DEVELOPING A CLIMATE-BASED RECREATION MANAGEMENT SYSTEM FOR A MEDITERRANEAN ISLAND

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ABSTRACT

Weather and climate have a crucial influence on tourism activities. As a result, tourism is vulnerable to the effects of climate change. One important category of such effects is the change in climatic suitability of tourist destinations. This study proposes a model for landscape management based on climate attractiveness for tourists within the context of the Theory of Ecological Modernization (TEM). The modelling process conforms to Ackoff’s wisdom hierarchy, which transforms data into information, knowledge and wisdom. Data were obtained from a meteorological station in Northern Cyprus where the Mediterranean Sea and its favorable climate are key resources for the tourism sector. The monthly Tourism Climate Index (TCI) was used at all stations and was digitized in Geographical Information System (GIS) setting. Spatial analysis was performed using Geostatistical methods, and tourism climate maps were produced for a 12 month period, aiming to identify temporal variations of TCI values on the island. A climate-based Recreation Management System (RMS) is proposed to determine three variables that are both spatial and temporal drivers for tourism activities: climate, environment and social factors. The main application of this process is the mitigation of problems of “seasonality”, as they always pose a challenge for the managers of different destinations.

KEYWORDS: Climate change; GIS; seasonality; Ecological Modernization Theory; Northern Cyprus.

1. INTRODUCTION

Tourism provides remarkable contributions such as economic gain, job creation, infrastructure development, cultural exchange, improvement of the livelihood of local communities and funding of conservation projects. On the other hand, crowding or deterioration of the environment negatively affect the social acceptance level of the hosts as well as the attitude of the tourists and can cause irreversible damage to the ecosystem. Hall conducted a survey that found that tourist visits damaged the vegetation cover of Sherwood Forest in England [1]. Similarly, Filimonau et al., in an assessment of the carbon impact of short-haul tourism using life-cycle analysis, revealed that tourism significantly escalates the global carbon footprint [2]. Tourism is one of the main contributors toward global warming and climate change. Such adverse impacts of tourism could be minimized through a knowledge-based management [3-6], the application of technology and financial sources [7] and the participation of stakeholders [8, 9]. This notion is corroborates the principles of Theory of Ecological Modernization (TEM), a school of thought in social sciences praised for addressing environmental issues [10].

The environmental impact of tourism is a foregone conclusion [11]. However, the level of impact differs regionally and is highly dependent on the concentration of tourist flow over time and space [12]. For instance, water consumption by the tourism sector, has become a great challenge, especially in the Mediterranean but even more so in the case of water-stressed Northern region [13]. Overall, international tourism water consumption may be less than 1% of national water use; however, in the case of Northern Cyprus the rate increases to 4.8% due to incoming tourists [12]. It is anticipated that chronic water shortage will occur in Northern Cyprus and many other island states by the year 2050. Potential conflicts between residents and tourists over water consumption are addressed by numerous authors [12, 14-16].

In the context of climate change scenarios, conflicts are expected to worsen due to “forecasted impacts of global climate change on the spatial and temporal variability of precipitation-particularly as it relates to recharge of surface and groundwater in regions all around the world” [16, p2]. If adequate adaptation policies are not put into place to mitigate the conflicts, direct consequences on environmental quality, socio-economic wellbeing and sustainability of the tourist destinations, especially in island states are to be expected [15, 17].

Tourism has negative environmental impacts on Mediterranean islands, which are intensified by the fragility of the environment, human pressure and lack of spatial planning [18, 19]. Vehbi and Doratli [20] in their assessment of

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environmental impacts of tourism on coastal cities of the northern part of the island witnessed deterioration and reduction of green fields, loss of natural landscape, loss of open space, sea water and air pollution, waste and visual pollution. The negative impact of tourism development is particularly strong in the coastal region where soils and water are highly susceptible to erosion and pollution [21]. There is significant evidence of a trend in environmental degradation in Northern Cyprus, whose economy is highly dependent on tourism, especially nature-based tourism. Figure 1 highlights an example of lack in landscape planning and spatio-temporal recreation mismanagement in the study area. Approximately 75% of the island hotels have been built on the northwest shoreline. Vehbi and Doratli [20] note that natural beauty, historical heritage and traditional urban patterns explain why the northwestern cities (e.g. Kyrenia) are leading tourist destinations in the Mediterranean Basin since the 1930s. Furthermore, Kyrenia possesses a well-developed infrastructure, easy access to the airport and capital city and access to the harbor and shipping lines. These attract investment especially in luxury hotels construction.

The concentration of tourism activities, regardless of the carrying capacity issue, is associated with excessive exploitation of natural resources, water pollution and water scarcity, solid and hazardous wastes, erosion and soil degradation, air pollution and loss in biodiversity. The consequences of this improper Recreation Management System (RMS) are combined with a complex set of political, social, and cultural issues. For example, as a result of economic leakage and land mismanagement, there is hesitation about the pro-poor role of tourism in improving the livelihood and welfare of residents on the island [21]. Moreover, seasonality results in large differences in tourist arrivals and revenues in the winter and the summer seasons in Mediterranean islands [22, 23]. To address this problem, an adaptive management system is needed to cover multifaceted interactions between humans and the environment with respect to political, social, ecological, and geographical characteristics of the island [18]. In other words, a comprehensive perspective is required to develop the RMS, which should involve the opinions and visions of local communities, planners and decision makers, business sector and scientists. Therefore, tourism scholars can effectively contribute to tourism management through generating knowledge and sharing innovative ideas. The gap between theory and practice can be reduced by proposing technical approaches that are developed by application of scientific tools (e.g. GIS).

In fact, the qualities of tourism development are highly correlated with land management strategies considering the principals of sustainability, conservation, cooperation, learning, appreciation, responsibility and respect for the resources. To prepare a scientific framework for a RMS, attributes of different resources can be digitized in a GIS setting to produce materials for spatial analysis that provide graphical guidance for policy makers. Turner recommended this procedure for landscape planning which acted as an interface between social and environmental issues [25].

![FIGURE 1 - Lack of a proper recreation management system in Northern Cyprus (spatial imbalance in tourism development).](image-url)
This research focuses on the nexus between tourism and climatology by using GIS to provide RMS guidelines for the island. Notwithstanding the environmental fragility of the study area, the tourism industry is highly dependent on a favorable climate, which can be mapped as a useful factor in tourism planning. There are two bases for the selection of climate as a main resource for RMS: Firstly, climate is an effective factor in RMS that affects human activities and the ecosystem [26-29]. Secondly, climate is frequently reported as one of the most valuable natural resources in tourism development [30, 31] that affects tourist decision-making in the selection process of a destination [24, 32]. Furthermore, climate does not solely contribute to the suitability of resorts but it also significantly influences their supplementary natural resources, which can be considered unique tourist assets as well [33].

Mapping climate changes (using spatio-temporal analysis) raises awareness of tourists and helps stakeholders to properly plan tourism development and management [34] by providing a realistic image of the destination’s weather for tourists [35-37]. Incorporation of the RMS in tourism holiday package and advertisements will also have implications for tourism marketers. Therefore, tourism planners and the business sector need to take notice “as tourists are becoming more educated and increasingly sophisticated in their consumption patterns; and they demand better quality tourism products and experiences. [Therefore], travel and tourism firms will need to respond with creative marketing strategies based on better quality products and more informative and trustworthy advertising messages” [38, p 87].

In addition to the advantage of a favorable climate in the selection of a tourist destination, it also positively boosts tourists’ loyalty to revisit a place [30]. Empirical evidence from Scandinavia revealed that the relationship between tourist’s perception and his/her intention to return was influenced by lack of access to clear information regarding the weather [36]. Therefore, a tourism climate map that illustrates the temporal and spatial variability of the climate-related well-being for tourists is one approach that can mitigate the probable gap between tourist expectation and actual experience. Using the same method, Wan et al., linked the spatial variation of water quality and land management [39]. Hence, a tourism climate map will assist planners and decision-makers to design RMS that not only controls tourist access to vulnerable natural areas, but also addresses the seasonality of tourist activities. This will also facilitates the equitable distribution of tourism expenditure throughout the island by dispersing tourists to for instance, the hinterland and away from coastal zones which are under stress. Furthermore, it will also decrease local dependency on the natural resources [40].

Concentration of tourism activities in coastal cities (i.e., based on S3 tourism), has led to adverse environmental impacts such as land deterioration due to land use change, soil and beach erosion, water scarcity, air, water, and noise pollutions, degradation of flora and fauna habitats, and exploitation of fragile natural resources [20, 41]. RMS as an implementable approach cannot only mitigate negative environmental and social impacts of tourism by reducing the density of tourism locations, it also contributes to sustainability through diversifying tourism products/activities, improvement of infrastructure, and poverty alleviation, especially in remote areas [42] where mass tourism has not infiltrated yet.

In addition to the RMS’s environmental advantages through creation of spatio-temporal decentralization, RMS’s social and environmental implications are also in line with the TEM [10]. Fisher and Freudentburg [10] argued that TEM becomes functional as a practical interface between social (i.e. cooperation of decision-makers and stakeholders), and environmental (i.e. RMS as spatio-temporal climate data/map). Correspondingly, Burns [43] proposed TEM as a model for addressing ecological problems in “tourism master-planning” to justify how ecological problems should be integrated into democratic politics. Belle and Bramwell [44] employed TEM to examine tourism managers’ and policymakers’ perspectives on climate change in a small island. Since there is a comprehensive consensus among researchers [e.g., 23, 45, 46] about the key role of climate in tourism, climate data can be a useful tool for tourism management in the context of TEM.

1.1 Contribution to the current knowledge base

This study contributes to tourism climate literature in several ways: Firstly, there is a paucity of empirical research on the application of TEM in the tourism climate nexus [47]. This study fills this gap by developing a model that functions in the context of TEM on the basis of a land management system performed to integrate socio-ecological issues (tourism and climate) and technology (GIS). The aim is to mitigate environmental pressures through the spatio-temporal distribution of tourism activities. Furthermore, it opens a new venue for researchers to share knowledge and cooperation, which are pivotal elements in TEM. In Giddens’ words, “Ecological modernization implies a partnership in which governments, businesses, moderate environmentalists, and scientists cooperate in the restructuring of the capitalist political economy along more environmentally defensible lines” [48, p. 57]. Giddens [48] reference to ‘moderate environmentalists’ was meant to be a reference to proponents of TEM, who are neither market fundamentalists (i.e., who believe nature has restorative properties that go well beyond any impact human beings might have on the environment), nor radical ecologists (i.e. whose ideologies are deployed in pursuit of ‘de-industrialization and de-marketing) [49]. In a way, the moderate environmentalist attitude, as a proponent of TEM, is a reaction to the anti-modernist views of fundamentalists and radical ecology in managing the processes of production and consumption without dismantling the market system and opting for mitigating environmental impact [49, 50].

Following this, the study is built on Imran et al.’s statement [9], who noted that the participation and cooperation of stakeholders in the process of tourism development is
not a straightforward issue. In this respect, Gouldson and Sullivan revealed that mitigating actions to combat climate change can be implemented within the context of TEM [51]. In other words, the proposed RMS plan based on spatio-temporal analysis of the Tourism Climate Index (TCI) is an example of stakeholders’ cooperation in the tourism industry as well as an embodiment of TEM.

Secondly, to the best of the authors’ knowledge, this research is the first to develop a model built on a knowledge-based management system, proposed by Ackoff [3], in tourism climate literature. The proposed model conforms to the transformation of “data” into “wisdom” in tourism management. In other words, meteorological data are used to create information (TCI value), followed by the production of tourism climate maps through spatial analysis in GIS software. A synthesis of the spatial patterns of TCI over 12 months (temporal analysis) contributes to proposing a guideline for RMS based on climate attractiveness and other considerations. This guideline is the RMS schedule/calendar. Accordingly, planners and decision-makers will have access to sufficient knowledge to manage tourism activities wisely in regions where climate is one of the most important tourism resources.

Thirdly, the results of this study will offer useful applications for tackling seasonality issues of tourism in Mediterranean regions including innovative tourism marketing by raising tourist awareness, restructuring spatial and temporal patterns of tourism activities, reducing environmental degradation and achieving equitable income distribution. This model has the appropriate flexibility to consider adaptive strategies against climate change.

Finally, climate is the most important tourism resource in Northern Cyprus, which attracts thousands of tourists from European countries. Surprisingly, no empirical research has been conducted on the spatio-temporal variations of tourism climate on this Mediterranean island. Changes of TCI are mapped in Europe by Perch-Nielsen et al. [52] as part of PESETA (Projection of Economic impacts of climate change in Sectors of the European Union based on boT-tom-up Analysis). However since the accuracy of the index at the continental scale is far too low, only one value is recorded and projected for the whole island. This means that the TCI map cannot reflect any pattern of variation of climate tourism across the island.

2. THEORETICAL BACKGROUND

2.1. Theory of Ecological Modernization (TEM)

As a backdrop to this study, TEM is initiated as a discourse in response to ecological problems. This is because sustainable development, notwithstanding its grand goals, is perceived as vague and difficult to operationalize [53]. However, this is not meant to undermine the credibility of the sustainable development paradigm. In fact, it has been a major force in the transformation of environmentalism into the ecological discourse resulting in the birth of TEM [48, 54]. Such a transformation, Giddens noted, is reflected by the fact that the “countries most influenced by the idea of ecological modernization are the cleanest and greenest of the industrial nations”. In Eder’s [53, p. 210] words, “Its transformation into a new ideological master frame provides the possibility of a way out, legitimating social institutions by means of environment-related ethical frames.” The focus of this study is to propose RMS based on spatio-temporal variations of climate for tourism actions on a Mediterranean island in the context of TEM.

TEM has captured the attention of numerous scholars around the world. More so in Western Europe (i.e., Germany, the Netherlands, the UK, Denmark, and Sweden), the United States and more recently in newly industrialized countries such as Malaysia and Thailand where the concept has been molded into an epistemological/paradigmatic framework [54, 55]. Anyhow, “Joseph Huber (from Germany) should be acknowledged as the father of ecological modernization theory due to his theoretical contributions to the environment and society from the 1980s onward” [56, p. 2].

TEM has also been applied to justify the shifting of institutional structures for solid waste management and improving its system in Malaysia [57] and/or reforming the planning system in Australia’s island-state [58]. Nevertheless, the paradigmatic structure of TEM is rooted in a process of production and consumption (i.e., the decoupling or dis-linking of material flows from economic flows) and institutional transformation, especially in the public sphere [53, 59]. The crux of the theory was initially established when:

The social dynamics behind these changes that are the emergence of actual environment-induced transformations of institutions and social practices in industrialized societies are encapsulated in the ecological modernization theory. This theory tries to understand, interpret and conceptualize the nature, extent and dynamics of this transformation process [59, p. 93].

In the case of Northern Cyprus, TEM has not yet been recognized as a policy framework due to lack of commitment and political will towards establishing political infrastructures essential for the implementation of a TEM agenda. One of the pillars of TEM is close cooperation and consensus among numerous stakeholders [60], especially the involvement of knowledge-based institutions for the purpose of innovation. This aspect of TEM requires structural changes in institutions and social practices [59], which is still absent in Northern Cyprus. TEM is highly conducive to integrating new tourism policy towards adaptation to climate change.

The main purpose of this research is to provide a climate-based Recreation Management System (RMS) based on TEM. This objective is the implementation of RMS (Figure 2) based on knowledge generation and knowledge sharing by scientists (i.e. transforming meteorological data to a RMS calendar) embedded in the contribution of all stakeholders (action plan in the context of tourism master plan) in accordance with the concept of TEM.
Thus, RMS is a loud call to planners and politicians who have promoted 3S (Sea, Sand and Sun) tourism solely for short term economic benefits without putting any measure/policy in place towards protection of coastal zones and reduction of environmental impacts in Northern Cyprus [20].

2.2. Tourism Climate Index

Two main approaches for the estimation of climate favorability for tourism activities are firstly, expert-based indices related to the TCI proposed by Mieczkowski [32] and secondly, user-based indices with relation to the Climate Index for Tourism (CIT) developed by De Freitas et al. [61]. Furthermore, the Beach-Users Climate Index, proposed by Morgan et al. [62] is based on tourist response. In the context of the TCI, Mieczkowski weighted five meteorological parameters (temperature, relative humidity, precipitation, wind speed, and sunshine hours) to estimate a categorical tourism climate index ranging from unfavorable (-20) to excellent (100) [32].

The TCI has several drawbacks, such as ignoring non-thermal aspects of weather and climate [63], overriding the effect of precipitation and wind [61] and the lack of empirical validation due to its expert-based approach [52]. Nevertheless, it has been frequently employed to estimate climate favorability for tourism activities and to investigate climate change [23, 45, 52, 64]. Georgopoulou et al. used the TCI to calculate the physical risks of climate change in the banking sector (with the hospitality industry regarded as a subsector). They also used the TCI as an indicator of attractiveness for tourists to change their location in a regression model that considered other non-meteorological parameters (e.g., infrastructure and economic growth) [65].

2.3. Study area

Northern Cyprus was an active tourism destination long before the explosion of mass tourism in the 1960s [66]. However, in the aftermath of the Turkish intervention in 1974, the tourism trajectory took a dramatic twist as the island was partitioned into the Turkish and Greek enclaves. Nevertheless, both sides are blessed by a suitable climate that generates calm seas and stable beaches. Long and dry summers with a concentration of precipitation over a few months during the mild winter renders perfect conditions for so-called 3S tourism [67].

Geçitkale and Nicosia are two populated cities inland that are not considered part of the coastal zones (See also Figure 1). The land use that dominates the island is dense to sparse forest, sparse forest and brush, cultivated and garden crops and irrigated fields. The main agricultural and horticultural productions on the island are wheat, barley, vegetable, olive and citrus fruits. Northern Cyprus’s economy is composed mainly of small and medium-size enterprises (SMEs) in the tourism and agricultural sector. However, over the last two decades policy makers have focused on making this part of the island a university hub and refreshing attention to restructuring the tourism sector. Presently, there are more than 10 universities in Northern Cyprus accommodating over 40,000 international students (http://www.studyinnorthcyprus.org/?page_id=3652).

Tourism remains a crucial source of GDP as well as the main source of job creation. The tourism sector employed over 12,000 people in the year 2013. The ratio of net tourism income to the trade balance is 39% and the net income from tourism reached 616 million SUS in the year 2013. The number of arrivals reached 1,366,077 in the year 2014. In comparison to 30 and 10 years ago, tourist arrivals increased by 2815% and 94%, respectively [68]. The main markets for Northern Cyprus’s tourism are: Turkey, the UK, Russia, Azerbaijan, Kazakhstan, Syria, Iran and Poland.

Regardless of historical, cultural, and growth of educational tourism in recent years, 3S tourism is still the dominant attraction over the whole island, more so in Northern Cyprus (i.e., main destination for coastal tourism in the Mediterranean) [69]. Nevertheless, determinants of 3S tourism, also known as ‘beach’ or ‘coastal’ tourism has its own complexity including the ‘climate’ variable. In the meantime, demand for 3S tourism differs according to the type of tourists (i.e. international or domestic).

For the case of Northern Cyprus, both domestic and international tourists have different expectations from so-called coastal tourism. Such expectations are highly relevant to the climate/tourism nexus. With the perspectives of climate change and changing relations between climate and tourism demand, it is generally agreed that climate change will affect tourist behavior spatially by shifting it to higher altitudes and latitudes [69, 70]. This will have serious implications for destination such as Northern Cyprus which is highly dependent on coastal tourism. Furthermore, attributes of coastal tourism have various functionalities depending on climate, environment, biodiversity, as well as susceptibility to anthropogenic pressures [70, 71]. In the case of a Mediterranean Island State, anthropogenic pressure, which is manifested in coastal development and cultural activities, demands specific policies/strategies for coastal protection.

It is in this context that environmental degradation is most probable as the pressure of tourism impact is concentrated on the coastal regions away from the hinterland. Such pressure has been noticed by tourism planners in southern Cyprus, which resulted in a moratorium on new tourism projects in coastal areas and a shift to the hinterland through incentives for rural tourism [72, 73]. Katircioglu et al. [73, p. 638] explored the idea that “tourist arrivals are a catalyst for energy consumption and therefore climate change in the long term of the Cyprus economy. When the Cypriot government sets measurements for environmental protection (controlling climate changes), the international tourism sector should be seriously taken into consideration”.

The issue of rural tourism, agro-tourism, and ecotourism are raised in the context of sustainable tourism which is a dominant concept and concern for the relationship between tourism and environment. These forms of tourism
are categorized under the so called ‘alternative’ tourism as opposed to mainstream/mass tourism criticized for being inconsiderate environmentally, socially, ethically and politically. In the case of Northern Cyprus, ecotourism projects have been established in different rural areas and remote villages.
These projects can be restructured in order to allow collective participation of all stakeholders from local public sector institutions, business, the commercial sector, non-profit organizations, and ecotourism entities. Application of these projects will be effective if a collective approach is practiced. However, the effectiveness of management and stakeholder participation is undermined when there is either a lack of collective approach or dominant centralized decision-making. This is not just the case for Northern Cyprus but unfortunately also for most developing economies. As Larson and Poudyal [74, p. 924] stated: “A heavy emphasis on centralized decision-making orchestrated by powerful government elites, not governance that involves a full range of invested individuals and organizations, has been a major constraint for developing countries trying to promote community participation in the tourism industry”.

3. METHODOLOGY

3.1. A descriptive and analytical approach

The research model (Figure 2), illustrates RMS development and operationalization processes based on the well-being of tourism climate—climate being the most important tourism resource on the island. Two approaches, namely, a knowledge-based management system and the TEM, are utilized as theoretical framework for designing the model. The model also depicts the process of development and application of RMS in tourism planning by a flowchart that begins with calculation and ends with action/implementation. This process is embedded in the context of data calculation and production of wisdom. Both flow processes correspond to each other, as shown in Figure 2.

The utility of the TCI value and TCI map with the final production of the RMS calendar, are paramount to the design of RMS and a tourism master plan. In fact, this model illustrates how climate as a unique, free, and non-substitutable resource, can be used in tourism planning (Figure 2). It also means that the RMS calendar is a technical assessment that can be a guideline for the preparation of a tourism master plan. In other words, comprehensive technical assessment including evaluation results of socio-economic, hydrologic, watershed management and geomorphology should be incorporated in the master planning process. Hence, outputs of other assessments (e.g., information regarding water scarcity, land degradation and soil erosion) have been used as inputs/feedbacks for monitoring and evaluation steps in the model. Thus, monitoring and evaluation ensures proposed flexibility in approach.

The application of a knowledge-based management system is an important part of the methodological approach. According to Ackoff [3] and Reed et al. [75], making the right decision in a complex system (e.g., destination management), allows planners/decision makers to use knowledge instead of raw data (Figure 2). As mentioned earlier, the proposed model can be implemented in the context of TEM [51], which emphasizes knowledge generation and sharing [6], as well as the cooperation of decision-makers and stakeholders [9]. There is a consensus among proponents of TEM that researchers are required to produce knowledge and share it with stakeholders [6, 75]. Furthermore, there is some evidence that postulates the application of TEM in the integration of climate change and development criteria under similar circumstances [51, 57, 58]. Accordingly, meteorological data are inserted into the TCI equation to calculate TCI values for each meteorological station (Table 1). Then, TCI values are digitized in a GIS setting using ArcGIS software. Spatial analysis of TCI is performed using geo-statistical techniques to create a TCI map.

An interpolation technique which encompasses measured TCI values is weighted to derive a predicted value for an unmeasured location on the island. Weights are based

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<th>Meteorological station</th>
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Note: * The unit is decimal degrees. Coordinate system for the data source is WGS 1984. A is altitude, AT is average temperature (°C), MAT is maximum average temperature (°C), ARH is average relative humidity (%), MARH is minimum average relative humidity (%), P is precipitation (mm), AWS is average wind speed (m/s), and SH is Sunshine hours. These numbers were obtained by calculation of parameters average for a period of 33 years (1980-2013).
on the distance between the meteorological stations, the prediction locations, and the overall spatial arrangement among the measured points. ArcGIS software provides geo-statistical tools to create surfaces from sample data (TCI value of stations) using interpolation methods such as inverse weighted distance, radial-based functions, global and local polynomials, kriging, co-kriging, and isotropical or anisotropical models. Kriging is known as the best linear unbiased estimator amongst all interpolation methods. It is also a popular geostatistical method in the interpolation of natural elements [76]. It provides an easy method for characterizing the variance or the precision of predictions. This method uses variograms to express the spatial variation and minimizes the error of predicted values which are estimated by spatial distribution of the predicted TCI values. As noted by Olya and Alipour [77] the Kriging technique functions adequately for the interpolation of tourism climate risk caused by excessive precipitation as a destructive factor related to the well-being of tourists. Therefore it is applied as geostatistical technique for the interpolation of TCI value in this study. The process of TCI calculation and interpolation are conducted for 12 months (January to December). Hence, a temporal analysis of TCI is produced based on the interpretation of monthly TCI maps.

As climate is one of the most important resources for tourism development on the island a RMS pattern based on spatio-temporal variations of TCI is developed. Notwithstanding the existence of sophisticated approaches such as the Recreational Opportunity Spectrum [78] and Limits of Acceptable Change [79] the proposed model has great potential to be used in regions where climate is the major tourism resource.

Based on the results, the five practical managerial implications are as follows:

- Overcoming the seasonality problem
- Equity in distribution of the economic benefits
- Reduction of pressure on the ecosystems
- Proposing an adaptive approach to climate change
- Tourism marketing

The aforementioned process is in line with Wong et al. who emphasize the importance of evaluating the policy environment for climate change adaptation in tourism, as well as continuous monitoring imbedded in the proposed model [80]. For evaluation and monitoring of adaptive coastal management Jacobson et al. [81, p. 51] stated that 'monitoring involves activities that measure the effectiveness of actions, whereas evaluating involves the interpretation of that information'.

Furthermore, updating the outputs of the model with new meteorological datasets enables destination communities to better adapt to forthcoming climate change. At the same time this is a practical approach for moving the tourism-and-climate-change nexus from a descriptive problem-based issue toward a more affirmative, action-oriented discourse [82]. The functionality of the proposed model entails continuous monitoring of climate change and patterns of tourists who visit the destination. Since the input to the system is meteorological data, the model ought to recalculate new data in order to design accurate recreation management calendar. The proposed model covers cross-cultural properties of tourism climate by monitoring the quantity and cultural origin of visitors. For instance, an optimal climate is perceived differently by Russian compared to Chinese tourists. As observed by the authors, the swimming season for Russian tourists in Northern Cyprus already begins in March whereas the locals will wait until early July. Therefore, the RMS should be modified according to changes in visitor pattern (geographic segment) [83] to avoid mismatch between the expectation and experience of a destination with respect to climate change.

Nevertheless, the use of long term data ensures reliability of the results of the proposed model. Three factors can be considered in the recalculation of the proposed model: firstly, changing climatic parameters, secondly changing tourist pattern in terms of cross-cultural characteristics and thirdly, as elaborated earlier, the implementation of a RMS as an important principle for the Tourism Master Plan. Since Master Plans are normally revised only every five years, it is suggested that the TCI should be recalculated for all stations and the RMS calendar be prepared every five years considering all changes in parameters.

More details about data and the procedure are elaborated in the following sections.

### 3.2. Data collection and analysis

Data was collected from the meteorological stations of Northern Cyprus in the Mediterranean, covering a data base from 1980 to 2013. The data was obtained after a lengthy discussion with the head of the meteorological organization in Lefkosa, the capital city of Northern Cyprus. Permission to use the data was granted after the purpose of the research was explained. Northern Cyprus is located in the Eastern flank of the Mediterranean Sea, whose climatic characteristics include warm and dry summers, mild winters, more than 3,300 hours of annual sunshine and light-to-moderate winds. Such climatic characteristics create typical 3S tourism that attracts a large number of tourists. Sun, Sea and Sand (3S) tourism is the main product that motivates mass tourism. In this context tourists seek a warm climate to indulge in sun tanning on sizzling beaches [84, 85]. This form of tourism has been dominant since the 1950s and 1960s with strong seasonal concentration, environmental destruction and unsustainable development along the coastal areas of the Mediterranean but also in the Adriatic, Aegean, Caribbean, and many islands in the Pacific, to name a few [86, 87]. Now-a-days, with the support of its international institutional agencies the tourism industry has embraced a moral agenda to redirect tourism planners and developers towards a so called ‘New tourism’ as an alternative to 3S tourism (mass tourism). "Whereas Mass Tourism might be characterized by sameness, crudeness, destructiveness, and modernity, New Moral Tourism can be viewed as difference
and sensitivity as well as constructive and critical of modernity. There are several categories of travel that might be described as New Moral Tourism, including ecotourism, community tourism, agro-tourism, and sustainable tourism” [as cited in 85].

3S tourism is also subject to overdevelopment. Though economically lucrative in the short run, some destinations, especially Mediterranean islands have realized that the long-term viability of this dominant mode of tourism has engendered a malaise in the tourism system. For instance, in Northern Cyprus, mass tourism has not only resulted in degradation of the coastal environment, it has also subjected the island to a seasonality syndrome. “Hence, the image of Cyprus as a sun-lust destination can be deemed a critical cause of seasonality. This is also true about Malta, which is struggling with extreme seasonality” [87, p. 704-711].

### 3.1.1. Tourism Climate Index

The TCI index is formulated based on the monthly means of seven meteorological factors: maximum daily temperature, mean daily temperature, minimum daily relative humidity, daily relative humidity, precipitation, daily duration of sunshine, and wind speed. To measure thermal comfort, Mieczkowski developed two sub-indices named CID (Daytime Comfort Index – which combines the variables of maximum daily temperature and minimum daily relative humidity) and CIA (Daily Comfort Index – which combines the variables of mean daily temperature and daily relative humidity) [32]. Accordingly, coefficients of each variable were weighted, and the formula (1) was used as an index to estimate the level of climatic well-being for tourists:

\[
TCI = BCID + 2CIA + 4R + 4S + 2W
\]  

(1)

Where CID and CIA are two sub-indices represented as a daytime comfort index; R is precipitation; S is hours of sunshine per day; and W is wind speed. The details of the variable rating system for the calculation of the TCI are described in Mieczkowski’s paper [32]. The TCI scores classified in five mapping categories are outlined in Table 2.

<table>
<thead>
<tr>
<th>No.</th>
<th>Numerical value of TCI</th>
<th>Mapping Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>80-100</td>
<td>Excellent</td>
</tr>
<tr>
<td>2</td>
<td>70-79</td>
<td>Very good</td>
</tr>
<tr>
<td>3</td>
<td>60-69</td>
<td>Good</td>
</tr>
<tr>
<td>4</td>
<td>40-59</td>
<td>Acceptable</td>
</tr>
<tr>
<td>5</td>
<td>20-39</td>
<td>Unfavorable</td>
</tr>
</tbody>
</table>

Source: [23].

### 3.1.2. Recreation Management System

In the knowledge-based management system developed by Ackoff [3], techniques and technology help to transform data into information and knowledge, which is consistent with the TEM theory (Figure 2). With this regard, GIS is used as an integration technology to project spatial and temporal variations of TCI [1]. Kriging is used as a popular geostatistical method in the interpolation of natural elements [76, 77]. A spatial analysis of TCI is performed for each month to enable temporal analysis of the variations of the TCI on the island. About 12 TCI maps illustrate the temporal and spatial attractiveness/appropriateness of climate for tourism (i.e. by month and location) (Figure 3). Based on this rational justification, the proposed RMS calendar can be applied as a scientific guideline in destination planning and management.

### 4. RESULTS

TCI values varied ranging from 41 (acceptable) in Yeni Erenkoy to 98 (excellent) in Çamlıbel and Kyrenia. Yeni Erenkoy is a flat shoreline characterized by dense to sparse forest. Land use mainly consists of bush which is also the habitat of famous Cyprus donkey. Çamlıbel has a special topography that varies from coastal (altitude=0 m) to mountainous (altitude >1000 m). Similar to the Yeni Erenkoy and Karpaz region, this area is also covered with dense to sparse forest and bush. This area also has cultivated fields and garden crops. Kyrenia and Çamlıbel have similar topographical and geomorphological conditions. Apart from forest and cultivated fields and garden crops, irrigated farms are also a dominant land use. The average TCI values for 12-months ranges from 70 (very good) in Nicosia to 85 (excellent) in Kyrenia, except for Yeni Erenkoy which is 56. Other districts have “very good” (70-80) climate conditions for tourism activities. During spring and fall, higher TCI scores are found throughout the island. Similar findings are reported in Amelung and Viner’s [23], Deniz’s [45], and Perch-Nielsen et al.’s [52] studies, which revealed that variations in average TCI scores present a bimodal distribution in the Mediterranean regions. This means that climate in the spring and fall is more suitable for the well-being of tourists than that in the winter and summer. Researchers have recognized that increasing temperatures caused by climate change will result in a decreased climate quality in the Mediterranean during the summer. Perch-Nielsen et al. [52] in their comparison of climate change for a period of 110 years found that the number of acceptable (TCI>40), good (TCI>60), and excellent (TCI>80) days in summer for Mediterranean region will decrease by 7, 10, and 8 days, respectively.

#### 4.1. Tourism Climate Index Map

According to the calculated TCI score for January (Figure 3a), the climate is good (60-70) for tourism. The climates of Nicosia, Lefke and Güzelyurt are more favourable (68, 65, and 64, respectively) for tourists during this month (see Table 2 for score classification). In Çamlıbel the TCI scores remain acceptable (59) (Figure 3b). In February Nicosia has a very good index (72). Eastern and south-western areas have good climates for tourist’ well-being. During the month
of March, a “very good” climate (70-80) prevails over the whole island (Figure 3c). However, the climate is more suitable in the eastern parts of the island.

During the winter there are no excellent climate scores (80-100) on the island, with the exception of Geçitkale in March. Geçitkale is a flat inland area (altitude= 100-300 m) that is mainly covered by irrigated and dryland farms.

The TCI values improve to an excellent category in April and May (Figure 3d and 3e), with the exception of Çamlıbel in April (73). The TCI reaches the highest score (≥90) in Yeni Erenkoy and Çamlıbel in May (Figure 3e).

The TCI scores drop from “excellent” to “very good” during the first two months of spring due to increasing temperature. However, Çamlıbel has an excellent (84) climate for recreation purposes in June (Figure 3f).

The diversity of climate well-being for leisure increases in July when the TCI score fluctuates between 53 (acceptable) in Nicosia to 80 (excellent) in Çamlıbel (Figure 3g). Famagusta (70), Guzelyurt (69), have “good” climates in June, while Lefke (77), Yeni Erenkoy (78) and Kyrenia (74) have “very good” climates. Variations of TCI scores in August are similar to July, demonstrating “acceptable” and “good” conditions in the central, south eastern and south-western areas. Meanwhile, Çamlıbel (80) and Yeni Erenkoy (68) are climatically “very good” for tourists (Figure 3h). In the last month of summer, all areas have a TCI rating below 75 except for Çamlıbel (80) and Geçitkale (75). In September, Çamlıbel and Geçitkale have “excellent” and “very good” climates, respectively (Figure 3i).

FIGURE 3 - Map of spatio-temporal variations of the tourism climate index over the 12 months of the year in Northern Cyprus (a-m)
Compared to the summer, TCI values are high across most of the island in the fall. The TCI values for Çamlıbel, Lefke, Yeni Erenköy, and Geçitkale are greater than 85, which represent an “excellent” climate in October (Figure 3k). Lefke is a coastal area with irrigated and cultivated fields and garden crops including wheat, vegetables, potatoes, and citrus fruits. In November, the central regions present excellent (>80) climates for tourism activities. Nevertheless, other regions still have “very good” climates during this month (Figure 3l). It can be clearly seen that the tourism climates in Famagusta (81) and Nicosia (80) are excellent in December (Figure 3m). Famagusta is a coastal area with a low altitude (<200 m) composed of irrigated farms and garden crops. Nicosia is an inland area whose altitude varies between 100 to 300 m with a dominant land use of cultivation of agriculture and garden products.

4.2. Recreation management system calendar

Results of the spatio-temporal pattern of TCI reveal that there are viable opportunities to reorganize tourism activities in the northwest part of the island, where two-thirds of the hotels are located (Figure 1). A Pearson correlation test (an inferential statistical analysis) was performed to investigate the correlation between number of the hotels and favorability level of the climate for tourism activities. According to the statistical results, the number of hotels does not correlate significantly to the level of TCI ($r=−2.62$, $P>0.05$). Such results confirm that climate is ignored in recreation management despite it being the most important tourism resource in the study area. Hamilton et al. [46], Amelung and Viner [23], and Saarinen [31], observed that climate as a key determinant of tourist demand, especially in the Mediterranean islands, can be considered just as important a factor in spatial and temporal tourism planning. Besides the importance of the climate factor for tourists, the need to propose adaptive strategies for climate change and seasonality issues provides a rational incentive to redistribute tourism activities (through RMS) based on the favorability of climate in terms of spatial and temporal changes. This logic is supported by Ma et al. [26] and Li et al. [27], who draw attention to the inevitable role of climate in RMS. Hence, based on spatio-temporal changes in the TCI, the RMS calendar is developed to determine the location and duration of tourism activities on the island (Figure 4). However, environmental and social concerns/potentials must be considered within the development procedure of the RMS calendar with respect to the principles of TEM. For example, based on the spatio-temporal patterns of TCI, January and December are suitable months in Guzelyurt and Lefke while simultaneously coincide with the citrus fruit harvesting season. Such coincidences enhance influence visitors’ perceptions and experiences. In addition, the orchid flower festival held in Guzelyurt and Lefke every February (named Orkide festivali) is another attractiveness in this region. Surfing is also a popular activity in the Guzelyurt and Lefke coastal area in October due to optimal wind conditions. Nicosia, capital of the island, mainly attracts tourists in January, February, November and December (Figure 4).

Tourism businesses can arrange exhibitions, festivals and events to accompany the other functions of the capital city (e.g. trade, politics). Coincidently, Nicosia has a “very good” to “excellent” climate for tourism during this period (Figure 4). An International theatre festival and similar social events are held in Nicosia in September. These events could be shifted to October when the climate is “excellent” (81).

Geçitkale is a destination with an excellent climate in February, March, April, September, and November. It has a remarkable potential for the development of rural tourism, agro-tourism, ecotourism, and other types of alternative tourism. For instance, the Hellim festival is a well-known food festival that is organized in Geçitkale in April. Tourist flow to Yeni Erenköy and Karpaz where the sandy beaches and panoramic views are abundant could be encouraged during the months of March, May, July and August. The Karpaz region is also home to the flower festivals (e.g. Medoş and Lale Festivalsi) and presentation of local handicrafts in March.

IskLe can be visited by tourists in August and September when regional and national food festivals (e.g. Yeni Boğazçı Pulya Festivali) are held to revive the local food culture. Birdwatching is also popular in Iskele during the months of March and April.

Kyrenia attracts tourists who enjoy the pleasant weather, social events, historical attractions, and trekking during the months of March, April, June, and July. Kyrenia is also home to Alagadi Beach where the unique kinds of turtles (green and the loggerhead turtles) have their nesting grounds. This is an attraction for nature lovers during the months of June and July. Kyrenia is also venue for a social event called Lepta Orchid, which takes place during the month of March, and home to several museums as well as an ancient shipwreck.

Famagusta is a coastal city and home to a major university. Over time it has suffered anthropogenic pressure due to overdevelopment and poor infrastructural amenities. It has access to several beaches that are crowded by domestic and international tourists between April and October. It is also a venue for numerous social events e.g. Children’s festival, Sand sculpting, musicals and spring festivals organized by the municipality and university.

Çamlıbel is a mountainous landscape that provides a favorable climate during the hot season (May to October) as shown in Figure 4. Apart from its climate well-being benefits, it hosts an exhibition in June which provides an opportunity for local people to sell their organic products as well as handicrafts. It is also venue for strawberry festival during the harvest.

According to the TCI results, high temperature and relative humidity negatively affects the suitability of the climate for tourism activities. Based on climate change scenarios, estimated temperature will rise in the Mediterranean regions with negative impacts expected on tourist comfort. Currently, spring and autumn are the most appreciated seasons for travel to the island. Nevertheless, it is
expected that the favorability of the climate will decline in early fall and late spring due to climate change. In contrast, winter could become a suitable future season for tourists. Furthermore, the period of the 3S tourism will expand due to temperature increase in the study area. Thus, climate change might generate new opportunities on the island by attracting tourists in spring instead of summer.

According to the proposed model, stakeholders have various options in terms of time and space to develop and rearrange their business. This will also allow decision-makers to apply knowledge-based approaches to their planning processes. Therefore, this model meets the criteria of TEM [7, 58, 59]. Moreover, this model follows the funneling process from “data to wisdom” that was suggested by Ackoff [3].

### 4.3. Policy implications

#### 4.3.1. Reducing environmental degradation

The proposed model provides a strategy for tourism decision makers to adapt tourism activities to the capacity and tolerance of the resources that are available in Northern Cyprus. Redistribution of tourism activities based on the RMS calendar would not only decrease human pressures (social carrying capacity) but also reduce the negative impact of tourism on the environment. Based on the RMS calendar, each area is matched by tourist demand in terms of climatic attractivity/ favorability. According to Perkins et al. [6] and Cantasano and Pellicone [18], planners should be sensitive to proper recreation management systems to prevent irreparable effects and carry out spatio-temporal analyses to reduce environmental degradation. As such, the practicality of RMS based on spatial analysis in a GIS setting was demonstrated by Turner [25] and Wan et al. [39]. One should keep in mind that the successful implementation of such a project relies on the participation of researchers, decision-makers, stakeholders, and local communities. Contributions and achievements of the project should meet their satisfaction [9, 27]. In other words, a package and advertisement calendar as a part of Master Plan requires the participation of all stakeholders. For instance, an adjustment of the date and place of social events/festivals that do not match the results of RMS in terms of climate suitability requires cooperation of local communities and business sectors. Similarly, deconcentration and diffusion of tourism activities from one location to another would require the development of certain types of rules to accelerate the process.

#### 4.3.2. Seasonality and tourism marketing

The results of seasonal variation of TCI on the island are depicted in Figure 5. As illustrated, the island has a “very good” (70-79) to “excellent” (80-100) climate during all seasons. Nevertheless, spring is the best season in terms of favorability of the climate with all stations reporting an “excellent” climate (>80) with the exception of Ercan (79). In autumn, Nicosia (83), Lefke (80), and Geçehkale (80) have an “excellent” climate whilst other areas achieve a
“very good” climate (>70). During the winter, the tourism climate in Nicosia (72) and Geçikale (70) is “very good”. Other areas present a “good” climate for tourist activities (>70). Nicosia (57), Guzelyurt (58), and Famagusta (57) offer an “acceptable” climate for tourist well-being during the summer. However, other destinations present a “good” climate for tourists (>60). According to these results, there is no unfavorable climate (<40) in Northern Cyprus and tourists can choose locations with “excellent” and “very good” climate during all seasons. As for the findings of Amelung and Viner [23], TCI values undergo possible shifts in climatic favorability for various areas during different seasons. The issue here is how the RMS calendar can address the spatial and temporal distribution of touristic activities throughout the island and respective districts.

More importantly, advertising and marketing the climatic attractiveness of all the districts during different seasons is a significant attribute for boosting the destination image [22]. Implementation of the RMS calendar, which is positively linked to tourist loyalty will enable tourism decision makers to minimize the gap between the expectations and experiences of tourists [30, 36]. The proposed model, which functions based on variations in the suitability of the climate for tourists, addresses seasonality issues. This claim matches Ridderstaat et al.’s study [24] who reiterated that seasonality is strongly associated with climate attractiveness. Therefore, the current study tackles this problem by proposing the RMS calendar that identifies which district renders the most favorable climate. The result of this study is a practical example of the application of TEM in tourism climate literature, which coherent with Belle and Bramwell’s study [44].

4.3.3. Distribution of tourism benefits (social achievement)

The concentration of tourism enterprises in Kyrenia region is not necessarily a benefit for the rest of the island. As Eagles [40] and Truong et al. [22] reported, this type of development tends to ignore the pro-poor role of tourism in poverty alleviation. This research, by proposing a knowledge-based management system [3], provides a guideline for distributing tourism activities and their benefits temporally and spatially throughout the island. One should bear in mind that the concentration of tourism in Kyrenia is accompanied by luxury hotels and casinos which are prone to foreign investment, unsustainable modes of imports as well as leakages [83]. In the context of TEM [48], the proposed model paves the way for innovative ideas that will not only contribute to environmental quality but also benefit remote areas. As described earlier, most of the remote areas have potentials for alternative forms of tourism without requiring high capital or foreign investment.

4.3.4. Adaptive strategy to climate change

In the proposed model, evaluating and monitoring are embedded as the key processes that enable the RMS calendar to adapt to climate change. Feeding the model with new meteorological datasets will produce updated information that can be translated into knowledge for policy-makers to apply a new strategy to climate change. It will also allow monitoring of activities that measure the effectiveness of actions [75, 79]. As most of the climate change patterns estimate temperature increase [88], especially in the Mediterranean region, TCI will vary in the near future. Hot summer weather in Northern Cyprus will adversely affect the favorability of climate for tourists. Increasing temperatures will be exacerbated by high relative humidity on the island, thereby decreasing tourist comfort. The situation is likely to escalate in inland areas (e.g. Nicosia) where there are no resources for 3S tourism.

This model considers Jacobson et al. [81] and Reed et al.’s [75] advice that it is not adequate to apply only adaptive management. Information, monitoring, evaluation and knowledge must also inform future decisions in coastal areas. Similarly, Wong et al. [82] emphasized the importance of monitoring and evaluating steps in adjusting environmental policies to climate change adaptation. The multicultural differentiation of tourism climate, which is often overlooked [61, 89], enhances the practicality of the RMS calendar. In other words, tourists who come from various places express different perceptions/sensations about climate. Hence, the
proposed model helps managers to match those sensations with the RMS calendar, which is extracted from the spatio-temporal patterns of the TCI.

5. CONCLUSION

This study develops a RMS model based on climatic attractiveness for tourism on the Mediterranean island of Northern Cyprus. The districts that do not have a favorable climate are not considered as destinations in RMS calendar. In contrast, tourism activities are distributed to regions where a more favorable climate exists during a specific period of time. Another functionality of the RMS calendar is its consideration of environmental and human pressures in the context of recreational management. Furthermore, tourism specific resources (i.e. climate and environment) have been considered for developing RMS calendar. This approach not only reduces negative environmental and social impacts that are caused by over-concentration of touristic activities in one location. It also addresses the suitability of numerous locations with a favorable climate for redistribution of tourists over time and space in view of improved marketing as well as for solving the seasonality problem.

The proposed approach is supported by the TEM theory through generating and sharing knowledge, using technology as well as considering the cooperation of policy makers, stakeholders and other contributors. In other words, this model integrates environmental concerns with economic benefits by utilizing GIS as an interface between environmental and social issues. Spatio-temporal patterns of TCI are considered as the base for proposing the RMS calendar that follows both environmental and human pressures (i.e. reducing human pressure on the environment, reducing excessive exploitation of natural resources and managing biodiversity) and socio-economic concerns. These objectives can be achieved by valorizing different locations, adapting resources to demand, innovating marketing strategies based on favorability of the climate, raising tourist awareness, developing alternative forms of tourism and avoiding the poor role of tourism by enhancing the livelihood of local communities.

The process of the transformation of data to knowledge and wisdom is based on a knowledge-based management system that recommends decision making built on knowledge instead of raw data. In fact, the RMS calendar provides practical knowledge for managers on how to manage recreation activities over time and space. This not only minimizes adverse environmental effects but also enhances social and economic benefits of tourism. The results illustrated in this study help managers to address seasonality-related challenges. This model is conducive to climate change as it is capable of monitoring and evaluating processes by empowering the system to accommodate changes in climatic data. Results of this empirical study contributed to the awareness of both “demand” (tourists) and “supply” (policy makers, managers, travel agencies, tour operators, hoteliers and local communities) to translate the spatio-temporal patterns of TCI into practical strategies. Ultimately, this study attempts to strengthen the link between theory and practice by developing the RMS calendar, which is clearer and more understandable for non-experts in this field.

5.1. Limitations and future research directions

There are four limitations that can be considered for future research.

Firstly, this research proposes a model that is triggered by meteorological data. It would be beneficial if data were available for the entire island of Cyprus. This study focuses on Northern Cyprus. The RMS process needs to examine the system as a whole by scrutinizing the effective dimensions of sustainable tourism development pertinent to political, socio-cultural, environmental, technological, and economic dimensions. In future studies, it is recommendable to apply the proposed model in more sophisticated approaches within tourism recreation management, such as the Recreational Opportunity Spectrum and the Limits of Acceptable Change. Furthermore, it is worth examining the extent to which these sophisticated approaches are compatible with TEM in tourism recreation management.

Secondly, the RMS calendar was based on a lengthy data set (1980-2013); however, a comparison of TCI maps derived from two long term scenarios would provide more accurate information for developing the RMS calendar.

Thirdly, from a technical point of view and consonant with other studies, the Kriging method was used for the spatial analysis of TCI values. However future studies should identify appropriate geostatistical approaches for the interpolation of TCI values amongst the meteorological stations.

Fourthly, due to the popularity and capabilities of TCI in the projection of tourism climate variations, it is used to perform spatio-temporal analysis in the study area. It is suggested to devise a mechanism in future that is capable of extracting and applying tourists’ attitudes about climate conditions. In other words, instead of expert-based indices such as TCI, it would perhaps be beneficial to cover demand spectrum considerations using CIT or fuzzy-based CIT.

Furthermore, assessment of the multicultural characteristics of tourism climate and risk assessment of negative climate impacts on tourism activities are two areas of future research that could improve the functionality of the current model.

The authors have declared no conflict of interest.

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