed that therapeutic landscapes are able to facilitate the medical tourism sites. [Abubakar and Ilkan \(2016\)](#) investigated the impact of online Word-of-Mouth (WoM) on destination trust and intention to travel in medical tourism. They also investigated the moderating effect of income in their study. The authors provide a model and conducted a survey with outbound medical tourists who visited Turkey for medical services. They found the importance of online WoM on destination trust and accordingly intention to travel. They also found that the relationship between WoM and intention to travel can be strengthened by income.

[Hallem and Barth \(2011\)](#) investigated the customer-perceived value of medical tourism in Tunisia by developing an exploratory study for cosmetic surgery. They showed the importance of cost as a major incentive in medical tourism. [Han and Hyun \(2015\)](#) studied the customer' retention in medical tourism. They investigated the impact of price reasonableness, satisfaction, trust, and quality. They considered Perceived Service Quality, Customer Satisfaction, Trust in the Staff, Perceived Medical Quality, Intention to Revisit, Trust in the Clinic, and Intention to Revisit Korea for Medical Care in their model. They conducted a field survey at medical clinics.

[Yu and Ko \(2012\)](#) developed a cross-cultural study on medical tourism to reveal the perceptions of Korean, Japanese and Chinese tourists in Korea. The aim was to identify cultural differences among these countries. This research established four factor groups (Selective factors, Inconveniences, Medical treatments and Well-being and healthcare) for medical tourism through an exploratory factor analysis. [Crooks, Turner, Snyder, Johnston, and Kingsbury \(2011\)](#) conducted a study in medical tourism to identify and understand the messages and images which are used by companies use for the marketing purpose in India as a global destination. [Smith, Álvarez, and Chanda \(2011\)](#) investigated the role of bi-lateral trade for medical tourism. They used UK-India as a case study. [Viladrich and Baron-Faust \(2014\)](#) examined the online marketing literature for cosmetic surgeries in Argentina. They argued that the role of Internet advertising should be further investigated for medical tourism in Argentina. [Aziz, Yusof, Ayob, Bakar, and Awang \(2015\)](#) conducted a study to measure the tourists' behavioural intention in Malaysian medical tourism industry.

[Moghimehfar and Nasr-Esfahani \(2011\)](#) examined the factors impacting destination choice in infertile couples who visited Isfahan, Iran. Their investigation was based on field evaluation through documentary survey and interview questionnaire. [Chang, Chou, Yeh, and Tseng \(2016\)](#) proposed a research model to investigate the factors impacting the Chinese patients' intention to use the Taiwan Medical Travel App. They used the questionnaires and statistical analyses to verify the research model. They found the importance of perceived usefulness, app involvement, and perceived ease of use in patients' intention to use the Taiwan Medical Travel App. [Hanefeld, Lunt, Smith, and Horsfall \(2015\)](#) investigated the impact of the networks on medical travel. They found that the majority of medical tourists have been for cosmetic, bariatric surgery and dental treatment. In Malaysia, [Yeoh, Othman, and Ahmad \(2013\)](#) conducted a nationwide study on medical tourists and found that medical tourists are highly influenced by the doctor's referral. [Cormany and Baloglu \(2011\)](#) conducted an exploratory study to analyse the web page contents and services provided for the prospective medical tourists. They considered two set of criteria for sites evaluation information (e.g., email contact, mailing address, telephone number, maps of destination served, notation of hospital accreditation, information request form, hospital selection, listing of medical procedures available, past traveller testimonials, links to informational websites, estimated treatment costs and the availability of last web page update) and the list of services offered by the firm. The second set of criteria was for evaluation purpose. The service areas included: ground transportation, arrangement of medical appointments, translation services, air travel, concierge services, transfer of medical records, site-seeing options, hotel accommodations, provision of aftercare support services and provision of an international cell phones.

[Wongkit and McKercher \(2013\)](#) examined tourists who had experience in medical treatment in Thailand. They found four different medical tourist segments in this country. They showed that the most medical tourists have decided to seek treatment in the destination prior to leaving home. [Han and Hwang \(2013\)](#) developed a model to investigate the perceived benefits in a medical hotel and how they impact on the international travellers' decision making process. They incorporated Medical Service, Convenience, Financial Saving, Perceived

Value, Hospitality Product and Behavioral Intentions in their model. Han (2013) conducted a study to identify the distinctive attributes of a healthcare hotel. The results of their study showed the importance of personal security among the healthcare-hotel attributes. They also found perceptions and cognitions, trust, and affect as significant mediators in healthcare hotel. Turner (2011) conducted a study to empirically analysis the websites of medical tourism companies in Canada. Chou, Kiser, and Rodriguez (2012) used expectation confirmation theory and investigated the impact of perceived performance, satisfaction, and expectations on the tourists' intentions to use overseas medical services. They collected the data from 118 participants and analyzed it using a statistical technique, Partial Least Squares (PLS). They found that perceived overseas medical service performance has positive impact on the overseas medical service expectation. They also found that the medical tourists' satisfaction can be predicted by their confirmation of expectation. Beladi, Chao, Ee, and Hollas (2019) developed a study on the impact of medical tourism on the economic growth through a cross-country analysis. They found that medical tourism has a positive effect on the economic growth of host countries.

2.2. Proposed model for medical tourism adoption

From the previous studies, we could find that the most studies have been conducted from the individual perspectives in medical tourism. In addition, it is found that the organizational readiness is not investigated for developing countries in medical tourism. Many developing countries are still in the early stage medical tourism. In this study, however, the success of adopting medical tourism by hotel firms is related to the readiness of an organization to provide the medical tourism services. In addition, for any hotel firm which is planned to adopt medical tourism the questions are: (i) *Is the hotel firm ready for medical tourism services?* and (ii) *what are the human, organizational, technological and environmental readiness factors that impact on the decision to adopt medical tourism by hotel firms?* Accordingly, this study aims to fill this gap by providing a tripod readiness model for medical hotel adoption in Malaysia. Here, according to medical hotel is defined a hotel that provides foods and beverages, rooms, hotel services as well as various aesthetic-related, healthcare, medical services to the customers. The readiness of hotel firms for healthcare services is important, as its diffusion is still far from full potential due to the several readiness issues. In Fig. 1, we provide the framework for the hotel firms' readiness from human, organizational, technological and environmental factors. The proposed model is based on HOT-fit and TOE framework.

The hierarchical model includes three levels, the goal (decision to adopt) level, the aspect levels (human, organizational, technological and environmental factors) and criteria level which includes efficient information systems (C1), internet (C2), medical technology (C3), cloud computing technologies (C4), top management commitment (C5), financial performance (C6), infrastructure (C7), international healthcare collaboration (C8), government policy (C9), national healthcare policy (C10), investment (C11), facilitating visits to malaysia (C12), language and communication (C13), service quality (C14), specialization (C15), and specialists (C16). The aim is to find which aspects of readiness can have significant impact on the hotel firms to adopt medical tourism services. In addition, as provided in the research model, finding the interrelationships among these aspects of readiness will also be the contribution of this research. The factors and their criteria are presented in Table 1.

3. Applied techniques and data analysis

In this research, we use DEMATEL and Fuzzy TOPSIS techniques to

analysis the data for revealing the importance levels of factors and finding the relationships between them in the model. The applied methodology is introduced in the following sections.

3.1. Fuzzy TOPSIS

Multi-criteria decision making approaches are widely used in decision making problems (Büyükoçkan & Çifçi, 2012; Fu & Liao, 2019; Zhu et al., 2019). As a multi-criteria decision making approach, the Fuzzy TOPSIS technique (Chen, 2000) has been successful in finding the best solution under uncertainty (Wang & Elhag, 2006; Wang & Lee, 2009) through experts' point of view (Büyükoçkan & Çifçi, 2012). This study used Fuzzy TOPSIS to find the most important factors for decision-makers for medical tourism adoption in Malaysia. The data is collected by TOPSIS scales as presented in Table 2. The procedure of this technique is presented as follows. For k decision makers D_r ($r = 1, \dots, k$) and a decision-making problem with m criteria and n alternatives A_i ($i = 1, \dots, n$), the following steps are performed to find the best criteria.

Step 1: The weights of criteria and ratings of alternatives are aggregated through the following equations:

$$\tilde{w}_j = \frac{1}{k} [\tilde{w}_j^1 + \tilde{w}_j^2 + \dots + \tilde{w}_j^k] \tag{1}$$

$$\tilde{x}_{ij} = \frac{1}{k} [\tilde{x}_{ij}^1 + \tilde{x}_{ij}^2 + \dots + \tilde{x}_{ij}^k] \tag{2}$$

where the weight of j th criterion (C_j) is expressed by \tilde{w}_r^j .

Step 2: Construct the fuzzy decision matrices of the criteria and the alternative (\tilde{D}) through the following equations:

$$\tilde{W} = [\tilde{w}_1 + \tilde{w}_2 + \dots + \tilde{w}_m] \tag{3}$$

$$\tilde{D} = A_j \begin{bmatrix} C_1 & C_2 & C_j & C_m \\ \tilde{x}_{11} & \tilde{x}_{12} & \tilde{x}_{1j} & \tilde{x}_{1m} \\ \vdots & \vdots & \vdots & \vdots \\ \tilde{x}_{n1} & \tilde{x}_{n2} & \tilde{x}_{nj} & \tilde{x}_{nm} \end{bmatrix} \tag{4}$$

Step 3: Construct the normalized fuzzy decision matrix \tilde{R} through the following equations:

$$\tilde{R} = [\tilde{r}_{ij}]_{m \times n} \tag{5}$$

$$\tilde{r}_{ij} = \left(\frac{l_{ij}}{u_j^+}, \frac{m_{ij}}{u_j^+}, \frac{u_{ij}}{u_j^+} \right) \text{ and } u_j^+ = \max_i u_{ij} \text{ (benefit criteria)} \tag{6}$$

$$\tilde{r}_{ij} = \left(\frac{l_j^-}{u_{ij}}, \frac{l_j^-}{m_{ij}}, \frac{l_j^-}{l_{ij}} \right) \text{ and } l_j^- = \max_i l_{ij} \text{ (cost criteria)} \tag{7}$$

Step 4: Construct the weighted normalize decision matrix \tilde{V} through the following equation:

$$\tilde{V} = [\tilde{v}_{ij}]_{m \times n}, \quad \tilde{v}_{ij} = \tilde{x}_{ij} \times \tilde{w}_j \tag{8}$$

Step 5: Compute the Fuzzy Negative Ideal (FNIS, A^-) and the Fuzzy Positive Ideal Solution (FPIS, A^+) through the following equations:

$$A^+ = \{\tilde{v}_1^+, \tilde{v}_j^+, \dots, \tilde{v}_m^+\} \tag{9}$$

$$A^- = \{\tilde{v}_1^-, \tilde{v}_j^-, \dots, \tilde{v}_m^-\} \tag{10}$$

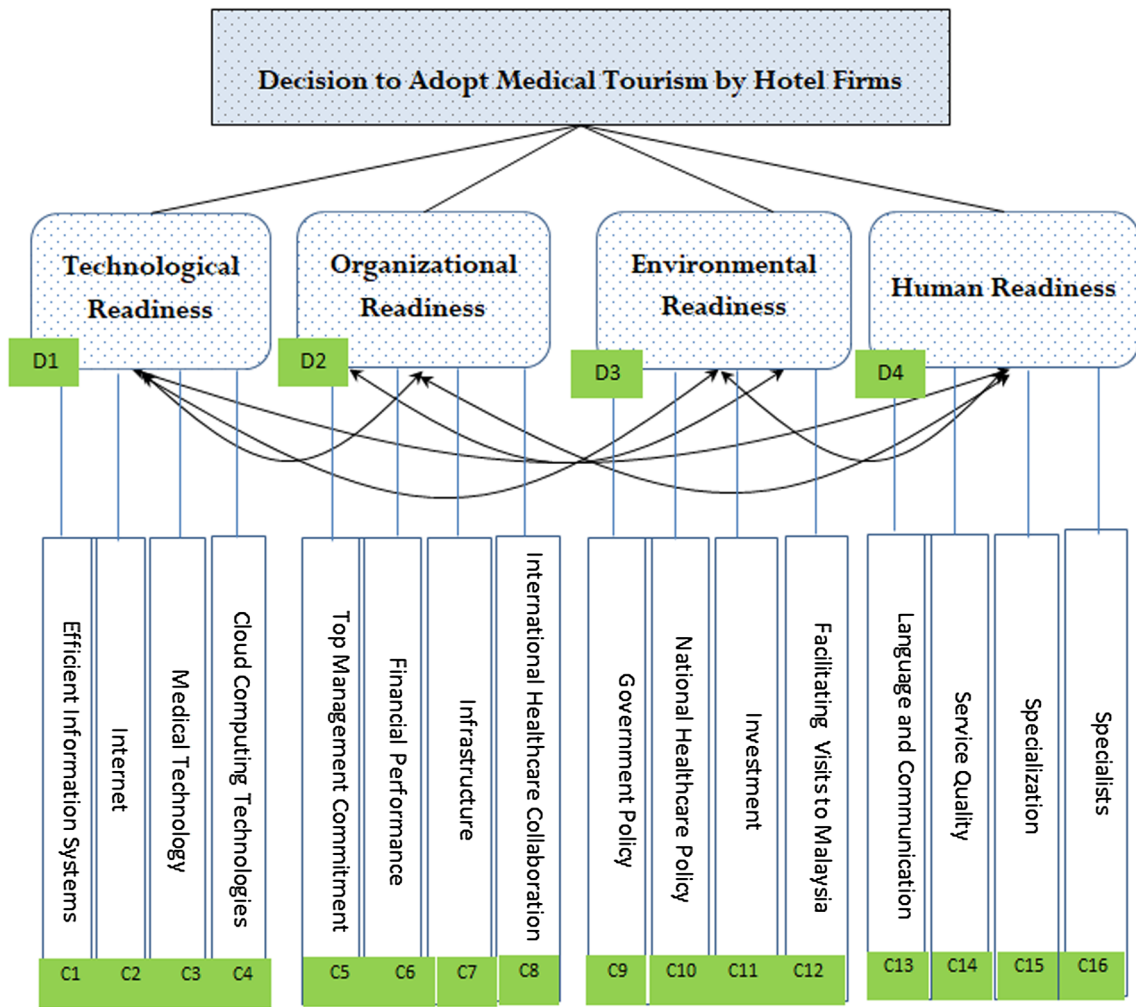


Fig. 1. Proposed model for medical hotel readiness.

Table 1
Factors and criteria for the adoption of medical tourism by hotel firms.

Factors	Criteria
Technological (D1)	Efficient Information Systems (C1)
	Internet (C2)
	Medical Technology (C3)
	Cloud Computing Technologies (C4)
Organizational (D2)	Top Management Commitment (C5)
	Financial Performance (C6)
	Infrastructure (C7)
	International Healthcare Collaboration (C8)
Environmental (D3)	Government Policy (C9)
	National Healthcare Policy (C10)
	Investment (C11)
	Facilitating Visits to Malaysia (C12)
Human (D4)	Language and Communication (C13)
	Service Quality (C14)
	Specialization (C15)
	Specialists (C16)

where $\tilde{v}_j^+ = (1, 1, 1)$ and $\tilde{v}_j^- = (0, 0, 0)$.

Step 6: Compute the distances indicated of each alternative from \tilde{v}_j^+ and \tilde{v}_j^- using the following equations:

$$d_i^+ = \sum_{j=1}^n dv(\tilde{v}_{ij}, \tilde{v}_j^+) \quad (11)$$

Table 2
Linguistic variables for the importance weight of each criterion.

Linguistic variable	Fuzzy number
“Very Low (VL)”	“(0,0.05,0.15)”
“Low (L)”	“(0.1,0.2,0.3)”
“Medium Low (ML)”	“(0.2,0.35,0.5)”
“Medium (M)”	“(0.3,0.5,0.7)”
“Medium High (MH)”	“(0.5,0.65,0.8)”
“High (H)”	“(0.7,0.8,0.9)”
“Very High (VH)”	“(0.85,0.95,1)”

Table 3
Sample characteristics.

Characteristics	Item	Number	Percentage (%)
Gender	Male	40	100
	Female	0	0
Experience	≤ 10 years	6	15
	11–14 years	8	20
	15–19 years	10	25
	20 ≥ years	16	40
City	Johor Bahru	8	20
	Melaka	5	12.5
	Penang	6	15
	Kuala Lumpur	21	52.5

Table 4
Average matrix.

	Technological	Organizational	Environmental	Human
Technological	0.0000	1.5750	1.5250	2.5250
Organizational	3.8500	0.0000	1.1500	3.0000
Environmental	2.1000	2.3250	0.0000	2.3000
Human	3.3750	2.7000	1.4250	0.0000

Table 5
The direct influence matrix.

	Technological	Organizational	Environmental	Human
Technological	0.0000	0.1689	0.1635	0.2708
Organizational	0.4129	0.0000	0.1233	0.3217
Environmental	0.2252	0.2493	0.0000	0.2466
Human	0.3619	0.2895	0.1528	0.0000

Table 6
The total relation matrix.

	Technological	Organizational	Environmental	Human
Technological	0.6197	0.6018	0.4528	0.7439
Organizational	1.1168	0.5924	0.5232	0.9438
Environmental	0.9015	0.7274	0.3615	0.8140
Human	1.0474	0.7900	0.5234	0.6669

Table 7
Final results of DEMATEL analysis.

Factors	R	C	R + C	R - C
Technological	2.4182	3.6854	6.1036	-1.2673
Organizational	3.1762	2.7117	5.8879	0.4646
Environmental	2.8045	1.8610	4.6654	0.9435
Human	3.0277	3.1685	6.1962	-0.1408

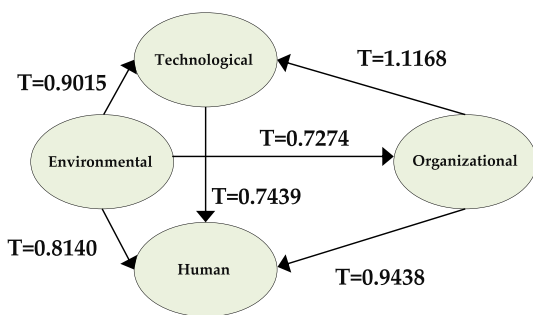


Fig. 2. Interrelationships among four factors of readiness and decision to adopt medical tourism by hotel firms.

$$d_i^- = \sum_{j=1}^n dv(\tilde{v}_{ij}, \tilde{v}_j^-) \tag{12}$$

$$d(\tilde{x}, \tilde{z}) = \sqrt{\frac{1}{3}[(l_x - l_z)^2 + (m_x - m_z)^2 + (u_x - u_z)^2]} \tag{13}$$

Step 7: Compute the closeness coefficient CC_i through the following equation:

$$CC_i = \frac{d_i^-}{d_i^+ + d_i^-} \tag{14}$$

Step 8: Compute the ranks of the alternatives according to CC_i in decreasing order.

3.2. DEMATEL

DEMATEL is one of the effective techniques to find and analyse the inter-relationship among the system factors. This method transforms the causal relationships between the factors indicators into a tangible structural model. DEMATEL is a comprehensive method for the preparation and analysis of a structural model that includes causal relationships between complex factors. This technique acts on directional graphs, and these graphs are able to display directional relationships between sub-systems. The result of the DEMATEL technique is to divide the factors into two cause and effect groups. The steps of DEMATEL technique are as follows:

Step 1. The data is collected from the respondents. Suppose that there is H respondents and n factors, each respondent provides the effect of the factor i on factor j . These effects are presented in a matrix $X^k = [X_{ij}^k]_{n \times n}$ (for the k th respondent). From this matrix, a direct relations matrix is formed. The scale ranges from 0 (No influence) to 4 (Very high influence). All elements a_{ii} in the main diagonal of X^k are 0. To have a combined matrix of all respondents' feedback, we use the following formula:

$$A = [A_{ij}]_{n \times n} = \frac{1}{H} \sum_{k=1}^H [X_{ij}^k]_{n \times n} \tag{15}$$

Step 2: In this step, the normalized primary direct matrix is calculated. We call this matrix as the initial influence matrix, D . To form a normalized matrix of direct relations matrix, we use the following formulas.

$$D = \frac{A}{S} \tag{16}$$

$$S = \max(\max_{j=1}^n \sum_{i=1}^n a_{ij}, \max_{i=1}^n \sum_{j=1}^n a_{ij}) \tag{17}$$

Step 3: We compute the direct/indirect influence matrix. This matrix reflects the direct and indirect effects that the matrix elements (factors) have on each other. L is an identity matrix. The total relation matrix T is calculated by:

$$T = D(L - D)^{-1} \tag{18}$$

Step 4: In this step, two matrices C and R are calculated. These matrices are constructed to form $R + C$ (total effects given and received by a factor) and $R - C$ (the net effects that a factor contributes to the system). Accordingly, if $R - C$ is positive, the factor is net cause, otherwise the factor is net receiver.

$$T = [t_{ij}]_{n \times n}, \quad j = 1, 2, \dots, n \tag{19}$$

$$C = (\sum_{j=1}^n t_{ij})_{n \times 1}, \quad i = 1, 2, \dots, n \tag{20}$$

$$R = (\sum_{i=1}^n t_{ij})_{1 \times n}, \quad j = 1, 2, \dots, n \tag{21}$$

3.3. Data collection

In Malaysia, the Tourism Development Corporation (TDC) was initiated in 1972, which was responsible for the development of domestic and international tourism (Ghani, 2016). Nowadays, the tourism sector is one of the major national key economic areas in Malaysia. With the help of various private and public agencies, the tourism and hospitality sector has contributed significantly to this country's economic growth. In 2017, the Malaysia's investment on Travel & Tourism was MYR23.0 billion, 6.7% of total investment (USD5.3 billion). In addition, in 2017,

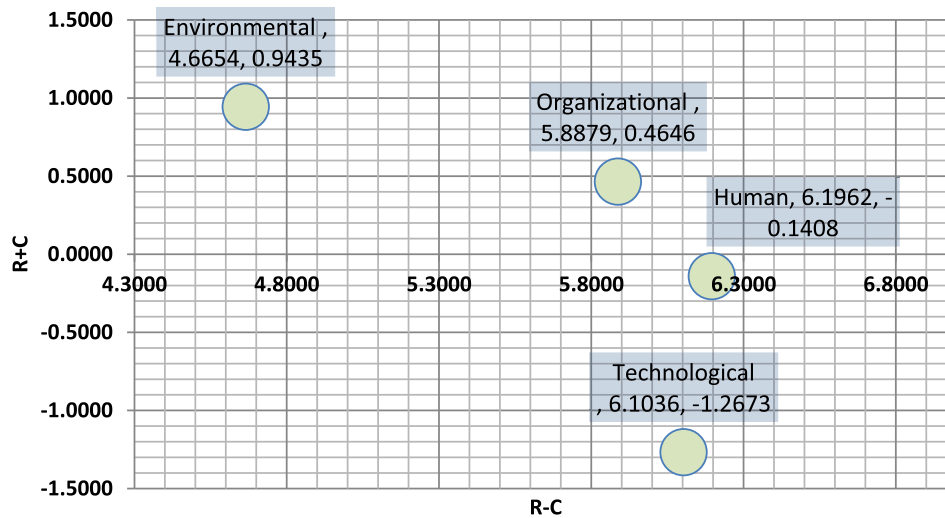


Fig. 3. The causal diagram for four factors of readiness.

Table 8
Average rating for each criteria of technological readiness.

Criteria	Fuzzy rating
Efficient Information Systems (C1)	(0.73,0.83,0.92)
Internet (C2)	(0.65,0.77,0.88)
Cloud Computing Technologies (C4)	(0.42,0.59,0.76)
Medical Technology (C3)	(0.79,0.89,0.96)

Table 10
Average rating for each criteria of organizational readiness.

Criteria	Fuzzy Rating
Top Management Commitment (C5)	(0.58,0.71,0.84)
Financial Performance (C6)	(0.65,0.77,0.88)
Infrastructure (C7)	(0.79,0.89,0.96)
International Healthcare Collaboration (C8)	(0.32,0.5,0.68)

Malaysia has achieved the GDP around MYR181.4 billion (USD41.9 billion), 13.4% of GDP, by contributing in the Travel & Tourism. Furthermore, Travel & Tourism in Malaysia has directly supported 670,000 jobs (4.6% of total employment).

Established in 2009, Malaysia Healthcare Travel Council (MHTC) as an agency under the Health Ministry has been responsible to provide world class healthcare services and facilitate the medical tourism development by building Public-Private Partnerships (PPP) and with the coordination of industry collaborations. Malaysian government has showed high interest towards the medical tourism in recent years. In a report by the Malaysian Ministry of Health (MOH), it has been emphasized that the income from foreign patients can significantly enhance the national health services which can bring benefits for the local population (Leng, 2010). The report of MOH shows that the number of foreign patients to Malaysia has been increased from 393,000 to 770,000 between 2010 and 2013 with a huge rise in financial receipts from RM379 million to RM690 million. Also, the report shows that medical tourism will generate RM35.5 billion in Gross National Income (GNI) and provide 181,000 new careers to cater to 1.9 million medical travellers by 2020. The report of MHTC also demonstrated that the income from medical tourism from an estimated 900,000 medical tourists was RM1 billion in 2016. Such other countries which have contributed to the medical tourism, there have been several hospitals and clinics, listed in the Malaysian medical tourism website (www.medicaltourism.com.my), to provide the medical treatments for the

people who come to Malaysia as medical travelers.

Although, the evidence shows that the medical tourism services in Malaysia are growing, these services are only provided in some of the public and private clinics and hospitals. In addition, small number of major hotels solely provide spa and wellness services and other types of medical services are not provided because of several readiness issues. This study focused on the four major readiness factors for the implementation of medical services by major hotels in Malaysia which are: human readiness, organizational readiness, technological readiness and environmental readiness. The target population of this research comprises the managers of hotels in Malaysia. We investigated their perception and attitude toward medical hotels and the problems faced by them in adopting this type of services. They were asked to provide their difficulties on four factors, human, organizational, technological and environmental factors. All details of major Malaysian hotels along with their websites were found in www.tripadvisor.com. These hotels provide 5-star accommodations. In addition, we randomly selected those hotels which provide Spa services to the customers. The sample characteristics of the hotels managers are provided in Table 3. The data collection is conducted in four cities in Malaysia, Johor Bahru, Melaka, Penang and Kuala Lumpur. From this table, it is found that the majority of respondents (52.5%) have been the hotels' managers in Kuala Lumpur. In addition, this table reveal that 40% of respondents have had more than 20 years' experience in hotel management for top-level management responsibilities.

Table 9
The linguistic terms correspond to the average fuzzy scores of the technological readiness factors.

Criteria	Distance between Linguistic Term and Factors							Minimum Distance	Linguistic Term
	VL	L	ML	M	MH	H	VH		
C1	0.76	0.627	0.479	0.338	0.182	0.027	0.108	0.027	H
C2	0.701	0.567	0.418	0.276	0.120	0.036	0.170	0.036	H
C3	0.814	0.68	0.533	0.391	0.236	0.081	0.054	0.054	VH
C4	0.529	0.394	0.241	0.093	0.062	0.218	0.352	0.062	MH

Table 11
The linguistic terms correspond to the average fuzzy scores of the organizational readiness factors.

Criteria	Distance between Linguistic Term and Factors							Minimum Distance	Linguistic Term
	VL	L	ML	M	MH	H	VH		
C5	0.645	0.511	0.36	0.218	0.062	0.093	0.228	0.062	MH
C6	0.701	0.567	0.418	0.276	0.120	0.036	0.170	0.036	H
C7	0.814	0.68	0.533	0.391	0.236	0.081	0.054	0.054	VH
C8	0.442	0.307	0.152	0.016	0.152	0.307	0.442	0.016	M

Table 12
Average rating for each criteria of environmental readiness.

Criteria	Fuzzy Rating
Government Policy (C9)	(0.65,0.77,0.88)
National Healthcare Policy (C10)	(0.54,0.68,0.82)
Investment (C11)	(0.76,0.86,0.94)
Facilitating Visits to Malaysia (12)	(0.42,0.59,0.76)

3.4. Data analysis and discussion

In this study, the data was collected from the 40 managers of major hotels in Malaysia. An in-depth interview was conducted with each manager of hotel before the data collection by a questionnaire survey. In addition, to better be familiar with the questionnaire and how to be completed, a guideline was prepared and the method of completing the questionnaire was explained. In addition, we tried to explain them about the methods of data analysis to be more aware about it, which helped them in understanding the types of questionnaires used in this study.

In the first step of data analysis, the DEMATEL survey questionnaires were distributed. The aim of this survey was to reveal the interrelationships among four factors of readiness and to find the importance level of them with respect to the managers' decision to adopt medical hotels in Malaysia. In this survey, the managers were asked to provide their answers to the questions by the following scores: "No Influence (0)," "Low Influence (1)," "Medium Influence (2)," "High Influence (3)," and "Very High Influence (4)". To perform the steps of DEMATEL presented in the previous section, the data was structured in the matrices for all respondents. In the first step of our analysis, the combined (average) matrix $A = [A_{ij}]_{n \times n}$ was calculated (see Table 4). Then, by calculating the normalized primary direct matrix (see Table 5), we could obtain the matrix T for all relationships (see Table 6). After calculating this matrix, we obtained C, R, C + R and C - R from each matrix T (see Table 7).

The results of Table 5 can be depicted in a model which reveals the relationships among the main factors according to the T values (see Fig. 2). In this model, based on a threshold value which is calculated from the average of the values in T matrix, the relationships are constructed. In fact, the significant relationships are presented in the model by T values for influence rate. In Fig. 2, it can be seen that the influence rates of environmental factor on technological, organizational and human factors are respectively, $T = 0.9015$, $T = 0.7274$ and $T = 0.8140$. In addition, the influence rates of organizational factor on

Table 13
The linguistic terms correspond to the average fuzzy scores of the environmental readiness factors.

Criteria	Distance between Linguistic Term and Factors							Minimum Distance	Linguistic Term
	VL	L	ML	M	MH	H	VH		
C9	0.701	0.567	0.418	0.276	0.120	0.036	0.170	0.036	H
C10	0.616	0.481	0.330	0.187	0.031	0.124	0.259	0.031	MH
C11	0.787	0.653	0.506	0.365	0.209	0.054	0.081	0.054	H
C12	0.529	0.394	0.241	0.093	0.062	0.218	0.352	0.062	MH

Table 14
Average rating for each criteria of human readiness.

Criteria	Fuzzy Rating
Language and Communication (C13)	(0.32,0.5,0.68)
Service Quality (C14)	(0.54,0.68,0.82)
Specialization (C15)	(0.76,0.86,0.94)
Specialists (C16)	(0.82,0.92,0.98)

technological and Human factors are respectively, $T = 1.1168$ and $T = 0.9438$. The results further reveal that there is a significant relationship between technological factor and human factor with the influence rate of $T = 0.7439$. In addition, the outcome of DEMATEL analysis showed that Human factor has no impact on the technological, environmental and organizational factors for decision to adopt medical hotels in Malaysia. In Fig. 3, the causal diagram for four factors of readiness is presented. This figure better shows the importance of the factors based on the results of Table 6. In fact, this figure shows that technological, organizational, environmental and human factors are respectively net receiver, net causer, net cause and net receiver with R - C values of -1.2673, 0.4646, 0.9435 and -0.1408. In addition, the result of R + C in this figure shows that technological and human factors are more important than organizational and environmental factors for decision to adopt medical hotels in Malaysia.

After data collection through first questionnaire, Fuzzy TOPSIS questionnaire was distributed which were designed based on 7 scales, "Very Low (VL)", "Low (L)", "Medium Low (ML)", "Medium (M)", "Medium High (MH)", "High (H)", and "Very High (VH)". Based on these linguistic scales, the experts provided the importance of each factor of the decision making model. In Tables 8-15, we present the average scores and the linguistic terms correspond to the average fuzzy scores of the technological, environmental, organizational and human readiness factors. The results of Fuzzy TOPSIS analysis for final ranking are presented in Table 16.

4. Discussions

Tourism has been one of the important economic activities in the developing and developed countries around the world (Nilashi et al., 2018). As a developing country, Malaysia's economic growth has caused a rapid rise of tourists' arrival. Regarding medical hotel development, the evidence shows that the trend of medical hotel in Malaysia is still in its early stages compared to the developed countries. In addition, despite a growing body of research in the field of tourism and

Table 15
The linguistic terms correspond to the average fuzzy scores of the human readiness factors.

Criteria	Distance between Linguistic Term and Factors							Minimum Distance	Linguistic Term
	VL	L	ML	M	MH	H	VH		
C13	0.442	0.307	0.152	0.016	0.152	0.307	0.442	0.016	M
C14	0.616	0.481	0.330	0.187	0.031	0.124	0.259	0.031	MH
C15	0.787	0.653	0.506	0.365	0.209	0.054	0.081	0.054	H
C16	0.840	0.707	0.560	0.418	0.263	0.108	0.027	0.027	VH

Table 16
Final ranks of criteria of decision making model.

Factors	Criteria	d_i^-	d_i^+	Closeness Coefficient (CC)	Criteria Rank
Technological (D1)	Efficient Information Systems (C1)	0.848	4.156	0.169	2
	Internet (C2)	0.788	4.22	0.157	3
	Cloud Computing Technologies (C4)	0.622	4.398	0.124	4
	Medical Technology (C3)	0.901	4.103	0.180	1
Organizational (D2)	Top Management Commitment (C5)	0.751	4.259	0.150	3
	Financial Performance (C6)	0.806	4.202	0.161	2
	Infrastructure (C7)	0.919	4.085	0.184	1
	International Healthcare Collaboration (C8)	0.542	4.484	0.108	4
Environmental (D3)	Government Policy (C9)	0.821	4.188	0.164	2
	National Healthcare Policy (C10)	0.733	4.282	0.146	3
	Investment (C11)	0.910	4.094	0.182	1
	Facilitating Visits to Malaysia (12)	0.647	4.376	0.129	4
Human (D4)	Language and Communication (C13)	0.534	4.491	0.106	4
	Service Quality (C14)	0.703	4.311	0.140	3
	Specialization (C15)	0.875	4.130	0.175	2
	Specialists (C16)	0.927	4.076	0.185	1

medical tourism, there is a limited research on the development of medical hotels in Malaysia.

This research has taken an important step toward filling this gap in medical hotel by identifying the most important challenges faced by hotels' managers in Malaysia. We found that the most hotels in Malaysia are not ready to provide medical hotel services because of several issues such as human, environmental, organizational and technological challenges. This study found human as one of the most critical readiness factor for developing medical hotels in Malaysia. Among language and communication, service quality, and specialization and specialists criteria in human factor of readiness, managers of hotels are more concerned about the shortage of medical manpower (specialists) and specialization (specialized treatments). They believe that a shortage of medical manpower has significantly impacted on their decision to provide medical hotel services.

With respect to the environmental factor of readiness, the hotels' managers are more concerned about the investment and government policy. This indicates that sizeable investments are needed to strengthen, upgrade and expand the medical hotel services in Malaysia. In addition, more qualified specialists are needed for medical hotels services which need partnerships between hotels and hospital investors. Furthermore, government policies play an important role in establishing medical hotels in Malaysia. Lack of governments' involvement can be a significant obstacle in developing this type of tourism, indicating that government's role in establishing the medical hotels should be reiterated through new policies to increase the budget for medical tourism. In addition, Malaysian Health Ministry supports can encourage the private providers of healthcare to invest on medical hotels with more motivations. Furthermore, to setting up medical hotels by the managers of hotels, policies are needed aimed at decreasing the expense of equipment and facilities, and attracting and supporting the overseas investors in medical tourism to promote medical traveling and tourism.

With respect to the technological factor of readiness, the hotels' managers reveal their concerns on the medical technology and efficient information systems. Medical hotel service providers such other healthcare service providers need efficient information systems and medical technology, as sharing the medical tourist information is performed electronically among the organizations. In addition, collaboration between the healthcare and tourism sectors needs adequate information processing technologies such as electronic medical records processing systems and telemedicine for the communication purpose (exchanging emails between the specialist and the patients), e-consultations and e-diagnoses.

With respect to the organizational factor of readiness, financial performance and infrastructure are considered as two important enablers of medical hotels. From the financial performance perspective, tourism organizations must consider enough budgets to be able to provide the medical hotel services in a comprehensive way. In addition, medical hotels providers need sufficient infrastructures such as physical environment, supportive facilities, and separate private and public clinics and hospitals to support medical tourism and provide medical hotel services. These infrastructures need huge amount of support from the private sectors and government. This indicates that scarcity of land, high land costs, limited access to financial facilities and budgetary allocation can significantly influence the managers' decision to establish medical hotels in Malaysia.

5. Conclusions and future study

In this research, the attempts have been made to develop a decision making model for the adoption of medical tourism in Malaysia. The decision making model included several factors and criteria which were identified from the literature. We employed two multi-criteria decision making model to achieve the objectives of this research, DEMATEL and Fuzzy TOPSIS. In the first stage of the data analysis, we employed

DEMATEL to reveal the interrelationships among the readiness factors. In fact, the DEMATEL techniques could effectively reveal the influence scores of technological, organizational, environmental and human readiness factors. In the next stage of our data analysis, we employed Fuzzy TOPSIS to find the importance of each criteria in the decision making model. The results from DEMATEL data analysis showed that, from the managers' perspectives, that technological and human factors are more important than organizational and environmental factors for decision to adopt medical hotels in Malaysia. The results further revealed that human factor significantly received influence (net receiver factor) from the technological, organizational, and environmental factors. The results of Fuzzy TOPSIS further revealed the importance of the criteria in each factor. The data analysis results indicated that medical technology and efficient information systems are more important for technological readiness. In addition, infrastructure and financial performance are more significant for the adoption of medical tourism in Malaysia. Furthermore, investment and government policy are found to be more important in environmental factor. Our results also found that specialization and specialists are more important for human readiness.

This research is not without theoretical and methodological limitations. In this study, a limited number of readiness factors are investigated for the adoption of medical tourism in Malaysia. Future studies may further investigate the role of other factors (e.g., culture, medical insurance coverage, global competition, transplantation law) in this context. In addition, this study was conducted from hotels managers' perspectives. Other studies can investigate the issue of medical tourism adoption from the tourists' perspectives. Furthermore, this study used multi-criteria decision making approaches for factors assessment. The future studies can find the relationships between the factor using Partial Least Squares based Structural Equation Modeling (PLS-SME) and compare the results with the results of the techniques used in this study. Moreover, this study used HOF-fit and TOE framework to develop the adoption model. Other organizational theories are suggested to be investigated in the future studies. Finally, the sensitivity analysis is suggested for the future studies to show the robustness of Fuzzy TOPSIS and its results by changing the criteria weights in different scenarios.

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