Journal of Architectural Sciences and Applications
JASA 2025, 10 (2), 1025-1048
Research article
e-ISSN: 2548-0170
https://dergipark.org.tr/en/pub/mbud

Crises, Tourism and Chaos Theory: Resilience Strategies in Tourism

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Abstract

This study uses Geographic Information Systems (GIS) to analyze tourism mobility in 11 provinces of southeastern Türkiye between 2017 and 2023. It examines the spatial-temporal impacts of the February 6, 2023 earthquakes and the COVID-19 pandemic. While the pandemic abruptly halted tourism globally, the earthquakes caused severe regional losses, with varied recovery patterns. Through the lens of Chaos Theory's "butterfly effect," the study assesses fluctuations in tourism. During the pandemic, tourism declined by 40–50%, with signs of recovery in 2021–2022. The 2023 earthquakes led to significant drops in Hatay, Malatya, and Kahramanmaraş, whereas Adana and Gaziantep recovered faster. Findings highlight the non-linear, spatially diverse nature of tourism's response to crises and emphasize the need for sustainable, proactive resilience strategies.

Keywords: *Tourism, crisis management, chaos theory, covid-19, earthquake.*

Krizler, Turizm ve Kaos Teorisi: Turizmde Dayanıklılık Stratejileri

Öz

Bu çalışma, 2017–2023 yılları arasında Türkiye'nin güneydoğusundaki 11 ilde turizm hareketliliğini Coğrafi Bilgi Sistemleri (CBS) ile analiz etmektedir. Araştırma, 6 Şubat 2023 Kahramanmaraş depremleri ile COVID-19 pandemisinin turizm üzerindeki mekânsal ve zamansal etkilerini incelemektedir. Pandemi küresel ölçekte turizmi durdururken, depremler bölgesel kayıplara yol açmıştır. Kaos Teorisi'nin "kelebek etkisi" çerçevesinde turizmdeki dalgalanmalar değerlendirilmiştir. Pandemide turizm %40–50 oranında düşmüş, 2021–2022'de toparlanma gözlenmiştir. 2023 depremleri Hatay, Malatya ve Kahramanmaraş'ta ciddi düşüşe neden olmuş; Adana ve Gaziantep daha hızlı toparlanmıştır. Bulgular, krizler karşısında turizmin doğrusal olmayan ve mekânsal olarak farklılaşan bir yapıya sahip olduğunu göstermektedir.

Anahtar kelimeler: *Turizm, kriz yönetimi, kaos teorisi, covid-19, deprem.*

Citation: Erdoğan, Ö., Aksoy, T., Özenen Kavlak, M., Korkmaz, C., Metin, T.C., Duymuş, H., Çabuk, A., Günok, E., Altunel, M.C., Şıklar, B. (2025). Crises, tourism and chaos theory: Resilience strategies in tourism. *Journal of Architectural Sciences and Applications*, 10 (2), 1025-1048.

DOI: https://doi.org/10.30785/mbud.1676057

Received: *April 14, 2025 –* ***Accepted:*** *September 6, 2025*

1. Introduction

Earthquakes are among the disasters that have devastating effects on the tourism sector. These seismic events give rise to numerous social challenges, including concerns regarding personal safety, disruptions in fundamental daily activities, loss of life, and the psychological and physical ramifications stemming from these losses (Tatar et al., 2024). In urban environments, they have been shown to cause damage to public areas, including health, education, the economy, security, social infrastructure, and technical infrastructure services (Cetin et al., 2024). Earthquakes have been shown to lead to chaos and significant damage to the natural environment, as well as to historical and cultural richness. In particular, seismic events in tourist destinations can give rise to heightened safety concerns and potentially paralyze tourism activities due to damage to critical infrastructure, including accommodation, transportation networks, and infrastructure. The ramifications of such disasters extend beyond the immediate aftermath, deleteriously impacting economic processes at local, regional, and national levels. The tourism sector is particularly vulnerable, experiencing significant damage. The long-term repercussions of seismic events on the tourism sector are not confined to physical destruction; they also tarnish the reputation of destinations, diminish tourist influx, and substantially decelerate the economic recovery process of the affected region.

Another disaster that negatively impacts the tourism sector is epidemics. Like earthquakes, epidemics have detrimental effects on all levels (Kavlak et al., 2021). Public health crises give rise to social and community problems, economic stagnation, and mental and physical losses. The rapid spread of infectious diseases, coupled with the challenges of effective control measures, poses significant challenges to crisis management and significantly disrupts tourism activities. The fear of contact, contamination, and death has a deleterious effect on the processes of accommodation, transportation, and travel, causing people to avoid crowded environments and reducing the demand for tourist destinations. Moreover, the implementation of quarantine measures, travel restrictions, and border closures during epidemics results in protracted economic losses for the tourism sector, thereby prompting businesses to confront challenges related to sustainability. This study undertakes a comparative analysis of the effects of crises on the tourism sector, evaluates the sector's vulnerability to crises, and presents an alternative perspective on crisis management. The research was conducted in the provinces of Adana, Adıyaman, Diyarbakır, Elazığ, Gaziantep, Hatay, Kahramanmaraş, Kilis, Malatya, Osmaniye and Şanlıurfa, which were affected by the February 6 Kahramanmaraş earthquakes. The repercussions of the pandemic process in 2019 and the earthquake in 2023 on the tourism sector were meticulously analyzed and evaluated within the framework of Chaos Theory. The study encompassed the compilation and analysis of tourism data from the earthquake-affected provinces from 2017 to 2023. This analysis was conducted on a provincial basis using Geographic Information Systems (GIS). Within the scope of the analysis, fundamental indicators of the tourism sector were examined, including the number of visitors to museums and archaeological sites, as well as data on entry and overnight stays in accommodation facilities. The repercussions of the Kahramanmaraş Earthquakes and the COVD-19 Pandemic on the sector were comparatively analyzed at the temporal and spatial levels to assess how diverse crises affect tourism activities in disparate ways. Furthermore, the vulnerability of the tourism sector to crises is a subject of discussion. The complex, irregular, and dynamic nature of crises is explained through the lens of Chaos Theory, offering an alternative perspective to traditional crisis management approaches that prioritize predictable patterns. The present study analyzes resilience strategies in the tourism sector on the basis of Chaos Theory, with the objective of better understanding how unpredictable events shape the industry.

The present study is distinctive in its focus on the uncertainties and irregularities engendered by disasters and pandemics in the tourism sector. While numerous studies have examined the impact of disasters and health crises on tourism (Xiong & Tang, 2023; Ma et al., 2020; Rosselló et al., 2020; Rindrasih et al., 2019; Maditinos & Vassiliadis, 2008), there is a paucity of research that elucidates the inherently uncertain nature of crisis dynamics in the tourism sector using Chaos Theory and that employs spatial analysis to support these theories. This study offers implications for increasing resilience in the post-crisis process by revealing the factors through which the tourism sector recovers in the face of disasters. It also visualizes the spatial effects of disasters on tourism mobility and shows

how post-crisis recovery processes are shaped at the regional level. The findings of this study provide concrete recommendations for developing more resilient and sustainable strategies in the tourism sector. Furthermore, the study provides a guiding framework for the formulation of disaster-resilient tourism policies.

1.1. Literature Review

A disaster is commonly defined as a significant disruption that causes widespread human, material, economic, or environmental losses that exceed the affected community's ability to cope using its resources. Disasters can be natural, such as earthquakes, floods, hurricanes, pandemics, and epidemics, or man-made, including terrorism and industrial accidents. Given their disruptive nature, disasters profoundly impact the tourism sector. They can lead to immediate declines in tourist arrivals, damage to infrastructure, and long-term negative perceptions of affected destinations (Aziz et al., 2022; Nadal et al., 2020; Wang, 2009). Disasters also trigger changes in tourism planning and management practices, encouraging a shift towards resilience and preparedness.

1.1.1. Impact of disasters on the tourism sector

The effects of disasters on the tourism sector are multifaceted, encompassing crisis management, economic losses, infrastructure damage, tourist safety, and travelers' confidence. Existing literature highlights those disasters can lead to significant economic downturns in tourism-dependent regions. For instance, the SARS outbreak resulted in estimated losses of USD 12–18 billion across Asia due to decreased travel and tourism activities (Qiu et al., 2018). Similarly, the immediate effects of the COVID-19 pandemic were catastrophic, with international tourist arrivals plummeting by as much as 98% in May 2020 compared to the previous year, according to the United Nations World Tourism Organization (UNWTO) (Joo et al., 2021). This unprecedented decline has led to significant economic repercussions, including the loss of millions of jobs and a substantial decrease in revenue for tourism-dependent businesses, particularly in developing countries where tourism constitutes a critical component of the economy (Bahrawe, 2023; Stanišić et al., 2022). While pandemics such as COVID-19 disrupt tourism through global mobility restrictions, natural disasters pose a different set of challenges, primarily through the physical destruction of critical infrastructure.

Natural disasters, such as earthquakes, often destroy critical tourism infrastructure, including hotels and transportation networks, necessitating extensive recovery efforts (Mair et al., 2014). These recovery efforts often require substantial investments in rebuilding not only physical infrastructure but also the destination's image to regain tourist confidence. For example, the Wenchuan Earthquake in Sichuan, China, resulted in a staggering loss of approximately 87.298 billion yuan in tourism revenue, with recovery taking several years (Xu et al., 2023). Similarly, the September 21 earthquake in Taiwan led to a significant drop in inbound tourism, with recovery not fully realized until nearly a year later (Wei et al., 2021). This economic impact is compounded by the damage to infrastructure, which can deter tourists from visiting affected areas. These examples demonstrate the importance of integrating disaster risk reduction into tourism planning to ensure quicker recovery and enhanced resilience.

To effectively address the risks and challenges imposed by disasters, comprehensive crisis management strategies become essential, encompassing both proactive and reactive measures. Effective crisis management is essential for mitigating the adverse effects of disasters on tourism (Choi, 2024). This involves developing flexible and adaptive strategies to address the unpredictable nature of crises, especially when natural disasters such as earthquakes are considered. Integrated models that combine proactive and reactive measures are particularly important for addressing challenges posed by earthquakes (Huang et al., 2008; Ketter, 2022). Key components of these models include risk assessments, contingency planning, and clear communication strategies to manage public perception and to restore tourist confidence (Ritchie et al., 2004; Tóth-Kaszás & Keller, 2023). Effective crisis management not only addresses immediate safety concerns but also mitigates economic losses, particularly in tourism-dependent regions where recovery is crucial for local livelihoods.

1.1.2. Chaos theory; Pandemics, tourism crises and natural disasters

Chaos Theory was developed to examine complex, dynamic, and nonlinear phenomena. It can be defined as an approach that analyzes dynamic systems whose behaviors are inherently unpredictable. Initially grounded in the study of unpredictability within deterministic mathematical models, the theory has since been applied to fields such as social sciences, ecology, disaster management, and tourism.

Chaos Theory provides a valuable lens through which the complex and often unpredictable nature of disasters can be understood in the context of tourism. The theory suggests that small, seemingly insignificant triggers can generate large-scale disruptions due to the non-linear and sensitive nature of interconnected systems (Faulkner, 2001; Ritchie, 2004). In tourism, this "butterfly effect" is evident when minor crises—such as localized health scares or brief infrastructural issues—rapidly escalate and impact broader visitor perceptions and destination reputations (Speakman & Sharpley, 2012). By acknowledging these sudden shifts and the potential for emergent patterns, tourism stakeholders can adopt more adaptive and flexible crisis management approaches that emphasize preparedness, rapid response, and continuous learning. This alignment with Chaos Theory helps destinations remain resilient and agile in the face of multiple, overlapping crises.

The tourism sector, inherently vulnerable to crises, has also been analyzed through a chaotic lens. For instance, Wut et al. (2021) reviewed 512 scholarly articles published between 1985 and 2020 on crisis management in tourism. Speakman & Sharpley (2012), examining the AH1N1 influenza crisis in Mexico, applied Chaos Theory to explore how tourism systems respond to pandemics and political instability, highlighting the presence of chaotic attractors during recovery phases. Similarly, Lloret-Climent et al. (2019) and Matuszak & Mysłowski (2021) employed nonlinear time series analysis to identify chaotic dynamics in tourism demand fluctuations in the context of external shocks.

Studies in the context of pandemics have demonstrated the applicability of Chaos Theory in understanding the unpredictable nature and evolution of outbreaks. Mangiarotti et al. (2020) developed a chaos-based modeling approach to forecast the trajectory of the COVID-19 pandemic and support policy decision-making. Likewise, Açıkalın & Erçetin (2022) emphasized the role of nonlinear societal responses in shaping crisis processes, suggesting that chaos-informed perspectives can guide decision-making during public health emergencies. Additional research has applied Chaos Theory to crisis management in the tourism sector during COVID-19, aiming to develop solutions for recovery (Choi, 2024; Ritchie, 2004).

Natural disaster research has similarly benefited from chaos-based approaches. Sellnow et al., (2002) analyzed crisis communication during the 1997 Red River Valley flood in Minnesota and North Dakota, demonstrating how Chaos Theory can aid in understanding the complex dynamics of information flow and decision-making in disaster contexts. Yildiz & Bostan (2024), based on interviews with ten experts in disaster management, proposed integrating a chaos-informed management approach into disaster management processes.

1.1.3. Earthquakes, pandemics and changes in tourist behavior

In the short term, the literature indicates that the perception of risk among potential tourists is heightened following an earthquake, leading to changes in travel behavior. Tourists may avoid affected areas, opting instead for destinations perceived as safer (Pahrudin et al., 2023). This shift in behavior can have lasting effects on the tourism market, as destinations may struggle to regain their pre-crisis visitor numbers. For example, the Wenchuan earthquake in China resulted in a significant decline in tourism demand, with recovery taking several years (Xu et al., 2023). Such declines are often attributed to heightened perceptions of risk among potential tourists, who may view affected areas as unsafe despite improvements in safety and infrastructure (Min et al., 2020; Guo & Xiong, 2011). This phenomenon emphasizes the critical role of destination image and safety perceptions in post-disaster tourism recovery. Addressing these short-term challenges is essential to pave the way for long-term recovery strategies that prioritize sustainability and resilience. For example, implementing anti-crisis marketing strategies has been recommended to help tourism businesses navigate crises and ensure a swift return to normalcy (Zakharova, 2022). Additionally, knowledge management is crucial in crisis

management, enabling tourism organizations to learn from past crises and adapt their strategies accordingly (Stolarek-Muszynska & Zieba, 2022; Blackman & Ritchie, 2008). The example of Sichuan further illustrates that the integration of tourism development into disaster recovery strategies has been shown to enhance local livelihoods and promote economic resilience (Liu-Lastres et al., 2020).

The immediate aftermath of an earthquake often sees a sharp drop in tourist arrivals due to safety concerns and damaged facilities, which can result in substantial economic losses for local economies reliant on tourism (Pforr & Hosie, 2008). While earthquakes pose significant challenges to tourism, the COVID-19 pandemic has further highlighted the vulnerabilities of the sector, particularly in regions heavily reliant on international visitors. Studies have shown that the economic fallout from the pandemic has disproportionately affected small and medium-sized enterprises (SMEs) within the tourism industry, which often lack the financial resilience to withstand prolonged periods of reduced demand (Janeček et al., 2021). The economic sustainability of these businesses is critical for the overall recovery of the tourism sector, as they play a vital role in local economies and employment (Janeček et al., 2021; Stanišić et al., 2022).

In addition to economic considerations, the psychological and emotional impacts of disasters on residents and tourists must be acknowledged. The concept of "dark tourism," where visitors are drawn to sites associated with tragedy, has also emerged as a viable strategy for some destinations, allowing them to capitalize on their unique narratives while fostering a deeper understanding of the events that transpired (Biran et al., 2014). However, such strategies require careful attention, as dark tourism raises ethical questions about the commodification of tragedy and the potential for exploitation of affected communities (Jordan & Prayag, 2021). In Gili Trawangan, Indonesia, the local community leveraged social capital to facilitate recovery efforts, transforming social hubs into triage centers for locals and tourists during crises (Partelow, 2020). This collective action provided immediate assistance and fostered a sense of community resilience that is essential for long-term recovery. In parallel with dark tourism initiatives, the role of local communities in recovery efforts cannot be overstated, as community resilience often forms the backbone of sustainable tourism recovery.

Residents may experience mixed feelings about the influx of tourists to disaster sites, grappling with their trauma while navigating the economic benefits that tourism can bring (Wright & Sharpley, 2016). Understanding these dynamics is crucial for developing tourism strategies sensitive to local communities' needs and perspectives. Research by Shin et al. (2022) indicates that interpersonal and political trust plays a crucial role in shaping travel decisions during times of uncertainty. As travelers become increasingly concerned about health risks due to COVID-19 pandemics, their preferences have shifted towards destinations demonstrating robust safety measures and a commitment to sustainable practices. This shift underscores the importance of building trust between travelers and tourism providers, which is essential for the sector's recovery (Shin et al., 2022).

Promoting tourism in post-disaster contexts often intersects with complex social and psychological dynamics within affected communities, especially considering the enhanced digitization of tourism in the post-pandemic era. The COVID-19 pandemic has prompted discussions around the digital transformation of the tourism sector. As George (2024) highlighted, the digital divide has become more pronounced during the pandemic, with unequal access to technology further exacerbating existing inequalities within the industry. The shift towards digital solutions for marketing, booking, and customer engagement has become critical for businesses aiming to survive and thrive in the post-pandemic landscape (George, 2024). Moreover, technological advancements and digital platforms have emerged as critical tools for real-time crisis communication, aiding both response and recovery efforts.

1.1.4. Post-crisis recovery

The literature outlines various post-crisis recovery strategies, including developing sustainable tourism practices to enhance resilience against future crises (Revilla et al., 2022; Leković & Milutinović, 2021). Sustainable tourism plays a critical role in the recovery phase, as it not only aids in the immediate rebuilding of infrastructure but also fosters enhanced resilience in tourism in the long run. By promoting environmentally friendly practices and supporting local economies, sustainable tourism can help mitigate the impacts of future disasters and enhance community resilience (Eva, 2024; Huang et

al., 2008). This approach aids in economic recovery in addition to ensuring that the destination remains resilient to future challenges, fostering a sense of stewardship among local stakeholders.

Despite ongoing advocacy for sustainable tourism, the long-term viability of tourism-led recovery remains a contentious issue. Critics argue that an over-reliance on tourism for economic recovery can lead to negative long-term consequences, including environmental degradation and cultural commodification (Zhang, 2022). The challenge lies in balancing the immediate economic benefits of tourism with the need for sustainable practices that protect local ecosystems and communities. For instance, nature-based tourism initiatives have been proposed to revitalize areas affected by disasters while minimizing negative environmental impacts (Liu et al., 2018). These approaches underscore the need to integrate sustainability into tourism development strategies, ensuring that recovery efforts do not compromise the resources that attract visitors.

Post-disaster recovery processes are critical for restoring tourism in affected areas. The literature emphasizes the importance of comprehensive recovery strategies that address both immediate needs and long-term sustainability goals (Mair et al., 2014). Studies have shown that destinations adopting a holistic recovery approach - integrating economic, social, and environmental considerations - are more likely to achieve successful outcomes (Leković & Milutinović, 2021; Mair et al., 2014).

Key strategies for rebuilding tourism destinations affected by earthquakes involve balancing economic recovery with social well-being and environmental sustainability. The literature suggests that recovery frameworks should prioritize community engagement and stakeholder collaboration to ensure that the needs and perspectives of local populations are considered (Campiranon & Scott, 2014; Kunwar & Karki, 2020). This approach not only fosters a sense of ownership among community members but also enhances the social fabric of the destination, which is crucial for long-term recovery. Such community-driven strategies can serve as a blueprint for effective crisis management in tourism, ensuring resilience and inclusivity in the recovery process. Furthermore, integrating sustainable practices into the recovery process can help mitigate environmental impacts and promote resilience against future disasters (Eva, 2024; Huang et al., 2008).

Different recovery models address the intersection of economic, social, and environmental factors in various ways. For instance, the Sustainable Livelihoods Framework (SLF) has been applied to analyze post-disaster tourism recovery, emphasizing the importance of community assets and local participation in achieving sustainable outcomes (Liu-Lastres et al., 2020). This model highlights how tourism can be leveraged for economic recovery while addressing social and environmental concerns. Additionally, the literature discusses integrated crisis management models that incorporate risk assessment, emergency response, and recovery planning to create a holistic approach to disaster recovery (Huang et al., 2008; Huang & Min, 2002).

Several studies focus on policies and practices for reconstructing tourism after disasters. For instance, research has highlighted the role of government policies in facilitating recovery efforts, such as providing financial assistance to affected businesses and promoting tourism through targeted marketing campaigns (Blackman & Ritchie, 2008; Liu et al., 2012). Collaboration among stakeholders, including government agencies, local communities, and tourism operators, is essential for effective recovery (Scott et al., 2008). The literature also points to establishing clear communication channels and frameworks for crisis response, enhancing coordination and efficiency during recovery efforts (Blackman & Ritchie, 2008; Evans & Elphick, 2005).

The aftermath of earthquakes poses significant challenges and opportunities for tourism activities in affected regions. Earthquakes can disrupt tourism flows, damage infrastructure, and alter potential visitors' perceptions of safety. However, they can also catalyze recovery efforts, leading to innovative tourism development strategies, community resilience, and economic revitalization. This synthesis explores the multifaceted impacts of earthquakes on tourism, focusing on recovery strategies, community responses, and the long-term implications for tourism destinations.

Overall, the literature indicates that pandemics, tourism crises, and natural disasters share structural similarities in their chaotic dynamics. By integrating these domains under the framework of Chaos

Theory, scholars highlight the value of nonlinear modeling in predicting, managing, and recovering from disruptive events. This integrated perspective not only advances theoretical development but also informs practical interventions in crisis-prone sectors.

In conclusion, the impact of disasters, particularly earthquakes, on the tourism sector is profound and multifaceted, encompassing economic losses, infrastructure damage, and shifts in tourist behavior.

Effective crisis management and recovery strategies are essential to mitigate these impacts and facilitate both short-term and long-term recovery. Sustainable tourism practices play a critical role in rebuilding resilient tourism destinations, balancing economic recovery with social well-being and environmental sustainability. While economic recovery is vital, the role of local communities in fostering long-term resilience cannot be overlooked. Community engagement, stakeholder collaboration, and integrated crisis management models are key to successful recovery efforts. While disasters pose significant challenges, they also present opportunities for innovative tourism development and community resilience. Ultimately, a holistic approach that addresses economic, social, and environmental dimensions is crucial for sustainable post-disaster tourism recovery.

2. Material and Method

This study was conducted to comparatively analyze the impacts of the 6 February 2023 Kahramanmaraş earthquakes and the 2019 novel coronavirus (nCoV) pandemic on the tourism sector. The study entailed the compilation and analysis of key tourism indicators using GIS to assess the vulnerability of the tourism sector to crises. By comparing pre- and post-crisis periods through GIS-based spatial analysis, the effects of different types of crises on the tourism sector are analyzed in temporal and spatial dimensions. Furthermore, an alternative perspective to traditional crisis management approaches is presented by using Chaos Theory to explain the unpredictable and disorderly nature of crisis processes. The objective of the present findings is to contribute to the development of resilience-oriented strategies in the future by revealing the spatial distribution of post-crisis recovery processes in the tourism sector. Comprehensive information regarding this subject is provided in this section.

2.1. Study Area

The geographical area under consideration is situated within the following coordinates: 35° 46’- 39° 09’ north latitude and 34° 51’- 41° 22’ east longitude. The region encompasses 11 provinces in the southeastern region of Turkey, including Adana, Osmaniye, Hatay, Kahramanmaraş, Gaziantep, Kilis, Malatya, Adıyaman, Şanlıurfa, Elazığ and Diyarbakır, which were impacted by the seismic events that occurred on February 6, 2023 (Figure 1).

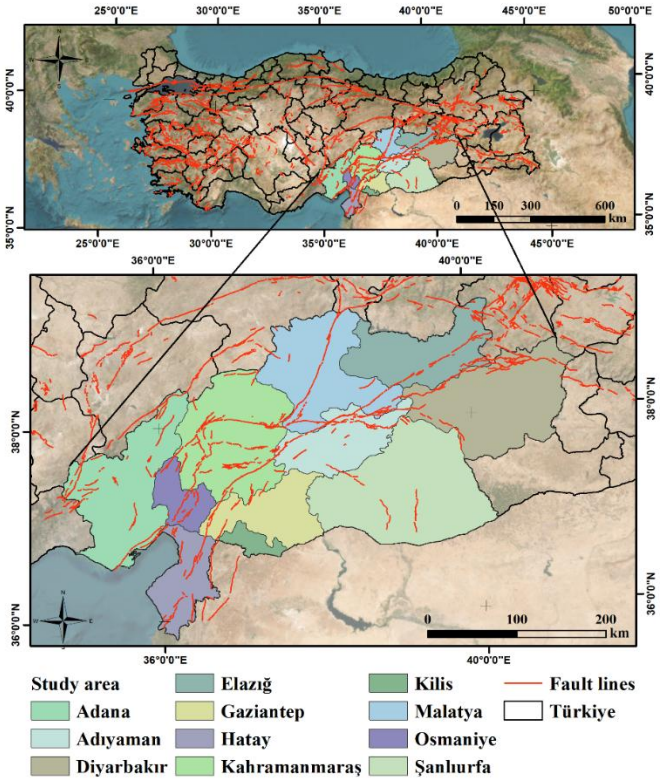


Figure 1. Study area (Created by the authors)

The geology and geomorphology of the region have undergone significant development as a result of the closure of the Tethys Ocean, which once extended between the Europe-Asia (Eurasia) plate in the north and the African and Arabian plates in the south along the Bitlis-Zagros suture. Given its inclusion in the Alpine-Himalayan Mountain System, the region is situated within the Alpine-Himalayan Earthquake Belt, a seismic zone of global significance. The Eastern Anatolian Fault, which developed in the collision area of the Anatolian plate and the Arabian plate, constitutes the strongest line of active tectonics in the region, and its earthquake activity is quite high.

The most prominent elevations in the region include the Southeastern Taurus Mountains, which reach heights of 3,000–4,000 meters, extending in an east-west direction, and the Amanos Mountains, which reach 2,240 meters and extend in a north-south direction. The Gaziantep and Şanlıurfa Plateaus, which range between 600 and 800 meters, are significant high plains in the region. These plateaus were formed by the Euphrates and its tributaries. The Çukurova, Harran, Suruç, Barak, Ceylanpınar, Amik, Dörtyol-Erzin, Malatya, Elazığ, Elbistan, and Maraş plains are significant plains in Turkey and the region.

The region's climatic characteristics, as delineated by the General Directorate of Meteorological Affairs, are characterized by a Mediterranean climate, a continental climate, and a transitional climate between these two climates. The long-term average real temperature values range from 18-20°C in Hatay, Adana, and Şanlıurfa to 15-18°C and 12-15°C in the northern parts of these provinces and other northern provinces. Hatay province has recorded the highest monthly total precipitation average (1154.2 mm), while Malatya has recorded the lowest (383.6 mm). According to Erinç, Hatay province is classified as humid, while Şanlıurfa center and its surroundings are designated as semi-arid, and other provinces are designated as semi-humid.

The Euphrates, Tigris, Seyhan, and Ceyhan Rivers, along with their respective tributaries, constitute the primary water bodies not only within the region but also throughout the country. Turkey's most significant hydroelectric power plants were developed along these waterways. Within the region's boundaries, there are the following dams and reservoirs on the Euphrates River: Keban, Karakaya, Atatürk, Birecik, Hancağız; on the Tigris River: Kralkızı, Dicle; on the Aksu Stream: Kartalkaya; and on the Karasu Stream: Kandil. Sarıgüzel, Menzelet, Sır, Aslantaş on the Ceyhan River, Yedigöze, Çatalan, Seyhan dams and reservoirs on the Seyhan River, Tahtaköprü on the Karasu Stream, Berdan dam and

reservoir on the Tarsus Stream. The primary functions of these dams and lakes encompass electricity generation and irrigation. The region is home to several tectonically formed lakes, including Hazar, Gölbaşı, Azaplı, and İnekli.

According to data from the Address Based Population Registration System, the total population of the 11 provinces in the region was 14,013,196 as of December 31, 2022, constituting 16.4% of the country's total population of 85,279,553. A significant proportion of the region's population, amounting to 96.7% of the total (13,553,283 individuals), resides in provincial and district centers, while the remaining 3.3% (459,913 individuals, excluding those residing in rural neighborhoods within the seven metropolitan cities in the region) live in smaller towns and villages.

According to the data from the Address Based Population Registration System for 2022, 21.3% of Turkey's child population (0-17 years old) and 16.7% of Turkey's youth population (18-29 years old) reside in the region. The median age of Turkey is 33.5 years; however, in all provinces except Diyarbakır and Malatya, the median age is lower than the national median. The region exhibits a 2.5 percentage point decrease in the proportion of the elderly population compared to the national average.

The following data, obtained from the Turkish Exporters' Assembly, reveal the provinces' shares in the nation's total exports by product or sector in 2022. The top exporters are as follows: Gaziantep: carpets (60.6%), cereals, pulses, oil seeds and products (31.7%), fruit and vegetable products (17.4%), textiles and raw materials (16.8%), leather and leather products (9.9%), dried fruits and products (9.5%), furniture, paper and forestry products (7.2%), air conditioning industry (6.0%), chemicals and chemical products (4.The top sectors contributing to Turkey's economy include agriculture, with a 7% share, machinery and components (2.3%), Hatay, with a 15.6% share, fresh fruits and vegetables (15.6%), steel (9.1%), mining products (2.1%), Malatya, with a 15.5% share, dried fruits and products, Kahramanmaraş, with a 15.5% share, textiles and raw materials (8.5%), Adana, with a 5.9%), aquaculture and animal products (5.1%), fresh fruits and vegetables (4.9%), cereals, pulses, oil seeds and products (3.8%), chemicals and products (2.6%), automotive industry (2.0%) (T.C. Strategy and Budget Presidency, 2023).

The region contains numerous valuable sites of global significance in terms of nature, history, faith tourism, and geological heritage. Examples of such sites include Karahantepe, Göbeklitepe, Zeugma, and Mount Nemrut. The Silk Road, a historical trade route connecting the Far East to Europe, traverses the region, facilitating the exchange of ideas, religions, cultures, and goods among diverse civilizations. The Mediterranean Sea, the world's most significant inland body of water, facilitates interaction between the region, Europe, Africa, the Arabian Peninsula, and the rest of the world via maritime trade. The coastal cities of Hatay and Adana are home to 12 and 3 sea border gates, respectively. The land border gates with Syria, which facilitate trade and international interaction with the Middle East, are Karkamış, Cilvegözü, Yayladağı, Akçakale, Öncüpınar, Çobanbey, Ceylanpınar, Kumlu, Mürsitpınar. According to data from the General Directorate of Highways of the Ministry of Transport and Infrastructure for the year 2024, the region has 629 km of highways, 3715.5 km of state roads, 4797 km of provincial roads, and a total road network length of 9141.4 km.

2.2. Data and Methodology

The main objective of the study is to analyze the impacts of the COVID-19 pandemic in 2019 and the 2023 Kahramanmaraş earthquakes on the tourism sector at the spatial and temporal level. In this context, in the first phase of the study, numerical data on the tourism sector in the related provinces between 2017 and 2023 were compiled and analyzed using GIS. In the analysis process, basic indicators of the tourism sector such as the number of visitors to museums and archaeological sites (Table 1), provided by the Ministry of Culture and Tourism for the years 2017-2023, and the number of entries to accommodation facilities (Table 2) and overnight stays (Table 3) obtained from TurkSat were evaluated. The data sets forming the basis of the study are used to understand the changes in tourism mobility in response to disasters and pandemics. Consequently, the effects of different types of crises, such as pandemics and earthquakes, on the sector are compared.

Table 1. Number of entries to museums and archaeological sites by provinces in 2017-2023 (NVMR)

Cities	NVMR 2017	NVMR 2018	NVMR 2019	NVMR 2020	NVMR 2021	NVMR 2022	NVMR 2023
Adana	63301	101891	215334	60107	119283	215401	347378
Adıyaman	16827	24001	97378	66908	150417	272629	72410
Diyarbakır	103218	211802	385557	78454	130336	129601	113232
Elazığ	-	-	-	-	-	-	-
Gaziantep	177618	282027	401494	108269	291723	497454	242874
Hatay	180819	479841	427923	172862	364321	700073	53309
Kahramanmaraş	15885	13213	21368	6311	13247	40164	3332
Kilis	-	-	-	-	938	10021	1594
Malatya	141188	121589	103229	29744	67455	110938	773
Osmaniye	11814	18783	22150	11901	4728	4863	9236
Şanlıurfa	164110	263464	729966	270906	749564	1276097	570317
Total	**874780**	**1516611**	**2404399**	**805462**	**1892012**	**3257241**	**1414455**

Table 2. Number of entries to accommodation facilities by province between 2017-2023

	2017	2018	2019	2020	2021	2022	2023
Adana	921832	942143	967168	702678	933280	1121037	1056284
Adıyaman	140252	190962	221871	132202	197282	241857	98207
Diyarbakır	302223	421705	536696	378299	541065	650499	494919
Elazığ	211474	222552	241071	194632	232767	241209	225100
Gaziantep	748433	803795	885428	550939	897618	1153807	932787
Hatay	697759	739944	739474	480391	618003	752987	423572
Kahramanmaraş	262782	328870	313203	231482	313694	341663	185140
Kilis	38808	35554	38917	24562	30297	35937	21971
Malatya	287236	296401	306375	266912	369808	385147	157401
Osmaniye	86173	70515	88026	78168	110025	107392	36864
Şanlıurfa	406689	604661	627345	310785	497021	576370	308439
Total	**4103661**	**4657102**	**4965574**	**3351050**	**4740860**	**5607905**	**3940684**

Table 3. Number of overnight stays in accommodation facilities by province between 2017-2023

	2017	2018	2019	2020	2021	2022	2023
Adana	1494739	1592013	1596139	1166260	1556040	1902731	1785461
Adıyaman	223626	282838	328393	243639	344296	380179	162330
Diyarbakır	485199	662295	812541	594382	837204	1054434	871135
Elazığ	351361	378034	387853	351361	414171	436839	402443
Gaziantep	1087668	1152420	1294725	826661	1361692	1790137	1437811
Hatay	1237086	1336140	1328148	924909	1306526	1434822	947909
Kahramanmaraş	444727	524467	529671	392176	538117	580886	370822
Kilis	95288	91816	83745	55746	61275	72817	39107
Malatya	486273	499126	510495	458056	612333	632524	272316
Osmaniye	134199	111570	120702	106034	157874	143103	62503
Şanlıurfa	704515	1008319	1057333	546996	810366	947696	504342
Total	**6744681**	**7639038**	**8049745**	**5666220**	**7999894**	**9376168**	**6856179**

Spatial analysis was performed using ArcGIS and QGIS software. GIS was utilized to examine the spatial distribution of tourism data, to map changes following disasters and pandemics, and to identify regional differences in tourism mobility. To this end, the number of visitors to museums and archaeological sites, as well as accommodation data for each year, were mapped on a provincial basis. Thematic mapping methodologies were employed to facilitate the comparative analysis of tourism trends across provinces. Temporal analyses were conducted to compare the pre-disaster, during-disaster, and post-disaster periods. The trends in the tourism sector were then visualized. A comparison was made between the pre-pandemic and pre-earthquake periods, and the sudden changes in tourism mobility that occurred in 2020 and 2023. A detailed analysis was conducted using spatial maps and statistical methods to examine the changes that occurred after the emergence of the novel Coronavirus (SARS-CoV-2) pandemic and the February 6 Kahramanmaraş Earthquakes.

In the second stage of the study, the irregularities and uncertainties that arise due to crises in the tourism sector were evaluated within the framework of Chaos Theory. Chaos Theory proposes that minute initial conditions can generate substantial and unpredictable outcomes over time (Lorenz, 2017). This theory suggests that events that appear to be disordered in nonlinear systems actually operate within certain patterns and that there is a hidden order in the system (Gleick, 2008). The "butterfly effect" in Chaos Theory posits that a minor alteration in the initial state of a system can elicit substantial consequences over an extended timeframe (Lorenz, 1993). In dynamic and crisis-prone sectors such as tourism, Chaos Theory is employed to explain that crises do not follow a linear process and that sudden changes and uncertainties can lead to unpredictable consequences (Baggio, 2008). In particular, it has been observed that external shocks, such as natural disasters and global health crises, cause non-linear fluctuations in the tourism sector, and that the recovery processes of the sector develop at different speeds in different regions (Faulkner, 2013). In this context, Chaos Theory underscores the necessity to surpass conventional crisis management methodologies and cultivate adaptive and flexible strategies (Ritchie, 2004). In this context, the present study delves beyond conventional crisis management methodologies, emphasizing the dynamic and unpredictable nature of crises. The study employs Chaos Theory as a methodological framework to comprehend the inherently uncertain dynamics of crises within the tourism sector and to meticulously analyze the repercussions of crisis processes. The theory is based on the notion that minor alterations can lead to major ramifications. Thus, it was employed to evaluate the repercussions of the pandemic caused by the novel coronavirus (SARS-CoV-2) and the Kahramanmaraş earthquakes on the tourism sector, both in terms of time and geography. In order to reveal the non-linear nature of crises, fluctuations in tourism data obtained through GIS were analyzed, and the unexpected consequences of crises on the sector were investigated. The "butterfly effect" principle, a foundational component of Chaos Theory, was examined to elucidate how pandemics and earthquakes precipitate sudden and protracted fluctuations in tourism mobility. In this context, examining the uncertain progression of crises highlights that conventional linear crisis management methodologies may prove to be insufficient, emphasizing the need for more adaptable and agile strategies. The central tenet of this study is that the tourism sector exhibits varying degrees of resilience to both anticipated and unanticipated crises, resulting in non-linear fluctuations within the sector. In light of these findings, a novel framework is proposed to elucidate the impact of crises on the tourism sector and to formulate resilience strategies. Geological disasters, such as earthquakes, are often anticipated and predicted, and occur within a specific region. However, the advent of the novel Coronavirus (SARS-CoV-2) pandemic emerged as an unexpected crisis, causing profound uncertainty on a global scale. The present study explores the divergent responses to these crises, highlighting the unique measures and crisis management approaches employed in the tourism sector. In the context of this study, regional variations were taken into account in accordance with the findings obtained to ascertain crisis management strategies in tourism and post-disaster recovery processes.

3. Findings and Discussion

This study analyzes the responses of the tourism sector to crises within the framework of Chaos Theory and evaluates the effects of the COVD-19 pandemic and the Kahramanmaraş earthquakes on the sector at the temporal and spatial levels. The findings indicate that tourism exhibits a high degree of sensitivity

to crises, with such shocks resulting in sudden and unpredictable fluctuations within the sector. The global pandemic, an unforeseen crisis, precipitated a precipitous decline in tourism activities; however, the post-crisis recovery process was expeditious. Conversely, although earthquakes are among the foreseeable risks, their repercussions have been considerably more protracted on a regional scale.

In this context, one of the most significant contributions of this study is the demonstration that the tourism sector's response to crises is distinct in each region and that crisis management strategies are influenced by regional resilience. For instance, while the post-pandemic recovery process accelerated in provinces such as Gaziantep and Diyarbakır, tourism activities almost completely ceased in regions directly impacted by the earthquake, including Hatay, Malatya, and Kahramanmaraş. The findings of the study are consistent with a significant portion of the extant research. As Rosselló et al. (2020) have emphasized, the repercussions of natural disasters on international tourism mobility are detrimental, and the recovery process following a disaster is contingent on regional differences. The present study lends support to these findings by revealing that the Kahramanmaraş earthquakes caused a sharp contraction in the tourism sector and that recovery processes differ across provinces. In particular, provinces directly impacted by the seismic events, such as Hatay, Malatya, and Kahramanmaraş, experienced a near-total halt of tourism activities. In contrast, provinces like Adana and Gaziantep witnessed a more modest decline in tourism. This study aligns with the findings of Ma et al. (2020), who underscored that the responses of the tourism sector to crises are not straightforward and are contingent on perceptions of security. In the present study, it was observed that the perception that a destination is not safe has been shown to reduce tourism demand in the long run, thereby further exacerbating economic problems and reinforcing the effects of the crisis. In their study, Xiong and Tang (2023) examined the impact of pandemics on tourism, positing that the quality of health systems and transportation infrastructure are pivotal in determining the ramifications of a pandemic on tourism. The present study demonstrates that the advent of the pandemic resulted in a precipitous decline in tourism mobility, precipitated by travel restrictions and health concerns, leading to a 40-50% contraction in accommodation arrivals in the region in 2020. However, in 2021 and 2022, with the lifting of post-pandemic travel restrictions, the tourism sector began to recover, with 30-40% increases in certain provinces. These outcomes lend support to the findings of Xiong & Tang (2023). An examination of the impact of crises on tourism at the regional level reveals that disasters in Indonesia have influenced the development of tourism policies and crisis management approaches. This study emphasizes the necessity for the tourism sector to develop adaptive strategies in the post-disaster recovery process. In a similar vein, our study demonstrates that the recovery process following a disaster does not adhere to a linear trajectory. We contend that regional dynamics play a pivotal role in shaping the recovery process.

This study makes a significant contribution to the existing literature by comparing the responses of the tourism sector to different types of crises. While extant research has predominantly focused on the impact of natural disasters on tourism or the damage caused by health crises, this study evaluates both types of crises spatially and temporally within the framework of Chaos Theory. The findings align with the perspective proposed by Maditinos & Vassiliadis (2008) that "crises in tourism can have global impacts even though they occur locally." In the present study, it was ascertained that global crises, such as pandemics, exert a substantial impact on regional tourism, thereby prolonging the recovery processes over an extended timeframe. Conversely, earthquakes, despite their more localized impact, have been associated with protracted economic losses, stemming from the deterioration of the region's tourism image. The present study demonstrates that Chaos Theory provides a robust framework for comprehending the ramifications of crises in the tourism sector. Furthermore, it is evidenced that the repercussions of crises in the tourism sector manifest in a non-linear structure. Theoretically, this study demonstrates the non-linear effects of crises and how they create feedback mechanisms within the system by applying Chaos Theory in the context of tourism crisis management. The study's findings reveal that crises in the tourism sector are shaped not only by immediate shocks but also by long-term transformations resulting from complex interactions. The study's findings underscore the limitations of conventional, linear crisis management approaches, emphasizing the necessity for more adaptable and flexible strategies. Furthermore, the post-disaster recovery process

of tourism destinations varies across regions, contingent on initial conditions, local government policies, and the extent of social solidarity. In practical terms, the present study offers a concrete decision-making instrument for local governments and tourism planners by supporting the impacts of disasters and global health crises on the tourism sector with spatial analysis. Specifically, the analysis utilizes Geographic Information Systems (GIS) to unveil the spatial dimension of changes in the tourism sector and to identify regions that necessitate augmented support in post-crisis recovery processes. The study's findings underscore the significance of spatial planning and post-crisis destination management, aiding decision makers in formulating more proactive strategies to combat crises. It is particularly noteworthy that crisis management plans, when formulated within the principles of flexibility and adaptability, contribute to the resilience of tourism policies in the face of disasters. This approach is predicated on the notion that tourism policies, when crafted with a focus on flexibility and adaptability, can enhance their resilience to the adverse impacts of disasters.

The present study makes a novel contribution to the existing literature on tourism crisis management by offering an alternative approach informed by the principles of Chaos Theory. In this vein, future researchers in this field may wish to investigate how crises in the tourism sector are shaped not only by economic or infrastructural aspects but also by complex system dynamics. Additionally, it would be worthwhile to examine how different types of crises can trigger each other. To this end, it is recommended to initiate the research by examining the interactions between different categories of disasters. The repercussions of various crises, including but not limited to earthquakes, pandemics, terrorism incidents, and climate change, on tourism should be assessed within the framework of multiple crisis scenarios. Utilizing the theoretical framework of Chaos Theory, the study will investigate the individual effects of crises, the long-term cascading effects triggered by these crises, and the sector's response to these crises. Furthermore, a more thorough examination of the tourism sector’s adaptation processes to crises is needed. While this study employed spatial analysis to examine changes in tourism mobility, future research could delve more profoundly into the decision-making processes of local businesses, tourism employees, and tourists during crisis situations. Research on emergent trends in the tourism sector in the aftermath of crises, consumer behavior, and the perception of tourism destinations will facilitate the preparation of the sector to be better prepared for future crises. Additionally, further exploration is necessary to investigate the relationship between technological solutions and crisis management. Digital platforms, social media, and artificial intelligence-supported analysis tools are becoming increasingly important in crisis management. Future research endeavors could concentrate on the utilization of data analysis in crisis processes and the enhancement of the tourism sector's responsiveness and agility. A promising avenue for future research lies in the development of more comprehensive models of post-crisis recovery processes. These models should be informed by comparative analyses of the impact of different types of crises on the tourism sector. Areas in which future research should prioritize comparative analysis include spatial planning, post-crisis strategic communication, and sustainable tourism policies. These comparative analyses will increase the resilience of the tourism sector and build a stronger structure against crises. This study offers a foundational framework for advancing the analysis of tourism crisis management within the paradigm of Chaos Theory. Subsequent research endeavors should concentrate on the development of models that offer a more profound understanding of the repercussions that crises have on the tourism sector. These models should also contribute to the enhancement of crisis management and resilience strategies.

3.1. Temporal and Spatial Analysis Findings

This study employed GIS techniques to analyze the temporal changes caused by disasters and epidemics in the tourism sector. The study's findings revealed spatial and temporal fluctuations in tourism mobility during crisis periods. In this context, Figure 2 illustrates the spatial and temporal variation in the number of visitors to museums and archaeological sites between 2017 and 2023. The figure is unambiguous in its demonstration of the fluctuations in tourism activity over the years and the repercussions of crises. During the 2017-2019 period (see Fig. 2a-c), the number of visitors increased in many provinces, with Şanlıurfa, Gaziantep, and Hatay particularly standing out. The significant surge in the number of visitors to museums and archaeological sites in Şanlıurfa, particularly

in 2019, can be attributed to the inscription of Göbeklitepe on the UNESCO World Heritage List and the declaration of the year as Göbeklitepe Year by official authorities. Furthermore, a substantial increase in the number of visitors to museums in Hatay was observed, with a nearly threefold increase in 2018 compared to 2017. This substantial increase may be directly associated with the province's cultural and gastronomic initiatives. For instance, in 2017, Hatay was incorporated into the UNESCO Creative Cities Program, specifically in the domain of gastronomy, a development that led to a substantial augmentation in the province's tourism sector. These developments have transformed these cities into major tourist attractions on the global stage. However, the year 2020 (Fig. 2d) witnessed a precipitous decline due to the pandemic, as evidenced by a substantial decrease in the number of visitors, as depicted in the maps. The Hatay City Museum, which opened in 2020, can be used as an indicator of the increase in the number of visitors to Hatay province compared to previous years. In 2021 and 2022 (Fig. 2e-f), tourism demonstrated a notable resurgence, particularly in Gaziantep, Şanlıurfa, and Hatay. Notably, in 2021, Şanlıurfa's museums and archaeological sites witnessed a resurgence in visitors, underscoring the enduring allure of Göbeklitepe as a major tourist destination. However, in 2023 (Fig. 2g), it is evident from the maps that tourism activity has nearly ceased, particularly in provinces such as Hatay, Kahramanmaraş, and Malatya, due to the impact of the Kahramanmaraş earthquakes. The line graph in Figure 2h provides a numerical representation of the changes over the years on a city-by-city basis, supporting the sharp declines and recovery trends in 2020 and 2023.

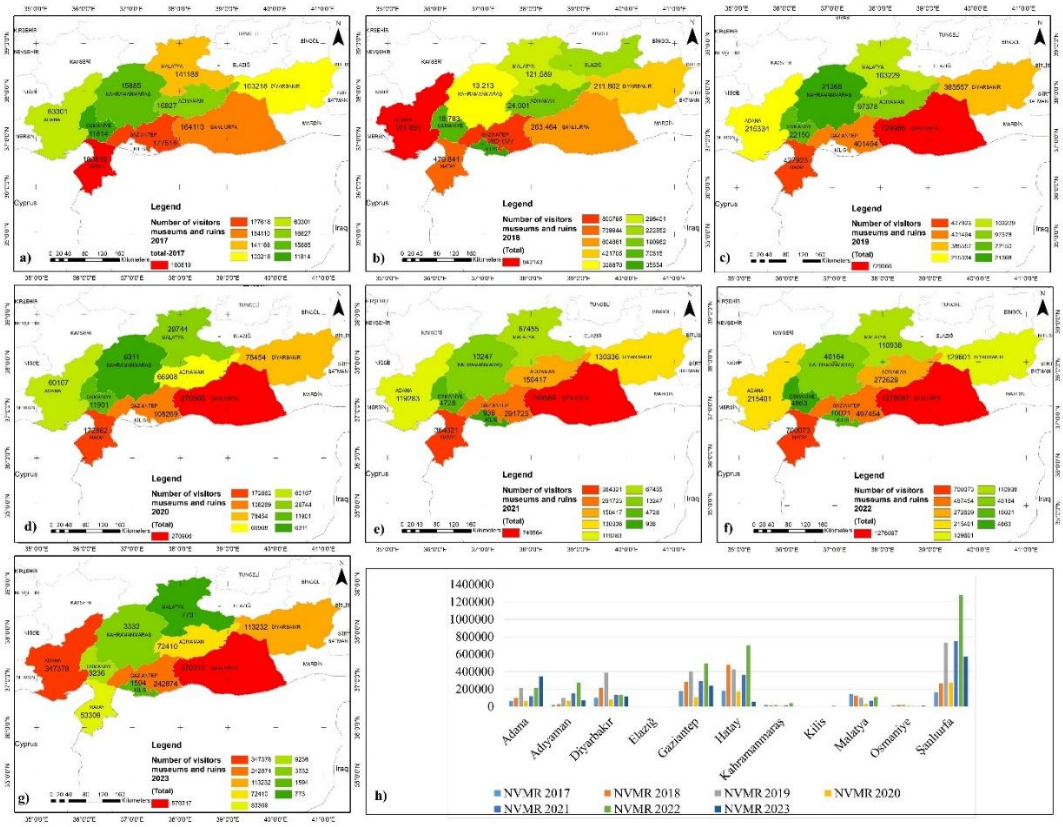


Figure 2. Number of visitors museums and ruins a) 2017 b) 2018 c) 2019 d) 2020 e) 2021 f) 2022 g) 2023 h) Graphical representation (Created by the authors)

The findings of the study indicate that tourism mobility is highly sensitive to crises and experiences sudden and sharp fluctuations due to pandemics and natural disasters. While the 2017-2019 period (Fig. 2a-c) was characterized by a steady growth period in tourism in the region, the year 2020 (Fig. 2d) witnessed a dramatic decline of 60-80% in almost all provinces due to the impact of the pandemic caused by the novel coronavirus, SARS-CoV-2, also known as "covid-19." This occurrence underscores the vulnerability of the tourism sector to global health crises, potentially leading to a sudden halt in its operations. In 2021 and 2022 (Fig. 2e-f), the post-pandemic recovery commenced, with an increase in visitor numbers surpassing 100%, particularly in cities with notable cultural heritage such as Şanlıurfa, Hatay, and Gaziantep. This recovery can be attributed to the resurgence of deferred tourism demand and the effective normalization efforts. However, this positive trend was abruptly reversed by the

seismic events in Kahramanmaraş in 2023 (Fig. 2g). The number of visitors saw a sharp decline, with drops exceeding 90%, particularly in the provinces directly affected by the seismic event, including Hatay, Kahramanmaraş, and Malatya. Malatya witnessed a 99.3% decrease, Kahramanmaraş a 91.7% decline, and Hatay a 92.3% reduction. These figures suggest that tourism in the region has nearly ceased, and a prolonged recovery period will be necessary. In contrast, cities such as Adana and Gaziantep, which experienced comparatively minimal damage, exhibited declines of approximately 50%. Among the cities that experienced the most significant decline in tourism, Şanlıurfa emerged as a notable case study in resilience. Despite the seismic activity, the city successfully hosted 570,000 visitors, a testament to its substantial tourist appeal. However, the 2017-2019 growth period gave way to a sharp decline in 2020. The tourism sector experienced a recovery in 2021 and 2022, but the 2023 earthquakes led to a significant crisis in the sector. In provinces such as Hatay, Malatya, and Kahramanmaraş, tourism activities nearly came to a complete halt, while provinces such as Şanlıurfa and Adana demonstrated faster recovery.

Figure 3 illustrates the number of entries to accommodation facilities in the region, both geographically and over time, from 2017 to 2023. The 2017-2019 period (Fig. 3a-c) reveals a steady growth in the tourism sector. Adana, Gaziantep, Diyarbakır, and Şanlıurfa stand out as the provinces with the highest number of accommodation arrivals during these years. In 2018, the region experienced a marked increase in both the number of tourist arrivals and overnight stays, indicating the successful implementation of regional tourism strategies and the start of a positive trend in the tourism sector. However, the onset of the pandemic in 2020 (Fig. 3d) led to a substantial decline in regional accommodation facilities. Hatay, notably, was among the provinces that endured the most substantial loss in 2020, with a 35% decrease in comparison with the preceding year. Furthermore, Şanlıurfa and Gaziantep experienced a 50% and 38% decline in accommodation arrivals, respectively. The maps provide a clear illustration of the stagnation caused by the pandemic in the tourism sector. However, in 2021 and 2022 (Fig. 3e-f), the tourism sector began to show signs of recovery, particularly in 2021. Diyarbakır emerged as one of the provinces that experienced the most rapid recovery, with an increase of 43% in accommodation arrivals. In 2022, Gaziantep registered a 28% increase in accommodation arrivals. In provinces such as Gaziantep, Adana, and Diyarbakır, the number of accommodation arrivals approached pre-pandemic levels. This recovery is attributed to the lifting of post-pandemic travel restrictions and the revival of touristic activities. However, in 2023 (Fig. 3g), there was a precipitous decline in accommodation arrivals due to the impact of the Kahramanmaraş earthquakes. Malatya, in particular, experienced a 60% decrease in accommodation arrivals, making it one of the provinces most severely impacted. Furthermore, Hatay and Kahramanmaraş experienced a decline in accommodation arrivals exceeding 50%, resulting in a near-total cessation of tourism activity in these provinces. In provinces such as Şanlıurfa and Adana, the decline was more limited, and regional differences in resilience became evident. The line graph in Figure 3h offers a numerical representation of the changes over the years by province. The graph substantiates the pronounced declines and recovery trends observed in 2020 and 2023.

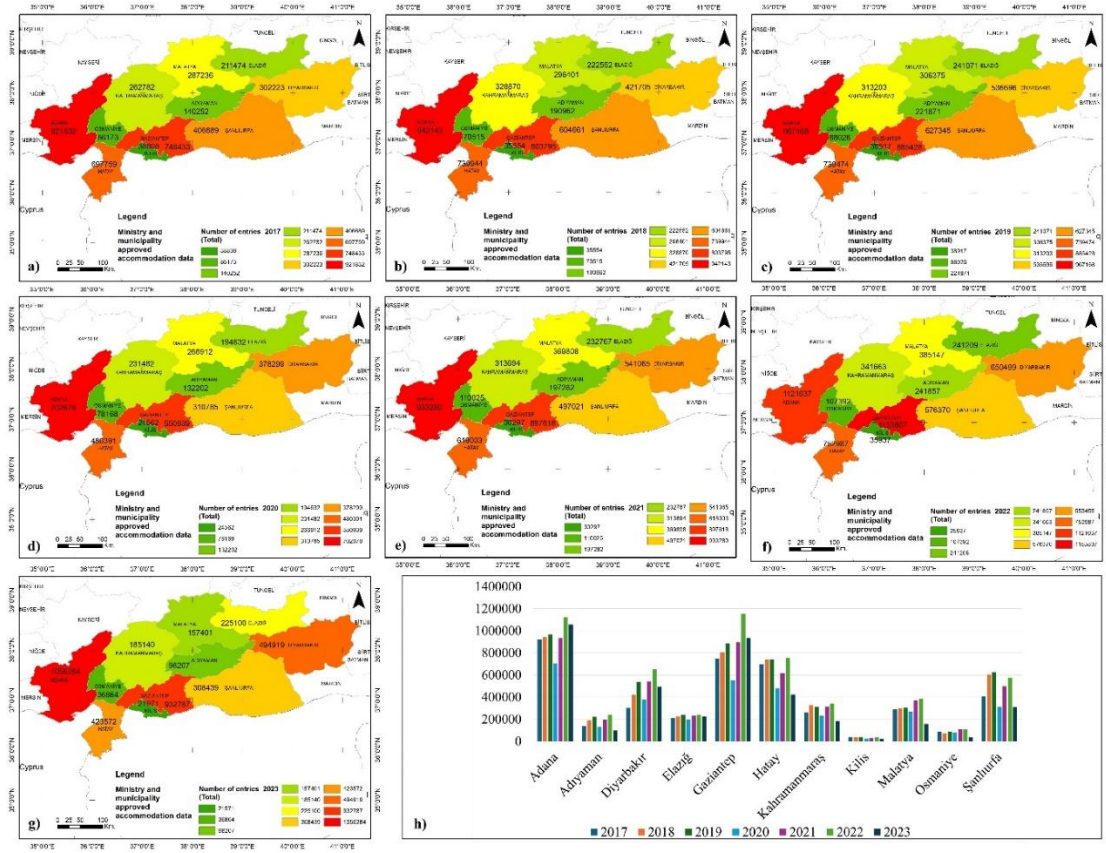


Figure 3. Number of entries to accommodation facilities by province a) 2017 b) 2018 c) 2019 d) 2020 e) 2021 f) 2022 g) 2023 h) graphical representation (Created by the authors)

As illustrated in Figure 4, the number of overnight stays in accommodation facilities between 2017 and 2023 is presented both temporally and spatially. The 2017-2019 period (Fig. 4a-c) reflects a period of steady growth in the tourism sector. In these years, Gaziantep, Adana, Hatay and Şanlıurfa emerged as the provinces with the highest number of overnight stays. The surge in tourism, particularly in 2019, led to a remarkable expansion in the region's accommodation sector, which reached its zenith during this period. The number of hotel check-ins and overnight stays increased across the region, reflecting the impact of tourism diversification and promotional efforts. Adana maintains its dominance in terms of hotel arrivals, functioning as a nexus of economic activity and commercial events. The surge in overnight stays in Gaziantep and Hatay signifies the thriving of cultural and gastronomy tourism in these cities. The year 2020 (Fig. 4d) was significantly impacted by the repercussions of the COVD-19 pandemic. Specifically, there was a 48% decrease in overnight stays in Şanlıurfa, a 36% decrease in Gaziantep, and a 26% decrease in Diyarbakır. This decline can be attributed to the travel restrictions imposed due to the pandemic and the subsequent decline in tourism activities. This decline is regarded as a direct consequence of the aforementioned travel restrictions and the subsequent downturn in tourism activity due to the pandemic. However, in 2021 and 2022 (Fig. 4e-f), the sector began to demonstrate signs of recovery, with overnight stays approaching pre-pandemic levels in numerous provinces. In 2021, Diyarbakır experienced a 40.9% surge in overnight stays, positioning it as one of the most rapidly recovering provinces. Meanwhile, Gaziantep demonstrated a notable recovery, recording an increase of 31.4% in 2022. Destinations with a robust cultural and gastronomic tourism presence experienced a surge in momentum during the recovery process. This rise is directly linked to the activation of deferred tourism demand and post-pandemic normalization processes. However, the year 2023 (Fig. 4g) dealt a second major blow to overnight stays due to the February 6 Kahramanmaraş earthquakes. In Malatya, overnight stays decreased by 57%, the most significant decline among all provinces. Hatay, Kahramanmaraş, and Osmaniye experienced respective declines of 34%, 36%, and 56%. Conversely, provinces such as Adana, Diyarbakır, and Gaziantep exhibited a comparatively modest decline and were able to sustain a degree of tourism activity. The line graph presented in Figure 4h illustrates the numerical changes over the years by province, thereby substantiating the impact of the

crises in 2020 and 2023 and the recovery trends observed in the tourism sector. Generally, overnight stays in accommodation facilities were significantly impacted by the crises, with a subsequent recovery following the pandemic. However, the 2023 Kahramanmaraş earthquakes led to a new interruption in the sector.

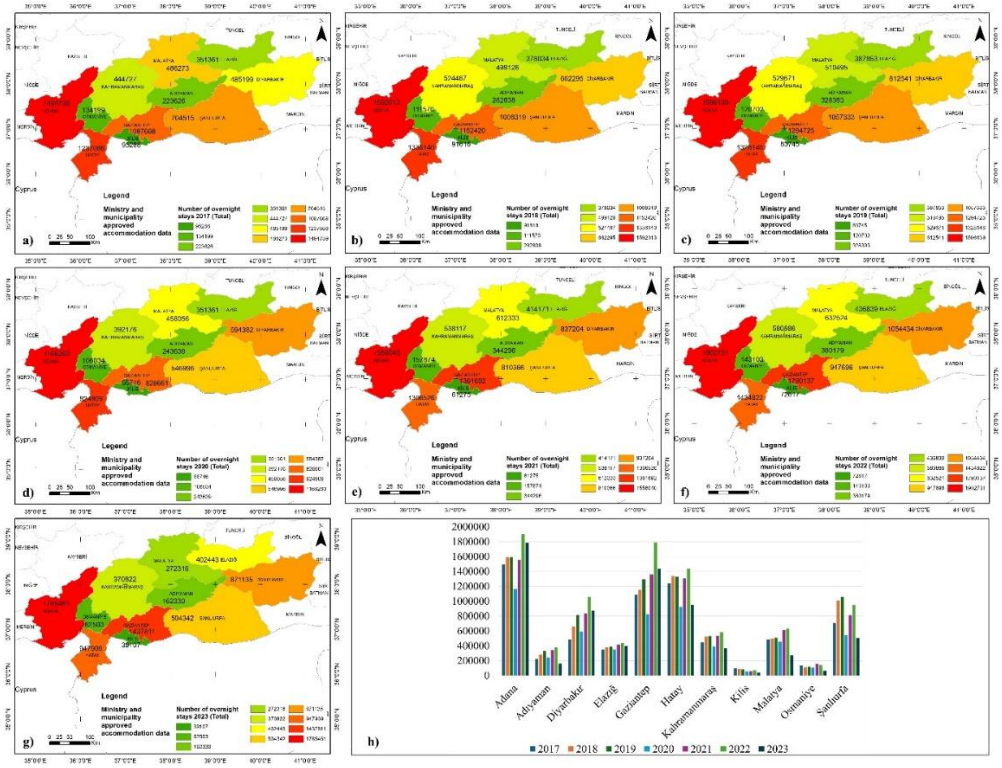


Figure 4. Number of overnight stays in accommodation facilities by province a) 2017 b) 2018 c) 2019 d) 2020 e) 2021 f) 2022 g) 2023 h) graphical representation (Created by the authors)

3.2. Evaluation of the Study Findings within the Framework of Chaos Theory

The findings of the study, when evaluated from the perspective of Chaos Theory, clearly reveal the unpredictable and non-linear nature of crisis processes in the tourism sector. The primary hypothesis of the study suggests that the tourism sector exhibits varying degrees of resilience to both anticipated and unanticipated crises, with these crises giving rise to non-linear fluctuations within the sector. Geological disasters, such as earthquakes, are anticipated and predictable events within a specific region. Conversely, the emergence of the novel Coronavirus (SARS-CoV-2) pandemic materialized as an unforeseen crisis, engendering profound uncertainty on a global scale. These distinct crises have precipitated erratic fluctuations in the tourism sector, underscoring the sector's non-linear response to crises.

The findings of the study indicate that Chaos Theory offers a suitable framework for comprehending the repercussions of crises in the tourism sector. The study's findings indicate that while tourism activity decreased by 40-50% in 2020 due to the pandemic, certain provinces demonstrated a recovery of 30-40% in 2021 and 2022. However, the recovery process exhibited disparities across different regions. Provinces such as Gaziantep and Diyarbakır demonstrated a rapid surge in tourism, while other provinces experienced a more gradual recovery. In the aftermath of the earthquake, tourism activity declined by more than 50% in provinces such as Hatay, Malatya, and Kahramanmaraş, with a more limited decline in provinces such as Adana and Gaziantep. This phenomenon underscores the potential for unexpected outcomes resulting from variations in initial conditions, emphasizing the importance of considering regional and temporal dynamics in tourism analysis.

The "butterfly effect," a foundational principle of Chaos Theory, is a pivotal concept in comprehending the sudden and long-term fluctuations in the tourism sector caused by pandemics and earthquakes. The initial phase of the pandemic, defined by travel restrictions and health concerns, led to an abrupt halt in tourism activities. Consequently, this has precipitated a transformation in the landscape of

domestic tourism, accompanied by the advent of novel trends, such as digitalization. Furthermore, seismic events have had a disruptive effect on tourism activities, given their direct impact on infrastructure and physical spaces. However, in the long term, some destinations have shown signs of recovery, partly due to the implementation of crisis management processes and resilience strategies.

The present study utilizes the framework of Chaos Theory to elucidate the repercussions of crises on the tourism sector. The tourism sector's response to crises has been non-linear, exhibiting fluctuations across regions and over time. However, these crises did not result in complete chaos within the tourism sector. Instead, certain regions demonstrated resilience, and the recovery process began. In this context, it has been demonstrated that crisis management strategies in the tourism sector should be addressed not only with short-term solutions, but also with a long-term and adaptive approach.

4. Conclusion and Suggestions

This study analyzes the resilience of the tourism sector in the face of anticipated and unanticipated crises and reveals how these crises cause non-linear fluctuations in the sector. The findings indicate that two distinct types of crises, the emergence of the novel Coronavirus (SARS-CoV-2) and the seismic events in Kahramanmaraş, Turkey, had substantial and unpredictable ramifications on tourism mobility. The pandemic, a global crisis that was both sudden and unpredictable, led to a sudden recession in the sector. In contrast, the earthquakes caused serious losses on a regional scale, but the recovery processes varied spatially.

In accordance with the principles of Chaos Theory, which posits that while crises are inherently unpredictable, they are nevertheless influenced by specific dynamic processes. In this regard, three primary dynamics have been identified as crucial for comprehending the response of the tourism sector to crises. Firstly, it is imperative to acknowledge the notion that minor alterations in initial conditions can often exert a substantial influence on the final outcomes. For instance, the prompt measures implemented by tourism facilities in the aftermath of a disaster directly influenced the swiftness of the recovery process of destinations. Secondly, the crisis management process exhibits a non-linear structure. The recovery process in the tourism sector has not progressed in the same way in all regions. Some destinations have experienced a rapid recovery, while others have experienced long-term declines. Thirdly, feedback mechanisms within the system have the potential to amplify the impact of crises. For instance, the perception that a destination is not safe has led to a decline in tourism demand, resulting in long-term economic challenges and exacerbating the repercussions of the crisis.

In this context, an analysis of the data reveals a general upward trend in the number of entries and overnight stays in accommodation facilities between 2017 and 2019, followed by a decline in 2020, an uptick in 2021 and 2022, and a subsequent decrease in 2023 following the disaster. Adana, Gaziantep, Hatay, and Şanlıurfa provinces, which are distinguished by their cultural, historical, and gastronomic richness within the disaster-stricken region, emerge as highly preferred destinations compared to other provinces in terms of the number of entries to accommodation facilities and overnight stays. A significant proportion of the visitors to the region's accommodation facilities between 2017 and 2023 were domestic tourists. In 2017, the number of tourists entering the accommodation facilities in the disaster area was 4,103,661, while the total number of overnight stays was 6,744,681. In 2018, the number of visitors to the accommodation facilities in the disaster area increased by 553,441 people compared to the previous year, reaching 4,657,102 people. The total number of domestic and foreign tourist accommodations increased by 894,357 people, reaching 7,639,038 people. In 2019, the number of entries to the facility increased by 308,472 compared to 2018 data and reached 4,965,574 people, while the number of accommodations increased by 410,707 people to 8,049,745. In 2020, the number of people entering the facility during the pandemic period decreased by 1,614,524 people to 3,351,050 compared to 2019 data, while the number of people staying decreased by 2,383,525 people to 5,666,220. In 2021, the number of visitors to 4,740,860 facilities increased by 867,045 people, reaching 5,607,905 in 2022. In 2022, the total number of domestic and foreign tourists who made accommodation, which was 7,999,894 people in 2021, increased by 1,376,274 people and reached 9,376,168 people. However, in the year of the February 6, 2023 earthquake, the number of visitors to tourism facilities decreased by 1,667,221 people to 3,940,684 people, and the number of domestic and

foreign tourists staying decreased by 2,519,989 people to 6,856,179 people. However, it is crucial to contextualize these figures within the broader context of the post-disaster period, during which tourism facilities also provided accommodation to earthquake victims whose homes were destroyed and to those engaged in the reconstruction process. This suggests that the actual number of visitors and tourists may have been even lower when evaluated based on conventional tourism metrics.

A key finding of the study is that the tourism sector's response to crises is non-linear and characterized by temporal and spatial fluctuations. The impact of the pandemic was evident in a precipitous decline of 40-50% in the number of accommodation and overnight stays in 2020. However, in 2021 and 2022, provinces such as Gaziantep and Diyarbakır demonstrated a 30-40% recovery. Conversely, following the 2023 Kahramanmaraş earthquakes, Hatay, Malatya, and Kahramanmaraş experienced a tourism activity decline exceeding 50%. In contrast, a comparatively modest decline was observed in provinces such as Adana and Gaziantep. The primary hypothesis of this study is predicated on the assumption that the tourism sector manifests disparate levels of resilience to both anticipated and unanticipated crises, with such crises engendering non-linear fluctuations in the sector. The findings of this study largely support this hypothesis. The emergence of the novel coronavirus (SARS-CoV-2) pandemic and the subsequent seismic events in Kahramanmaraş triggered abrupt and unanticipated shifts in tourism mobility patterns. However, the recovery processes exhibited notable variations, contingent on the nature of the crisis and regional characteristics. The pandemic, acting as an unexpected crisis on a global scale, precipitated acute fluctuations in the sector. In contrast, the earthquake, despite its greater predictability, engendered protracted losses in tourism due to the magnitude of regional destruction. It has been observed that crises do not invariably lead to a state of complete chaos within the tourism sector; rather, they give rise to unpredictable fluctuations.

The findings indicate that Chaos Theory offers a robust framework for comprehending the repercussions of crises in the tourism sector. The notion of the butterfly effect is instrumental in explaining the manner in which pandemics and earthquakes give rise to unanticipated long-term ramifications for tourism. The initial phase of the pandemic was marked by a precipitous decline in tourism due to the implementation of travel restrictions and health concerns. Consequently, this crisis gave rise to novel trends, such as a resurgence in domestic tourism and the adoption of digital technologies. Conversely, the direct impact of earthquakes on infrastructure and physical spaces led to a cessation in tourism. Nonetheless, certain provinces demonstrated a more rapid recovery, linked to the efficacy of crisis management strategies and the inherent regional resilience differences.

However, the study is not without its limitations. Primarily, the external validity of the results is constrained by the analysis' focus on a particular region. Additionally, the data is derived from available official statistics, and factors such as informal activities in the tourism sector and alternative forms of accommodation (house rentals, short-term accommodation) are not taken into account. Nevertheless, these limitations do not significantly compromise the study's findings.

The results obtained within the framework of Chaos Theory emphasize the importance of the principles of flexibility and adaptability in determining crisis management and resilience strategies in the tourism sector. It is imperative that measures undertaken in response to crises are meticulously designed to not only ameliorate the present situation, but also to fortify the system against the looming uncertainties of the future. In this context, spatial planning, post-crisis strategic communication, and sustainable tourism policies play a critical role in enhancing resilience in the sector. To mitigate the long-term ramifications of disasters and pandemics on tourism, proactive policies must be implemented to enhance the resilience of tourism destinations to crises. Furthermore, the establishment of a systematic crisis management model within the tourism sector is imperative.

Acknowledgements and Information Note

The article complies with national and international research and publication ethics. Ethics committee approval was not required for the study.

Author Contribution and Conflict of Interest Declaration Information

All authors contributed equally to the article. There is no conflict of interest.

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