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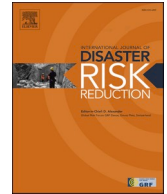
Rebuilding Antakya: Cultivating urban resilience through cultural identity and education for post-disaster reconstruction in Turkey

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A R T I C L E   I N F O

A B S T R A C T

On February 6th, 2023, 11 cities around the southeast of Turkey were hit by a major earthquake with magnitude of 7.9 and 7.6, which resulted in mass destruction and loss of lives in many cities. Antakya, Hatay was one of those cities that lost more than 50 % of the built environment and a death toll of over 50,000. Previously known for its profound historical lineage, rich and diverse cultural heritage, and deep-rooted connection to its cultural identity, Antakya's reconstruction process holds a critical case not only for Turkey but also for the global discourse on urban resilience and post-disaster recovery strategies. Thus, in this study, we deep dive into an ongoing recovery process in Antakya, Turkey. The study's primary objective is to identify the key factors, constraints, opportunities, and challenges involved in reconstructing a city that can withstand future earthquakes. The data used in the study was gathered during fieldwork that was carried out in Hatay, Turkey, in June 2023. The methodology consists of total of 16 focus groups and in-depth interviews with stakeholders, including representatives of professional associations, local government agencies, and public institutions. Our results showed that re-opening educational services plays a crucial role in promoting recovery in Antakya. Furthermore, we examined the complex interplay between cultural ties to place, and urban resilience in the context of disaster recovery. We found that in Antakya, cultural identify may play a crucial role and would have a direct influence on its recovery. These findings hold significance for policymakers, urban planners, and disaster management professionals who must navigate the challenging terrain of post-disaster reconstruction while considering the cultural and emotional ties that bind residents to their cities. Ultimately, this research provides valuable insights into the intricacies of urban recovery and reconstruction processes and contributes to the growing body of knowledge on urban resilience and disaster recovery.

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1. Introduction

On February 6, 2023, earthquakes struck Kahramanmaraş, followed by another devastating earthquake centered in Hatay on February 20, 2023. These seismic events had a significant impact, affecting 11 provinces throughout Turkey and resulting in massive loss of life and property. The earthquakes had a devastating impact on a vast number of people. Approximately 16 million individuals were affected by this tragic disaster, with 9.1 million directly impacted [1]. Among the afflicted regions, Antakya, the central city of Hatay Province, experienced the strongest hit. In addition to the tragic loss of lives and the detrimental impact on properties, Antakya's multicultural fabric and tangible cultural heritage suffered damages to structures that had stood still for centuries. This includes monuments representing different civilizations and ethnicities. This earthquake has left a mark on this vibrant city which has thrived for centuries, affecting its residents and physical structures, and jeopardizing the tangible links to its historical and cultural heritage.

1.1. Impact of the earthquake in Antakya

The heart of the city, including the administrative and commercial functions, municipal buildings, the infamous Uzun Çarşı, and the small businesses that thrived along its streets, became unusable, bringing the city's daily life to a stop (See Appendix A Figure A.1). According to initial evaluations in Antakya, a region severely affected by an earthquake, approximately 50 % of buildings have been classified as requiring immediate demolition, while those that were collapsed or heavily damaged have yet to undergo risk assessments to determine the extent of their earthquake resilience.

As of June 2023, the demolition of severely damaged structures in and around the city center was still ongoing (see Appendix A Figure A.2), with debris clearance efforts persisting in nearly every neighborhood. This situation gives rise to new infrastructure challenges. The proximity of rubble disposal sites to residential areas has resulted in significant health concerns stemming from asbestos exposure and environmental problems caused by improper site selection.

Mass Housing Administration of government is building permanent housing units (known as TOKI) on the outskirts of urban areas in order to meet housing demands. Individuals seeking a long-term housing solution proactively addressed the issue by building prefabricated housing units on their property. The government has been constructing TOKI housing units on the urban peripheries to meet the housing needs. Despite time constraints and urgency of meeting housing demand, there is a need for a roadmap to ensure the healthy execution of recovery efforts [2] by local authorities. Furthermore, the declaration of the area surrounding the city center and culturally significant structures under Law No. 6306 [3] on the Transformation of Areas at Risk of Disasters has sparked apprehensions. Concerns have emerged among the local population and relevant institutions and organizations about the potential loss of the city center and its cultural heritage buildings. This has raised concerns regarding the gradual erosion of Antakya's unique identity, as it is recognized among the local community for its distinctive cultural fabric.

This paper explores the complexities surrounding the reconstruction and recovery process in Antakya, examining the interplay of cultural identity, post-disaster recovery, and resilience of a city deeply rooted in its historical and cultural heritage. The main research question we focus on is, "*What are the key factors, constraints, challenges, and opportunities influencing the reconstruction and recovery of Antakya, Turkey, in the aftermath of a major seismic disaster?*". To answer this question, we applied semi-structured interviews with the various local stakeholders in June 2023 during a site visit. We analyzed these interviews with a grounded theory approach to identify and code themes in texts. Using the identified factors, we present a recovery scenario and reveal the emergent constraints and interdependencies derived from the interviews.

2. Background

We first present the background literature, including disaster management processes in Turkey and the means of "recovery," encompassing its components and factors affecting the recovery process. The background information is helping to understand the rebuilding process in general to provide a benchmark for the Antakya case as well.

2.1. Resilience and recovery after major disasters

Resilience has emerged in response to the limitations of conventional risk management, which often fails to address extreme and unforeseen disasters. These disruptions can trigger cascading effects, or perfect storms, particularly given the increasing interdependencies between critical infrastructures, climate change, and natural disasters in our future. Therefore, there is a compelling need to address the complexity of the past and transform our strategic spatial plans to prioritize resilience explicitly [4]. Resilience has been defined many times in the literature, Meerow et al. [5] described urban resilience as *the capacity of an urban system including all of its social ecological and technological dimensions to sustain or swiftly recover (or transform) its essential functions when faced with disruptions.*

Some have also argued [6] that the vagueness around the concept of resilience, specifically in policy documents or visions, hinders pinpointing specific measuring techniques for resilience. Various domains, such as engineering, urban, and social studies, employ distinct approaches when assessing resilience. For example, a seminal paper by Bruneau et al. [7] in resilience engineering highlights that resilience comprises multiple dimensions, such as robustness (e.g., Warnier et al. [8]), redundancy, resourcefulness, and rapidity. Examples of these dimensions explored in Refs. [8–12]).

Social scientists view resilience through the lens of equity, fairness, and equal access to resources, striving to avoid privileging one group, sector, or institution over another. Copeland et al. [13] argue that social resilience is a normative concept and to formulate and measure social resilience, indicators are used as a basic measuring system to evaluate the social resilience. Similarly, Cutter [6]

proposed core indicators including twenty variables to assess the ability of individuals, stakeholders, or communities' response dynamics to changes. More resilience assessment methods and frameworks are reviewed for critical infrastructure [14], urban, social resilience [15], and community resilience [16]. A shared understanding is that resilience should be transformative, shifting the emphasis toward "building back better" [17] and pushing forward rather than merely returning to the initial state [13].

We argue that large-scale destructive disasters, such as the case in Antakya, present a unique "opportunity" to rebuild cities and bounce back even stronger. While these events are devastating and result in unfortunate casualties, they should serve as valuable lessons to avoid repeating past vulnerabilities [18]. In essence, they should be viewed as opportunities for innovation, as explored in transition science, where chaotic events can act as signals or drivers for transformative change [19–21]. Therefore, the large-scale resilience principles should be applied during the recovery phase of disasters so as not to repeat the vulnerabilities. This entails addressing the immediate post-disaster challenges and striving for long-term resilience to ensure communities and built environments can withstand future shocks and stresses.

2.2. Disaster management in Turkey

Turkey, a country prone to natural disasters, has faced numerous challenges, with earthquakes causing the highest number of casualties and property damage. To address these vulnerabilities, Turkey initiated the Ministry of Environment and Urbanization (MoeUCC) in 1983, followed by establishing the Mass Housing Administration in 1984 to provide urbanization and housing solutions (i.e., TOKI). Turkey further improved its disaster management capabilities by establishing the Disaster and Emergency Management Presidency of Turkey (AFAD) in 2009. The National Earthquake Strategy and Action Plan of Turkey (2012–2023) [22] aimed to reduce earthquake-related losses by 2023, making the country earthquake-resistant and resilient. Other laws and regulations, including the Turkish Building Earthquake Codes, have been introduced to enhance safety. Although formal disaster management history in Turkey reflects its commitment to reducing vulnerability and enhancing resilience, the Kahramanmaraş earthquake proved that the post-disaster management strategies fell short, and the correct implementation and follow-up on the codes and regulations are vulnerable to political and profit-oriented pressures.

2.3. Factors that are influencing recovery

Traditional disaster management involves four primary phases: mitigation, preparedness, response, and recovery. Smith et al. [23] define disaster recovery as the process of rebuilding, restoring, and reshaping the natural, social, and economic surroundings using a variety of post-disaster approaches. Disaster recovery and the restoration phase entail not only the repair of physically damaged structures such as housing, infrastructure, and commercial buildings but also addressing the psychological well-being of individuals and the community.

Returning to normalcy is one of the crucial features. Despite the growing body of experience in post-disaster reconstruction, the recovery phase continues to grapple with issues of inefficiency and inadequate oversight [18]. In fact, among the four phases of disaster management, the recovery phase is the least understood phase of all [24]. Historically, post-disaster rehabilitation primarily concentrated on repairing the physical damage caused by the disaster. However, the recovery process presents greater complexity and challenges, given the interdependence of dynamic tasks. For example, achieving local economic recovery is contingent on the concurrent restoration of networks, housing, and public services ([25,26]). Furthermore, the tendency to rebuild the physical environment and infrastructure exactly as they were prior to the disaster often perpetuates the same vulnerabilities that existed before, as pointed out by academics [18,27,28]. Further, the recovery phase of disasters might lead to substantiating the pre-existing inequalities [25]. We identified several recovery features from the literature that were considered for disaster management.

Timeline is one of the critical features. After disasters, in the short term, the primary aim is to restore the community to its pre-disaster state, while in the long term, the emphasis shifts towards enhancing community resilience, reducing vulnerability, and improving the ability to cope with future disasters [25]. The objective of short-term rehabilitation efforts should be speeding up individuals regaining secure **housing** and a stable **income** source. Providing continuous assistance, guidance, and information to communities during this "transitional" phase is crucial to alleviate the stress and uncertainty experienced by residents. To achieve long-term strategic planning, comprehensive policies spanning multiple years and including multi-sectoral strategies need to be established [29].

A further important recovery feature involves the **physical, economic, and community** aspects. The reconstruction of neighborhoods and communities is crucial in achieving social psychological restoration. This involves reinstating a sense of place, rebuilding community pride, and revitalizing the local economy. Measures may include reconstructing community landmarks, places of worship, and public spaces dedicated to those affected by the disaster. Strategies may include promoting new economic investments and mitigating the economic impact on tourism. Additionally, restoring natural systems involves repairing environmental damage, particularly the repercussions of structures located in environmentally sensitive areas. In essence, rebuilding focuses on the physical reconstruction of the built environment, encompassing infrastructure, homes, businesses, and community assets [30].

Aside from the physical and economic features, **critical services** such as the availability of **education** and **healthcare** services are important factors that influence recovery. Fontana [31] emphasized the importance of the education sector during the post-disaster recovery phase and investigated the factors to reduce the impact of disasters on the school system in Italy. They identified indicators to test schools' resilience against disasters; however, their work mostly remained on the physical recovery and functionality of schools rather than the benefit of education as a service during disasters. Long school closures and educational disruptions due to disasters deprive millions of their right to education, jeopardizing their future. Promoting seismic resilience in schools is crucial for

children's safety, educational continuity, and effective community recovery post-earthquake [32]. Overall, the literature that focus on the service-level benefits of education for disaster survivors are quite rare. Similar to education as a service, availability, and access to healthcare as a service can facilitate the recovery process and ensure that communities return to normalcy swiftly [33].

Another factor that influences the recovery is the community's **adaptive capacity** and ability to foster a **culture of prevention.** In Japan, this concept is known as "Bosai Bunka," which emphasizes the crucial role that culture plays in achieving a resilient society. According to Pastrana-Huguet et al. [34], frequent exposure to hazards can influence the development of a culture of prevention. Torrence and Grattan [35] further discuss that understanding how societies respond to disasters can help us comprehend the evolution and history of a country. Large-scale disasters undeniably impact any culture for years to come. In some countries, like Japan, preserving the collective **cultural memory** of disasters is prioritized and significantly influences disaster governance [34]. This, however, is not necessarily the case in all countries. Whether or not large disruptions lead to beneficial practices, intangible cultural elements play a crucial role in community resilience. They provide a sense of belonging, identity, and promote social cohesion [36].

The dynamics of recovery are closely linked to the **availability of resources**. When the resources are not available especially to improve the extent of damage to land and the conditions of residential housing, this can impede recovery efforts, affecting the long-term demographic and economic landscape. Love [37] highlighted that residents typically tend to return to their homes within six months. However, when this return does not happen within a two-year timeframe, it often signifies permanent migration, especially when resources for recovery are insufficient. These disruptions can lead to population redistribution and change the social structure [38]. In this context, land plays a pivotal role in residential stability, local economies, and community security [39].

Strong **social networks** are essential for effective disaster response and recovery. Studies by Refs. [40–42] have highlighted that communities with strong social networks recovery more effectively. The management of disaster recovery plays a critical role in either fostering social cohesion or perpetuating divisions within the affected communities. Maintaining social connections and trust is critical for rebuilding community resilience.

Overall, long term recovery necessitates careful planning and effective communication. Rushing to implement policies can have long term ramifications that are challenging to reverse and may amplify human vulnerability in the long run [29]. The process of reducing vulnerability demands a comprehensive approach of the intricate interplay between physical, environmental, and social elements that contribute to it, as emphasized by Refs. [29,43]. For this, achieving the ideal of "building back better" and drawing lessons from past experiences in disaster recovery presents a significant challenge. Understanding the complexities of post-disaster recovery, along with the key factors for ensuring its sustainability, is a formidable task. This process involves multiple dimensions, including the physical, environmental, social, psychological, and demographic aspects, each progressing at varying rates and interplaying in ways that can either facilitate or hinder progress [18].

3. Method of the study

The research adopts a qualitative approach, obtaining data directly from participants via semi-structured interviews without preconceived notions (see Fig. 1). Key stakeholder interviews and focus group discussions enhance our understanding of Antakya's recovery process, complementing quantitative outcomes. Purposive sampling ensures maximum diversity in participant selection, with four focused focus group discussions conducted to conclude data collection and comprehend the procedure.

3.1. Case study

Antakya is the central city of Hatay and is located in the south of Turkey, bordering Syria, with a population of 393634 in 2022 [44] (see Fig. 2). Antakya has been developed around the Orontes River (i.e., Asi River) and is known for its rich and ancient heritage. According to Donmez [45] Antakya, called Antioch, was historically founded in 300 BC by the Seleucid Empire. The city became quite
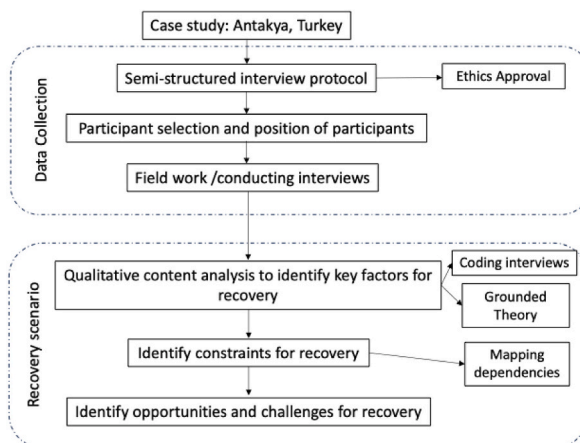

Fig. 1. Methodology of the study.

Fig. 2. Historic center of Antakya and its location within Turkey.

prominent when the Hellenistic period ended in 64 BC, especially in Roman times. The city was the capital of Syria and the third greatest city of the Roman Empire, after Rome and Alexandria. The city developed throughout the Byzantine period, which began in 395. With 638, the city fell into Arab decline. Byzantine siege of Antioch in 968–969 recovered the city. From 1085 to 1098, the city was under the Seljuk Empire, then the Crusaders, and finally the Memluks from 1268 to 1516. Although the city tried to regain its status by becoming a silk producer in the Crusader period, its importance and function weakened over time. Christianity gave way to Islam in the city.

Table 1
List of interviewed people and institutions.

Institution	Profession	Gender
Hatay Bar Association	Lawyer	Woman
Hatay Provincial Directorate of National Education	Provincial director	Man
Hatay Provincial Directorate of National Education	Teacher	Woman
Hatay Chamber of Commerce	Minister	Man
Bar Association	Lawyer	Man
Hatay Mustafa Kemal University	Vice-Chancellor	Man
Hatay Mustafa Kemal University	Rector	Man
Hatay Mustafa Kemal University	Professor	Woman (online)
Hatay Metropolitan Municipality	Mayor	Man
Hatay Directorate of National Education	School Principal	Man
Hatay AFAD	Topographical engineer	Man (not recorded)
DASK[a]	General manager	Man (online)
Focus group discussions		
Presidents of Hatay Professional Chambers	• Chamber of Civil Engineers Hatay Branch Chairman of the Board •Hatay Chamber of City Planners Provincial Representative •Chamber of Architects Hatay Branch President •Hatay Provincial Representative of the Chamber of Mechanical Engineers •Geophysical Engineers Hatay Provincial Representative	5 Men
Sports Facilities-Tent City	The group consists of representatives of the Ministry of National Education, AFAD, Ministry of Family, psychologists, and volunteers	6 people (4 men, 2 women)
Konya Second Stage-Container City	A group consisting of representatives of the Ministry of National Education, AFAD, the Ministry of Family, psychologists, and security officers.	6 people (5 men, 1 woman)
Pazaryeri Tent City	With women living in tents, they created the place on their initiative	6 women

[a] Natural Disaster Insurance Institution, also known as Turkish Catastrophe Insurance Pool.

During the Ottoman Empire (1516–1919), the city was shaped by its proximity to the hajj route, which transformed it. The city had a short French Mandate period after the First World War. Then, it became Hatay State's capital after independence in 1938 and joined the Republic of Turkey in 1939. With the first church in the world and the first mosque in Anatolia, Antakya is a city where the term 'Christian' originated and was first used to describe the religious community of believers, and the religion of Christianity emerged [45]. In 1963, the Pope selected Antakya as a pilgrimage destination. Antakya's rich historical and cultural heritage has fostered a harmonious coexistence of religious beliefs such as Christianity, Islam, and Judaism. Antakya is where Turkish, Arabic, Armenian, and other ethnic groups come together, resulting in a vibrant and varied cultural blend.

Because of its unique characteristics and the significant physical damage after the Kahramanmaraş earthquake, Antakya was selected for a closer examination of the reorganization's participants and potential benefits. It has a long history and a rich and diverse cultural past. In the recovery process, community cohesion, identity, and solidarity are crucial attributes of Antakya, representing prized possessions that underpin life and a sense of belonging. In addition, the district suffered the most significant effects from the earthquakes that occurred on February 6, 2023. Following the earthquake, numerous residents of Antakya were compelled to evacuate their homes as approximately 50 % of the city's building stock was destroyed [46].

Addressing how the recovery should unfold in Antakya is a matter that necessitates an understanding of complexities attributed to recovery and rehabilitation process. To initiate a recovery process, all stakeholders must share a common knowledge of what transpired and what is expected to occur throughout the recovery phase.

3.2. Data collection

A major part of the data collection revolved around conducting semi-structured interviews (Fig. 1), focus group discussions, field notes, and participant observation that took place in June 2023 approximately 5 months after the first earthquake. An interview form was created so that the interviews would follow a specific format (Appendix B). A general question regarding the participants' experiences of the earthquake they had attended was asked at the start of each interview. Inquiries were made based on each participant's reconstruction of their post-disaster life, including how they perceived the rebuilding process, the services they needed, the obstacles to receiving those services, the function of social networks, and the structure of disaster recovery.

We obtained privileged access to key stakeholders in the recovery process and conducted 16 in-depth interviews with diverse respondents from various roles and backgrounds (refer to Table 1 for interviewee details). Participants included state actors, private sector businesses, legal and institutional frameworks, academia, professional chambers, and non-governmental organizations. One of the researchers' affiliations as an associate professor in the geography department of Hatay Mustafa Kemal University facilitated connections with local people, streamlining the interview process. Interviews focused on units with potential roles in Antakya's restructuring. Note that before conducting a full set of in-person interviews, we tested our interview protocol by conducting an online interview with a professor in Hatay Mustafa Kemal University. This helped us refine our interview protocol and remove any biases that it might have. We only transcribed the in-person and recorded meetings during the site visitation at Hatay to derive insights about the recovery scenario.

The Ministry of Interior Disaster and Emergency Management Presidency (AFAD) of Hatay allowed official visits to the tent city and container city, with focus group meetings held in both areas involving teams responsible for daily sustainability. Additionally, women living in tents in the marketplace initiated a focus group meeting. We held two focus group sessions with eleven local survivors. The third and fourth sessions included presidents from Hatay Professional Chambers and representatives from tent and container living spaces. The research team documented Antakya's city center through pictures and conducted continuous observations for eight days.

3.3. Recovery scenario

3.3.1. Qualitative content analysis and coding to identify key factors for recovery

To uncover emerging themes from the semi-structured interviews, we utilized qualitative content analysis, employing Grounded Theory as our research approach. Grounded Theory, first proposed by Glaser and Strauss in 1967 [47], is a systematic, data-driven approach designed to identify and define critical categories and their interconnections [48]. This method emphasizes bottom-up data collection and analysis to develop theories grounded in empirical evidence. Over time, it has evolved into constructivist grounded theory, which integrates interpretive and contextual elements [49].

A key advantage of grounded theory is its structured yet flexible approach to conceptualizing data [50]. It fosters creativity and inductive discovery by allowing researchers to derive insights directly from data [51]. This is particularly valuable in complex contexts, such as disaster recovery, where understanding lived experiences is essential [52]. Constructivist approaches encourage researchers to engage deeply with their study environments, leading to integrated theoretical concepts that reflect real-world complexities [49]. By emphasizing **processual relationships**, grounded theory helps researchers understand how interpretations are shaped by prior experiences, research contexts, and interactions with participants [49]. This adaptability and commitment to inductive discovery make grounded theory a robust method for generating meaningful, context-specific insights [51].

Another advantage of grounded theory over quantitative methods, such as structured surveys, by allowing researchers to uncover context-specific insights and emergent patterns directly from the data. This qualitative approach is particularly effective in complex, evolving situations like disaster recovery, where understanding human behavior, cultural memory, and social dynamics is crucial. Unlike more rigid, quantitative approaches, grounded theory captures the lived experiences of individuals and communities, providing a holistic perspective that enhances recovery research.

Grounded theory has been used in many disaster resilience studies to understand the underlying processes behind building resilient

socio technical systems. Arosio et al. [53] applied grounded theory approach to explore flood risk assessment dynamics in the Po River District, Italy. Using this approach, they identified flood risk assessment process framework which serves as a tool for decision makers and stakeholders to accomplish **critical** evaluation in their Flood Risk Assessment practices. Lak et al. [54] uses grounded theory to evaluate the impact of sand and dust storms on health of the communities, and how those storms might result in declining interaction and mobility among communities. Their findings showed that the social interactions play a **significant** role in the locals' daily lives and that dust storms disrupts these interactions leading to loss of social capital. Lynch et al. [55] studied disaster risk perception in the aftermath of Hurricane Sandy. They used grounded theory which revealed the **critical** factors such as importance of historical social, environmental, and cultural factors in shaping risk perception and guiding recovery efforts. Tsubouchi et al. [56] investigated long-term relocation in the Koizumi district, Japan, showing that relocation efforts evolved from community-driven processes to ones driven by project needs. These examples illustrate the **adaptability** of grounded theory in capturing complex, context-specific recovery dynamics. These studies demonstrate how grounded theory can uncover **critical and significant** social impacts and decision-making processes during disasters.

In this study, qualitative content analysis, employing Grounded Theory is used. The unit of analysis consists of the individual conducted with participants and focus group interviews. Initially, relying on field notes and initial impressions from interviews, we identified key factors deemed influential in the recovery process and crucial for consideration within a recovery scenario. Field notes that were taken during the interviews were subsequently compared and discussed among the co-authors after each interview to ensure objective conclusions.

In contrast to standard qualitative analysis, which often results in an interpretive view of events, grounded theory analysis involves searching for the concepts underlying the data by identifying codes, ideas, and categories. For this, verbatim transcriptions of recorded interviews were made. The transcribed text was then read multiple times for familiarization before coding. Codes and categories were extracted using open coding through an inductive process involving the line-by-line reading of the text and assigning pertinent codes (see Table 2). Concepts were identified following the completion of coding and verification of coding accuracy. Direct quotes from the viewpoints of the participants were included to corroborate the findings of the content analysis. Then, we applied thematic analysis to the qualitative data in this study [57]. This approach entails searching across the dataset to identify, analyze, and report repeated patterns [58] which is then also used for the identification of constraints for recovery and dependency mapping.

3.3.2. Identification of constraints for recovery and dependency mapping

In this phase, we systematically pinpointed the important factors and constraints essential to the recovery process in our case study. We developed an overall dependency mapping based on information from interviews and thematic analysis. Building on the thematic analysis, we identified repeated patterns that led us to establish three key themes (see Table 2 and i.e., Factors leading to catastrophic

Table 2
Illustrates select themes, sub-themes, and codes in this paper.

Theme	Sub-theme	Code
Factors leading to catastrophic results	Infrastructure	Planning
		Construction and urbanization
		Transportation
		Housing
	Politics and Local governance	Central government
		Political and local favoritism
		Budget distribution
	Lay people and NGOs	Precautions
Immediate effects of the earthquake	Infrastructure	All systems down
	Politics, Local governance	Recovery
		Uncertainty
	Lay people and NGOs	Chaos
		Uncertainty
	Migration/population mobility	Population mobility
Post-earthquake conditions	Fear	City identity
		Population mobility
	Uncertainty	Property
		Living place
		Basic services/infrastructure
	What needs to be done?	Permanent housing
		Labor market
		Reverse migration
		Basic services/infrastructure
		Transparent planning
Opportunities and challenges for recovery	Opportunities	Homeland/hometown
		Being from Antakya
	Challenges	Uncertainty
		To be forgotten
		Less aid
		Demography
		Property

results, immediate effects of the earthquake, and post-earthquake conditions) to derive key factors essential for the recovery process. These themes allowed us to consider the various aspects of the disaster and its aftermath to identify and map important elements necessary for effective recovery.

However, the relevance and contribution of these factors to the recovery process vary significantly. Through our interviews, it became clear that some factors are critical for recovery progression, while others pertain to softer constraints. This understanding led us to develop different levels of constraints for each factor. By doing so, the identified factors were matched with the constraints enabling us to develop a detailed recovery scenario and dependency mapping. Each factor underwent further elaboration (i.e., sub-factors), and the following constraints were identified:

(1) **"Needs to be Satisfied":** This category identifies the factors and sub-factors that stakeholders consider essential for Antakya to become a livable space.
(2) **"Needs to be Completed":** This category consists of factors that need to be prioritized and sub-factors that should be completed first to advance the recovery process. The implication here is that there is a step-by-step process where the initiation of a recovery action is contingent upon completing another task. For instance, clearing debris is a crucial step that must be taken before starting housing construction.
(3) **"Depends On":** This category explores aspects related to the availability of resources and the resolution of specific factors and sub-factors to ensure successful recovery. For instance, the achievement of housing construction hinges on the efficient establishment of financial support and credit mechanisms.

The distinction between these categories lies in their nature. The category "needs to be complete" imposes a sequential restriction, ensuring that specific tasks must be completed before others commence. In contrast, the category "depends on" highlights dependencies, indicating that accomplishing the recovery's phases rely on the success of a particular constraint or available resources.

3.3.3. Identification of opportunities and challenges for recovery

After identifying key factors, a thematic analysis of dependencies among the constraints was conducted to uncover the challenges and opportunities. Our dependency mapping involved examining the interplay between identified factors and constraints, analyzing how they influence with each other which is essentially contributed identification of potential opportunities and challenges.

During this final stage of our methodology, through rigorous peer discussions among co-authors and revisiting the relevant quotes from the interviews, we synthesized all the relevant factors and constraints necessary for the recovery processes, into the potential opportunities and challenges that may arise during the recovery of Antakya. While some of these factors, represented in the quotations, came to light through meticulous thematic analysis of connections and restrictions that might not be immediately apparent, especially from the viewpoint of stakeholders, others emerged from the data collection process.

4. Results

The presented methodology (Fig. 1) unpacked important factors, constraints, and dependencies of recovery in Antakya by utilizing coded and transcribed data from the field trip in June 2023. During the initial phase of gathering insights and investigating memos, a clear trend emerged: the participants emphasized the value of education. The parents were highly invested in their children's education, primarily due to the challenges posed by the prolonged COVID lockdowns. Likewise, participants from both higher education and primary/secondary education sectors highlighted and elaborated on the strategies for restoring education promptly to enable a "return to normalcy" and counteract migration. This educational matter became a significant factor influencing people's decisions to leave. In Appendix C, Figure C.1, we include the number of times the terms education, and school were mentioned and how many participants mentioned them together charts that illustrate the frequency of the terms "education" and "school" mentioned by all participants during our interviews. Approximately 69 % of the participants mentioned the term 'education' during our interviews, while the term 'school' was mentioned over 200 times which illustrates the prominence and significance of education for the recovery.

Acknowledging this, we have identified the following crucial factors for recovery: **infrastructure**, **governance**, **residential housing, economy**, and **education**. We chose these factors for (1) they were mentioned as factors effecting recovery process in the literature (See Section 2.b), (2) they were repeatedly mentioned by the interviewees. In the upcoming sections, we delve into these factors extensively, uncovering the various sub-factors and constraints crucial in the recovery process.

4.1. Key factors, constraints, and dependency mapping for recovery

4.1.1. Infrastructure

Through the interviews, it became evident that the lack of structured urban planning and implementation, incomplete administrative processes during the transition to metropolitan status, unregulated and chaotic growth, transportation challenges, and the prevalence of high-rise and densely built structures were cited as instances of inadequate urban development.

"When we look at urbanization, there has been no urbanization considering the reality of earthquakes here. It has never happened in any period." [Quotation (Q) 1]

"Our lack of knowledge about the culture of urbanization, there are many discourses … I mean, in the city's growth process, its leaders have not fulfilled their duties sufficiently." [Q2]

Both Turkey and Antakya, historically, have an "earthquake memory," meaning that the city has experienced significant earthquakes in the recent and distant past. Regarding Antakya's earthquake history, a shared understanding among stakeholders can be summarized as "*we knew there would be an earthquake.*" At least seven destructive major earthquakes have occurred in the societal memory of Antakya, and each time, the city was destroyed significantly. However, as expressed by participants, "*lessons have not been learned*". The lack of learning ability from past earthquakes and building earthquake readiness despite having a significant history with earthquakes are associated with the failure to learn these lessons. The experience of Antakya residents indicates that the awareness of earthquake risk has been known, but stakeholders, especially decision-makers, have not prepared for this risk.

> "*For example, a public structure will be built, let's say, a museum. This place belongs to the treasury; let's not bother with expropriation. What happened? The ground was swampy, and they drove the world's largest piles. Maybe a much better place could have been expropriated with the cost of those piles. This is simply in the criteria for site selection, my brother, if you're going to invest, do it on your plot … Are you going to build it in a tourism area, for example? You haven't invested; do expropriation. Are you going to build an industry? And these authorities don't object to it. You know, it starts from the top, brother. The government is doing it, and the people are doing it, and it's a very wrong thing. I mean, there is no such thing as site selection criteria, brother. [state/decision-makers] This is my property; I'll build here … The state is doing that, too. They built the AFAD building. They said, 'Oh, it's our property,' and they went and built the AFAD building at the bottom of the creek". [Q3]*

During interviews with a primary and secondary education personnel, it was revealed that a school opened without a functional water supply system and lacked the necessary equipment for internet services, potentially causing health issues and hindering educational activities.

> "*Two hours later, the smell made this place unbearable. With transported water … It was a serious problem, but that problem has been resolved now. An organization brought us plastic tanks, and dynamo pumps were installed. We still get water from transportation, but at least water reaches here. This is how it got resolved. Things are happening here, but it's always complicated, and the foundation is empty. I mean, we opened the school, but where will the teachers stay? We opened the school, but there is no water." [Q4]*

> "*For example, there is no tap water in my school. I used to bring hoses from the fire department, climb onto the roof, and have the tanks filled so that the children could use the restroom. Just last week, I had a ten-ton tank installed in the back." [Q5]*

The earthquake's aftermath led to the loss of school supplies, including equipment vital for internet-based education support. To address the internet problem, a participant from primary and secondary education sector resorted to using a personal device.

> "*They opened the school, but they don't have internet. Without the Internet, you can't communicate or do anything. We still don't have internet. Look, I'm still traveling with my Superbox (modem) that I carry from home." [Q6]*

Additionally, restoring transportation networks is crucial for ensuring school accessibility, particularly as families are dispersed across different locations and schools cater to a broader population. This accessibility is vital not only for the current provision of services but also for facilitating recovery efforts.

> "*Since May 16th, we have been receiving a lot of transfers. But we are getting them from everywhere. We currently have students from Samandağ with us. For example, we also have students coming from distant places." [Q7]*

After carefully analyzing the infrastructure recovery, we have identified a set of sub-factors that emerged from our interviews and are also supported by existing literature. Fig. 3 showcases the various sub-factors that contribute to the overall functioning of water and wastewater systems, transportation systems, healthcare, telecommunication, and energy systems. Although no clear hierarchy was identified for prioritizing sub-factors, it was observed that specific infrastructures, such as water and wastewater systems, are crucial for resuming education services. Likewise, the transportation network was recognized as a crucial infrastructure for education, healthcare, waste management, supply chain, and other recovery efforts. However, in the context of recovery, all the subfactors are subject to the constraint of "need to be completed".

4.1.2. Governance of recovery

All parties involved, including the central government, local administration, businesses, and residents, acknowledge the individuals responsible for the pre-earthquake circumstances. The excessive concentration of decision-making power in the hands of the central government, inadequate performance of public institutions at the local level, political favoritism, insufficient funding from the
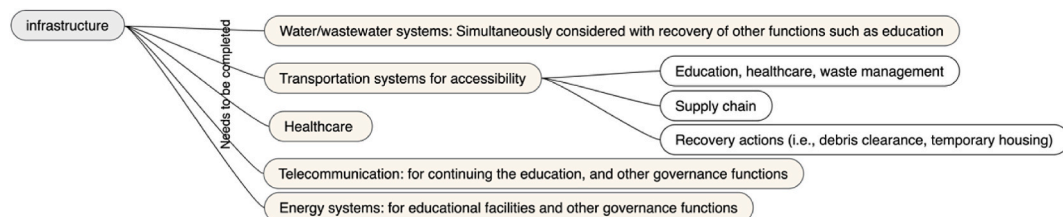

Fig. 3. Sub-factors for infrastructure recovery.

central budget for investments, failure to plan considering earthquake risks, and the absence of post-earthquake management processes and availability of shelter areas are cited as reasons that collectively rendered the city highly fragile and vulnerable to earthquakes.

"Hatay became a metropolitan city in 2018, you know. In that sense, it's relatively new. The earthquake happened at a time when the metropolitan city had not fully developed its capacities to provide services." [Q8]

"Look at local administrations. Locally elected administrations have made significant flaws in terms of urban planning. If you go to the districts, you'll see narrow streets and dead-end alleys." [Q9]

On the other hand, local administration holds the central government responsible and emphasizes that Antakya has not received the state investments it deserves for many years. They highlight the inability to do necessary work and improvements due to a low budget.

"It saddens me that Hatay has only one entrance; normally, the government should handle the road between districts. But the government looked at us like stepchildren here. Last year, out of the 25 billion taxes you paid, they allocated a share from the 670 million general budget for investment. They allocate investment share to us like giving alms, 1 in 40." [Q10]

Professional groups, however, highlight that ensuring housing safety is a public responsibility, but they find that public mechanisms responsible for this process have not fulfilled their duties.

"The state must provide safe housing. When we buy these apartments, we all deal with contractors, right? Okay, they build a nice building, a stylish, spacious apartment. But there is a building inspector, there is the municipality, and there are institutions. They say, 'You can live in this building, you can sleep comfortably in this building. So buy it, go to the title deed, pay the money, and register it.' We did that, but these buildings became uninhabitable, collapsed." [Q11]

It is especially noted that zoning permits were granted incorrectly, and political favoritism was decisive. In this context, members of the Zoning Committees were not selected from competent individuals, and concern for profit was determinant.

"What kind of settlement is this? How does it happen like this? We saw this when it was being built anyway. In the previous site, where seven floors were not allowed, in the next one, permission for 12 floors was given." [Q12]

"But the situation in Antakya is so painful. As I mentioned, there are seven council members looking at the neighborhoods … I'm not saying this to belittle them … The character of a council member who is a mechanic, and how does he do the job? Profit-oriented. A man comes in, pays three liras, gets five floors, pays five liras, gets seven floors, pays six liras, gets ten floors … In this way, there has been urbanization in the districts. But during this urbanization, no provision was made, neither expanding roads nor allocating additional green spaces." [Q13]
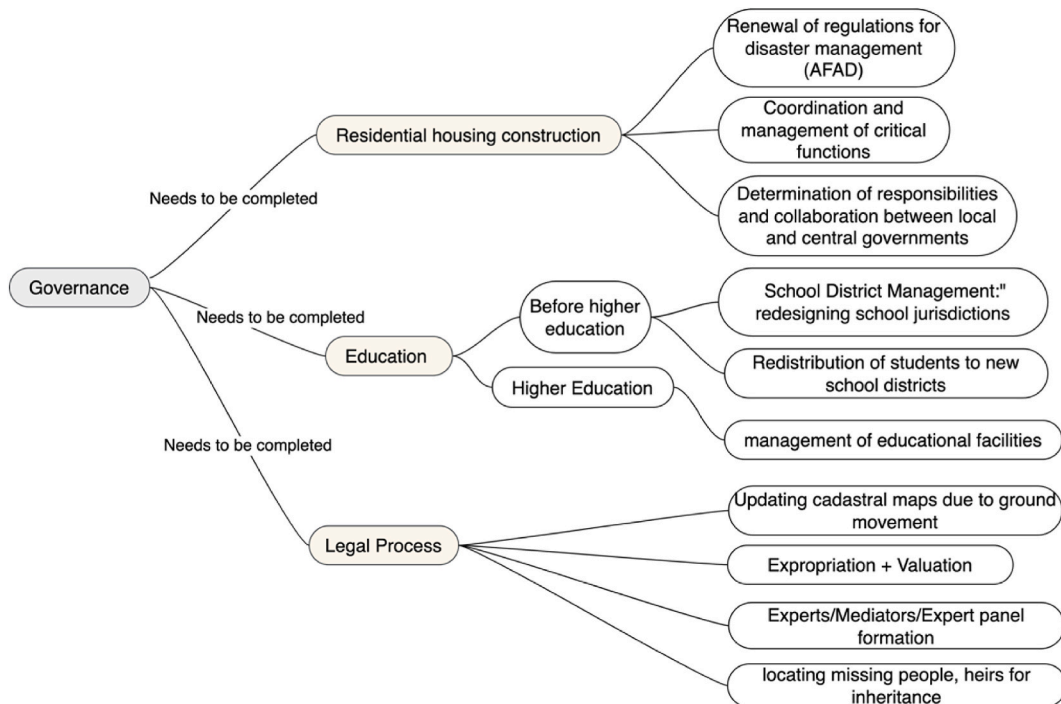

Fig. 4. Sub-factors for governance of recovery.

In our analysis of the primary and secondary factors, we pinpointed that the governance of residential housing construction and the governance of education stand out as pivotal elements for recovery, as illustrated in Fig. 4. Completing both factors is crucial for the recovery initiative's overall success and streamlining the recovery process.

A key finding, we identified revolves around the governance of plans is that deciding who will undertake these initiatives and with what capacity. Essentially, determining responsibilities and fostering collaboration between local and central governments emerged as imperative steps to alleviate citizens' unease stemming from uncertainty. Clearly defining these responsibilities mitigates uncertainty and enhances the coordination and management of critical functions. In Antakya, significant uncertainty surrounds the governance of housing construction, contributing to tension due to disparities between local and central government plans. This lack of coordination, coupled with communication gaps between authorities and communities, adds to citizens' anxiety.

Our focus group meeting with the professional groups highlighted several key issues. Firstly, there is an updating challenge from cadaster-related concerns due to the significant amount of ground movement, which requires surveying and updating the existing cadaster. Additionally, the failure of some property owners to declare deaths introduces complications in the resolution of ownership issues. Planning efforts are underway, with TOKI permanent housing units pursuing its independent plans, while the municipality and the Ministry of Environment and Urbanization also hold distinct visions. This multifaceted set of challenges underscores the complex landscape of housing reconstruction governance.

> "But of course, when there is a discord between the local and the general, unfortunately, the projects you do end up resembling the theoretical-technical projects done by the same professors." … "Local power is not enough. We need to find our own financing." [Q14]

Different statements of the officials exacerbate uncertainties.

> "During that period, our member of parliament, who is also from our profession, said, 'We will evacuate the area around Asi River by 100 m on both sides. We will expropriate this area and hand it over to Emlak Konut. Here, we will build triplexes and other things, sell them, and with the money earned, we will establish a new city in the mentioned place. " [Q15]

Addressing the governance aspects of residential housing construction, legal processes, and education is fundamental to laying a solid foundation for a successful recovery. Fig. 4 demonstrates the governance aspect of the recovery scenario, highlighting three key factors: (1) The process of residential housing construction encompasses coordinating various tasks, dividing responsibilities, and making necessary revisions to regulatory processes. (2) Education, as an essential factor for recovery, is divided into higher education and pre-higher education. Effective management of educational facilities, including restructuring school districts and providing student housing, is seen as vital. (3) The legal processes involve a range of activities, such as revising cadastral maps, valuation procedures, expropriation cases, establishing expert panels, and addressing legal matters pertaining to missing individuals in the context of inheritances. These factors are considered "needs to be completed" to avoid additional delays in the reconstruction process. For instance, the commencement of reconstruction or debris clearance is contingent upon the completion of new cadastral maps and the finalization of expropriation and valuations.

4.1.3. Residential housing recovery

Overall, we found that a prominently highlighted sub-factor crucial to the recovery of residential housing is the community's aspirations (also see Fig. 5). Antakyans are deeply concerned about the city's replanning. There have been discussions about the
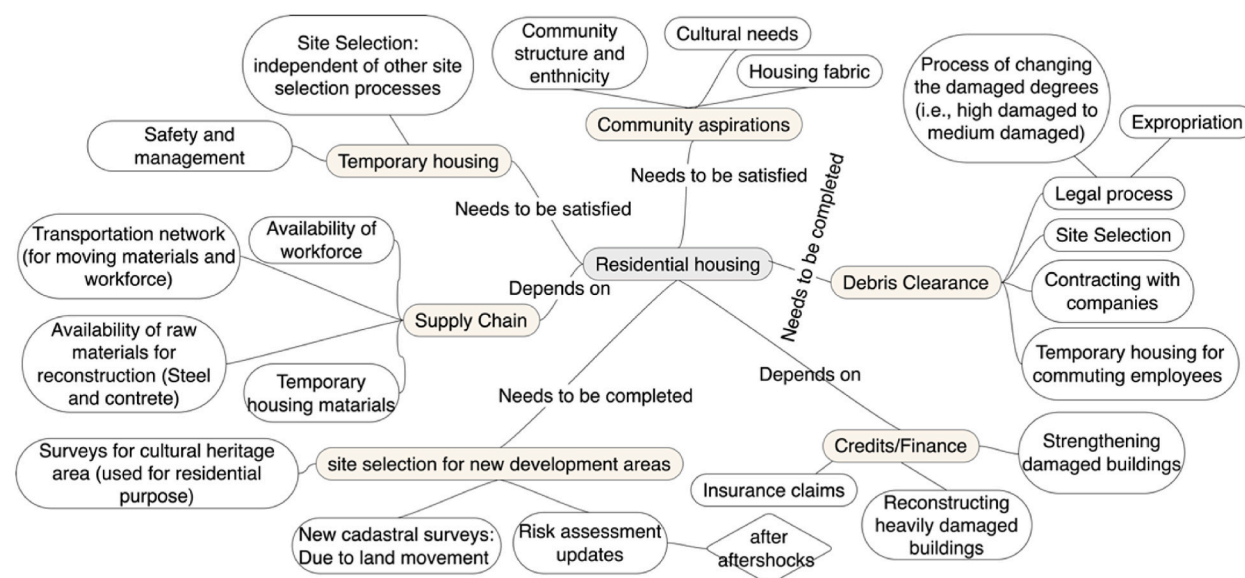

Fig. 5. Sub-factors for residential housing recovery.

possibility of clearing the city center, which has caused social anxiety and raised concerns about the potential loss of the city's identity. Considering the community's preferences, some survivors of the earthquake have indicated a desire to live in low-rise buildings.

"In the Maraş earthquake, those buildings also collapsed. The most robust and resilient houses, stating it very clearly, are the TOKİ houses, meaning curtain-concrete structures." [Q16]

There were diverse sentiments regarding the TOKI housing construction. Some signaled a reluctance to inhabit the mass housing buildings constructed by Mass Housing Administration. Conversely, some individuals exhibit trust in TOKI buildings, attributing this confidence to the robustness of TOKI structures, which appear to withstand seismic events effectively.

"In Defne, there are areas designated by TOKI. They don't openly share with the public what is being done here, sir. We hear it through word of mouth. They say, 'Your homes will be taken away, and you'll be given other places.' The biggest fear for people is not being able to rebuild their friendships and family ties. That is the biggest issue for these people. Otherwise, take ten families, familiar faces, and relatives and place them in one apartment building. Wherever it is, they will live. But being under the same roof, in the same building, or in the same complex with people they don't know, don't trust, or are unfamiliar with scares them. There is currently uncertainty." [Q17]

"But the building where I was born and raised is still standing. Despite severe damage, they managed to get out without a scratch. This means it should be low-rise, that's the rule. It shouldn't be five floors, definitely not six. Twelve or thirteen floors, massive densities, unbelievable … We went overboard with it after the 2000s. That trend started, huge buildings … We need to let go of them." [Q18]

Before beginning the reconstruction process, removing the debris that remains after the earthquake is essential. During the site visit, the teams had recently started the debris clearance process in specific neighborhoods within and around the city center. Upon interacting with these teams, it became clear they were deployed from neighboring cities, temporarily sent here by their employers. Unfortunately, these construction teams' housing arrangements were not considered adequately. No mention was made by any of the interviewees regarding the prioritization or discussion of temporary housing solutions for the teams.

We established a dependency mapping for residential housing recovery, as shown in Fig. 5, to highlight the sub-factors. Significantly, several interdependencies were noted within the residential housing recovery scenario. Within these sub-factors, community aspirations and temporary housing constraints are categorized as "needs to be satisfied". It is essential to consider these limitations in order to meet the needs of those involved and make Antakya a desirable place to live during or after the reconstruction process. Requirements for factors like debris clearance and site selection are labeled as "needs to be completed" indicating a distinct sequential limitation linked to these sub-factors. Finally, the availability of the supply chain and credits and finance is categorized as "depends on". Although not absolute requirements, these factors significantly influence the effectiveness of the reconstruction processes.

4.1.4. Economic recovery

Our research suggests that the recovery of the economy, particularly for small and medium-sized businesses, depends on addressing the issue of migration and rebuilding the existing infrastructure. During the site visit, it was observed that several small businesses had resumed operations in the city center, although largely abandoned, particularly in less-damaged buildings.

To initiate the revitalization of commercial areas, it is essential to ensure that insurance claims are promptly and thoroughly processed. However, while earthquake insurance for residential buildings is mandatory and somewhat enforced, especially when occupants need to connect utilities, commercial building insurance is not compulsory, resulting in fewer people obtaining coverage. Furthermore, concerns were raised that even those with insurance may find it insufficient, given the expenses associated with building recovery.

"He says, 'Okay, I will receive some money from insurance, but that won't be enough,' considering construction costs … Therefore, the ministry or the government needs to provide support." [Q19]

It was also noted that economic revitalization has been disregarded, much like social and cultural recovery. The city needs a comprehensive, sustainable economic development plan that is closely linked to a spatial plan to revitalize and create a livable environment for the residents successfully.

"Moreover, for reverse migration to occur, the economic cycle needs to restart. This requires a rapid reconstruction of businesses, but there is no specific effort directed towards this. Only housing is being considered." [Q20]

"The city has a certain urban identity. When you came, you would visit a synagogue, explore churches, and go to specific mosques. Now, all of these are gone. There are no dining places, no boutique hotels." [Q21]

Based on the interview with the participant from Hatay Chamber of Commerce, it is considered unrealistic to expect an economic recovery in a region that has been severely affected by a devastating event without offering economic incentives to small and medium enterprises. This emphasizes that the local adaptive capacity or resourcefulness may not be adequate for a rapid recovery. Hence, it is crucial to consider the various aspects of disaster resilience, such as economic incentives, both at the local level and on a broader scale, to provide adequate assistance to the affected regions.

"For this, the system here can rise with super incentives. Now, expecting this city to recover with its own dynamics seems a bit disconnected … To expect Hatay to rise with the sixth region, that too is a diagnosis disconnected from reality. It is necessary to move with district-based incentives, that is, incentives based on the damage. Now, when we say Hatay, in Erzin, let's say the damage is 3–5%, we

come to Kırkhan, the damage is 60%, we come to Antakya, the damage is 90%, we go to Defne, it's 80%, we go to Samandağı, it's 70%, with accurate diagnoses and priorities, if a working group is created … Of course, some of these damages can be compensated." [Q22]

Overall, we charted the dependencies for economic recovery using insights from our interviews. The factors, sub-factors, and constraints are detailed in Fig. 6. Our analysis revealed that the success of economic recovery depends on factors such as back migration to facilitate the return of small and medium enterprises, the reconstruction of the building stock, and the formulation of a comprehensive long-term economic development plan for the city (i.e., a long-term urban vision). Further, we identified finance-related aspects, including the completion of insurance claims, the availability of incentives, credits, and finances, as hard constraints categorized as "needs to be completed." These constraints play a crucial role in financing the recovery and reconstruction of the city.

4.1.5. Overall recovery through education and dependency mapping

Surprisingly, one of the primary concerns for locals in the recovery process was the accessibility of education for their children. We identified that many parents worried about potential long-term repercussions if their children's education was disrupted due to the earthquake. Given the adverse effects of the extended COVID lockdowns on education, parents hesitated to rely on online learning. Families with the means to migrate had already done so to ensure a quality education for their children. Those who stayed sought educational opportunities within the city.

"Those [Local Teachers] who are from here and have young children have left due to the school problem. It's entirely because of education. The others are still here." [Q23]

"All individuals who have the means left. We want our families and children to study, not to fall behind in education." [Q24]

As of June 2023, only a limited number of educational facilities had reopened and resumed teaching. However, according to participants, including teachers and school principals, these schools primarily emphasized providing psychological support to the surviving students.

"Now, let me tell you, there are entire studies focused on the psychology of the children. Friends are organizing a lot of outdoor activities. Rather than education, they are working more on activities and games that would relax the children's psychology. This is how it's going on right now. I mean, there is basic information but not much. It's mostly outdoor games and activities … That's how it's going on." [Q25]

Authorities from the Ministry of Education and higher educational institutions have indicated their intention to fully resume regular education by September 2023, marking the start of the next academic term. However, the specifics regarding where and how the education will occur remain unclear. The government adopts a dynamic approach, intending to figure out details as they progress. For instance, their strategy involves utilizing repaired buildings as educational facilities, but individuals currently using those facilities may reside in containers or tents elsewhere. Consequently, it becomes crucial for children to have a school near their containers. The necessity of moving back and forth between functional educational facilities also underscores the need to address transportation challenges between these facilities and the container locations (refer to Fig. 8 for mapping dependencies). Similarly, there is a need for a certain number of teachers to deliver education. The government assigns new teachers to commence work in September without fully addressing the housing problem.

"Uncertain. Transportation-based education … There are many rumors, sir. Transportation-based education is discussed, container schools are discussed, a school in a central area is discussed. My personal opinion is that a school should be built for every container city." [Q26]

"Our biggest problem is our teachers. We opened the school, which I think is wonderful for the children. But it's a very chaotic situation for the teachers because they all have problems. Not all of our teachers came because they don't have a place to stay. We have many teachers whose homes have been destroyed. Everyone is requesting a container, but I don't know any teacher who has been allocated one. I am staying in a container that I found on my own." [Q27]

We illustrated the dependencies for education recovery in Fig. 7. The factors "needs to be satisfied" include support systems
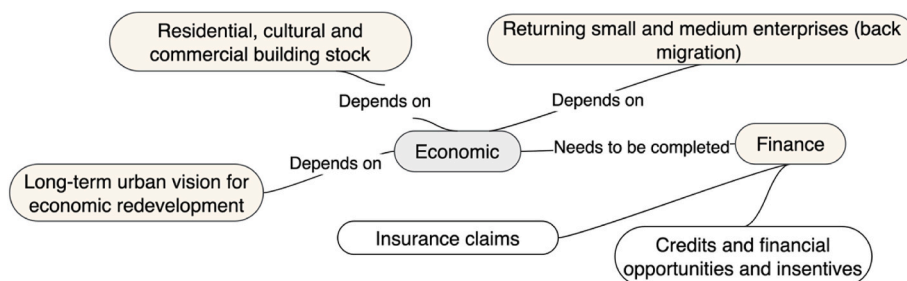

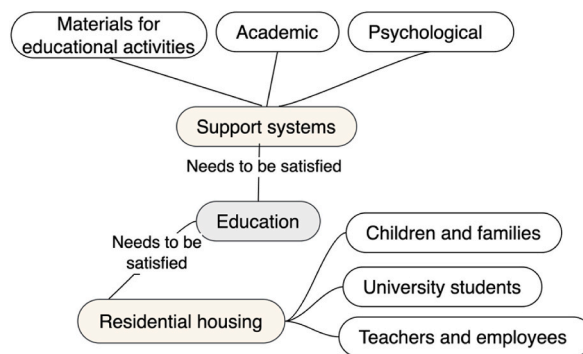
Fig. 6. Sub-factors for economic recovery.

Fig. 7. Recovery of education.

encompassing materials, academic and psychological support for students and teachers, and residential housing for children, higher education students, and teachers. It is noteworthy that these factors are not considered hard constraints. For example, schools might open without proper materials like internet access or computers, but these constraints must be addressed and satisfied to ensure optimal functionality.

In considering the success of recovery for each factor, it is essential to recognize the interdependencies among these factors for the overall recovery of the city (see Fig. 8). For instance, governance and infrastructure are interlinked as sub-factors crucial for residential housing recovery. Similarly, the recovery of residential housing needs to be satisfied to for restoration of education services in the city. We mapped these dependencies in red in Fig. 8.

Throughout the interviews, we observed that certain factors and their dependencies were acknowledged, while others went unmentioned. For instance, in discussions about education, the governance aspect of infrastructure recovery received little attention. This oversight extended to vital components such as reinstating accessibility in transportation networks. Notably, considering the broader service area of schools, which admit students from remote districts, enhancing accessibility through public transport for commuting students was overlooked. Consequently, parents use private cars for dropping off their children.

> *"Because access to education is very challenging. There are parents who come from Samandag just to ensure their children receive an education. In fact, a friend shared yesterday that buses are now departing every hour, even from Samandag." [Q28]*

Similarly, authorities omitted to discuss housing solutions for teachers assigned from other cities by the government to commence teaching in the upcoming academic calendar. This oversight highlights the need to comprehensively examine factors and their interconnections to ensure a more effective recovery strategy.

4.2. Opportunities and challenges

Some factors have been overlooked in the overall recovery efforts by local authorities and central agencies. The primary concern we have identified revolves around reversing the migration. The local and central governments have prioritized physical recovery; however, the equally important aspect of cultural recovery, which involves bringing back the local population, has not been adequately addressed.

The participants we interviewed predicted it would take over a decade to achieve long-term recovery and restore a sense of normalcy in the city. According to one participant, the prolonged recovery timeline could potentially endanger Antakya's cultural identity. Even people who are typically willing to return may have second thoughts if the time it takes to recover goes beyond a certain point [29]. This may particularly apply to families with children who moved to meet their children's educational needs and settled in different cities. Returning to their homeland in Antakya becomes increasingly difficult as the recovery period continues. There are concerns about the potential loss of cultural ties and identity if the restoration process exceeds the expected timeframe.

> *"The recovery from the devastation caused by such an earthquake cannot be achieved even with the strength of the state in less than ten years. Ten years is not a short time in a person's life. They may have children who will be studying or seeking job opportunities if they have already graduated. In a city that has been destroyed like this, finding adequate educational and job opportunities is challenging." [Q29]*

However, focusing on education and improving residential housing were the key factors in encouraging locals to stay in the city and could potentially help reverse the migration trend. A participant emphasized the negative consequences of locals not returning.

> *"So, many of the locals from Antakya have left. Some of them may return, but I believe a significant portion may not. There will be difficulty in transferring that cultural accumulation developed over thousands of years to the next generations, possibly resulting in the loss of that accumulation over time." [Q30]*

Despite the challenges, the remaining locals are optimistic that those who moved away will eventually come back and have an intense desire to do so. It was stated that possible reasons for their decision to return include the expensive cost of rent in their new
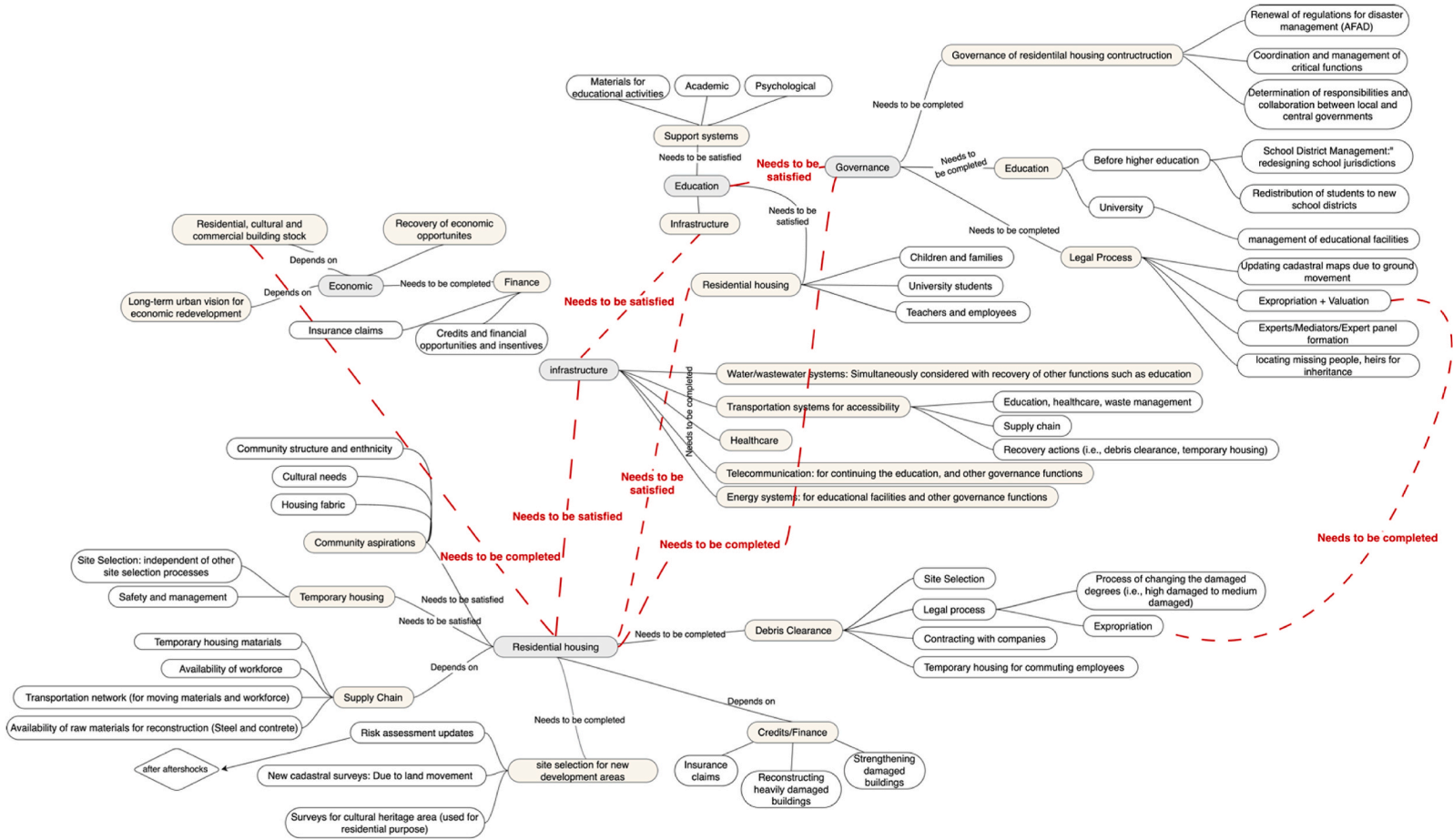
Fig. 8. Dependencies between recovery factors and sub-factors.

areas, strong family connections, and a deep connection to the city's culture and sense of belonging. Although this profound sense of belonging is present, authorities must recognize and include it in their action plans, blending it with physical recovery efforts. Culture, identity and Antakya's history was mentioned multiple by participants may times sometimes as an opportunity and sometimes as a challenge. We provided the frequency of the terms "culture", "history" and "identify" mentioned during the focus groups and in-depth interviews in Appendix C, Figure C.2. Approximately 50 % of the participants mentioned the term "culture" to emphasize the importance of Antakyans' culture.

> *"Of course, the city's identity has been lost, and regaining this identity is very important. Authentic restoration is crucial. Working closely with UNESCO is essential. Otherwise, if we cannot achieve these for Antakya, it will turn into an ordinary city." [Q31]*

The subject of migration is closely connected to the presence of physical opportunities. Without a well-rounded policy in place, there is a potential danger of cultural values and the identity of the city being compromised. Understanding and tackling the various dimensions of migration, including cultural connections, is crucial for a holistic approach to recovery.

Lastly, we observed a lesser emphasis on the supply chain aspect of recovery. The availability of raw materials required to recover residential and commercial building stocks presents a less apparent challenge. The broader implications of reconstruction and rebuilding on the economy and environment have not been comprehensively addressed. Our findings indicate that the materials supply chain, particularly the production of cement and steel required for reconstruction in Antakya, will have significant economic and environmental impacts. The demand for construction materials in affected areas is likely to strain availability in other cities, potentially disrupting supply and increasing costs nationwide. The cement industry alone contributes to 7 % of global greenhouse gas emissions [59], creating a feedback loop where recovery actions increase carbon emissions, consequently amplifying the impact of climate change and climate-induced disasters.

5. Discussion

Infrastructure: Antakya's infrastructure vulnerabilities have been magnified by a history of poor site selection and inadequate urban and infrastructure development strategies (see Section 4.1.1, quotes 1, 2, and 3). Repeated failures to incorporate lessons from past earthquakes contributed to the devastation caused by the 2023 Kahramanmaraş earthquake. The lack of collective disaster memory has turned natural disasters into avoidable, man-made catastrophes, resulting in extensive damage to critical infrastructure. Although a large-scale earthquake has been expected in Antakya for many years, and historically Antakya has been exposed to such disasters, the lack of disaster memory led to inadequate preparedness, poor urban planning, and a failure to implement effective risk reduction measures. Resilient infrastructure planning must prioritize safe site selection, durable construction, and community needs. Addressing these issues will not only support recovery but also enhance long-term resilience against future disasters. In addition, participants highlighted that inadequate infrastructure is hindering the functionality of essential services like education (see quotes 4, 5, and 6). This highlights that recovery policies, such as reopening schools, must align with infrastructure restoration to support a resilient recovery.

Governance of recovery: Based on our interviews, the current trajectory of reconstruction planning shows little intention of involving citizens through a structured participatory planning process for urban regeneration. This leads to increasing uncertainty and misinformation lead to citizens' frustration, undermining their trust in planning processes (see quote 17 and 26). Regarding Antakya, our interviews revealed that rumors were circulating about potential changes to the city center and the relocation of housing areas (see quote 15). These rumors caused frustration, mistrust, and added distress among a population that was already emotionally and physically affected. An open and inclusive approach is crucial to ensure a successful recovery and the creation of a sustainable and resilient city for the future. Reconstruction planning remained centralized during the interviews, leaving citizens and planning professionals to respond only after plans were made public. This reactive approach led to mismatches between community expectations and planning outcomes. To reduce these uncertainties, clearly defining the roles and responsibilities of central and local governments is essential for aligning reconstruction efforts with community needs.

Residential housing recovery: In the case of Antakya, it is evident that the authorities are primarily focused on restoring the building stock as fast as possible with a mindset of returning to the previous state rather than embracing a forward-thinking approach. At the time of the interviews, the central government had already announced that TOKI housing construction although the spatial location was not disclosed (see quote 17). This approach was also taken in the aftermath of previous large-scale earthquakes in Turkey. For example, after the 1999 Marmara Earthquake in Adapazari, Erten [60] found that in the absence of a comprehensive framework governing the ownership and development rights in the affected urban areas, the government provided around 43,000 housing units to provide compensation for the property loss of the disaster survivors. Relocating survivors to new housing sites that are quite remote from existing housing areas resulted in numerous alterations being required to property arrangements [60].

Similarly, following the 1999 earthquake, Tas et al. [61] investigated permanent housing production in Kocaeli. They found that the available time for reconstruction was restricted due to a massive need for housing in Kocaeli, leading to a quest for uncomplicated planning solutions. The extensive damage caused during the earthquake highlighted the importance of prioritizing the durability and safety of building construction. Several variables were overlooked during the initial planning stage, resulting in a decline in overall satisfaction. The selection of the site did not take into account social factors, such as distance from business and trade centers or proximity to previous settlements. The housing design did not consider local life, culture, and aesthetics. User complaints emerged due to building quality deficiencies [62].

In 2011, Van earthquake, the government built around 15,000 apartments in Van and 5,000 in Ercis within 12 months under the coordination of TOKI [54]. However, a study showed that without participatory processes and involving communities during the

planning and design phases, community satisfaction from the newly built housing lead to dissatisfaction with the living conditions among the beneficiaries, especially when they are forced to relocate [64] which highlights the importance of considering long term consequences of planning decisions. While addressing the immediate housing needs of survivors is essential, planning and policy development must be systematic to avoid repeating past mistakes and reinstating existing vulnerabilities.

Economic recovery: Together with the availability of the economic incentives, social capital and the existence of a community structure can create opportunity during the recovery process to bounce back and implement sustainable local development [42,65]. Antakya serves as a compelling example to support this argument. We argue that the sentiment of Antakyans and the cultural and spatial identity of a city can have a direct influence on its recovery in general but also for economic recovery which highly depends on reverse migration (derived from quotes 21 and 31). Our interviewees have emphasized that while a significant portion of the population has left after the earthquake, it is crucial for the people of Antakya to restore their former living places and bring the population back to the city especially for the economic recovery (see quotes 20 and 30). This was also reported in literature (e.g. Ref. [37]) that ensuring the availability of resources to revive the economy would encourage reverse migration.

Overall recovery through education and dependencies: As highlighted by the previous studies, the long term recovery needs to be planned carefully and effectively communicated with the communities [29]. Deliberations to engage with citizens, enhance safety, and thoughtful land use planning are just as important as the speed of recovery [63]. When addressing immediate housing needs, it is crucial to take a systematic approach to avoid repeating past mistakes. While there is pressure to restore the city quickly, rushing to implemented policies can lead to long-term vulnerabilities. Reconstruction plans must integrate cultural identity with housing solutions to encourage displaced residents to return [66]. In Antakya, our interviewees emphasized the importance of education in reversing migration trends. Reopening schools can play a vital role in restoring normalcy and retaining the population. However, education recovery is closely tied to dependencies such as housing for teachers, reliable transportation, and infrastructure repairs. These dependencies were not fully addressed or communicated during the time of our interviews. To achieve sustainable recovery, these interdependencies must be carefully considered and integrated into the overall reconstruction plan.

6. Conclusion

In this study, we explored the post-earthquake recovery process in Antakya, Turkey, a city severely impacted by the February 2023 earthquake. With over 50 % of its built environment destroyed and a significant loss of life, Antakya's reconstruction offers crucial insights for global discussions on urban resilience. Our fieldwork, that we conducted in June 2023, involved interviews, and focus groups with key stakeholders, uncovering the important role of re-establishing educational services as soon as possible for the recovery. Furthermore, we found that the cultural identity and ties between communities emerged as important factors influencing the recovery process. These findings provide valuable perspectives for urban planners, policymakers, and disaster recovery professionals tasked with balancing physical reconstruction with the preservation of cultural identity in post-disaster contexts.

As it was well documented in the past earthquakes of 1999 Marmara and the 2011 Van (e.g. Refs. [60–62,64]), only prioritizing housing without participatory and co-creation processes leads to dissatisfaction with the living conditions among the beneficiaries. Moreover, such a recovery process does not guarantee the resilience of the overall urban environment. It is important to take a more integrated and adaptable approach to disaster recovery, going beyond the conventional practices where the government's main priority is to quickly restore the building stock by providing housing (see Refs. [18,27]).

Limitations and future work: it is essential to acknowledge the limitations of this study, specifically the fact that the findings are derived based on interviews with 16 participants and focus groups. We focused exclusively on identifying crucial elements and limitations during these interviews, creating a visual representation of the associated interconnections. As a result, some factors, like the recovery of commercial buildings, were left out, even though they are still relevant and deserve more investigation. Further research should expand the scope for a more thorough study to confirm the findings presented in this paper. In addition, it is crucial to update the dependencies mapped for the recovery scenario as the recovery progresses. This is necessary to account for any new dependencies that may arise during the medium and long-term recovery processes. It is important to note that the findings should not be generalized to other locations but rather should be used as a context-specific reference to inform recovery strategies in similar disaster-affected areas.

Furthermore, the critique of the grounded theory is that the findings might lead to includes subjective views of analysts. To overcome the subjectivity and validate the results of our analysis, we have taken multiple steps including a healthy amount of self-reflexive activities [67] comparison of memos field notes, testing the interview protocols and transparent coding. By engaging in peer discussion sessions among co-authors, we refined the emerging themes to enhance the credibility of our findings. We continued to analyze the data until no new themes or concepts emerged, indicating that we had reached saturation.

Further research is necessary to also share our findings with participants to obtain their feedback. In addition, future work could focus on utilizing the Grounded Theory approach to explore the complexities of post-disaster life. These studies can contribute to developing strategies to improve disaster recovery systems. One limitation of this study is the relatively small number of interviews conducted, which may limit the generalizability of the findings. Additionally, the theoretical framework used, while aligned with previous disaster recovery research such as those well documented in the past earthquakes of 1999 Marmara and the 2011 Van. Despite these limitations, the study's results reinforce existing knowledge from past disaster recovery processes and offer new insights into the role of cultural identity and rebuilding educational services in urban resilience.

While this study focuses on the recovery and reconstruction process following the recent earthquake, future research should aim to situate this event within the broader context of previous earthquakes in Turkey. A comparative analysis of past large-scale earthquakes could provide valuable insights into how recovery efforts and knowledge have evolved over time.

Considerations of risks beyond the earthquake, particularly those associated with the impacts of climate change need to be considered to explore "bouncing forwards" in future studies. The escalating effects of climate change are bound to exert more intense pressure on cities in the future, Antakya and other cities affected by this earthquake should turn this natural hazard into opportunity to include climate risks into urbanization plans [68]. Future research should include longitudinal studies to explore resilience and recovery as ongoing processes in the medium- and long-term following disasters. This approach can deepen our understanding of reconstruction, recovery, and resilience dynamics in cities over time.

CRediT authorship contribution statement

Nazli Yonca Aydin: Writing – review & editing, Writing – original draft, Visualization, Validation, Resources, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Kezban Celik:** Writing – original draft, Validation, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Resat Gecen:** Writing – review & editing, Visualization, Resources, Investigation, Data curation. **Sibel Kalaycioglu:** Writing – review & editing, Conceptualization. **Sebnem Duzgun:** Writing – original draft, Validation, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization.

Ethical considerations

Informed consent was obtained by explaining the aim and process of the study orally. The study was approved by the ethical committee of the TU Delft, Netherlands. Information was kept confidential and participants had the right to withdraw at each stage of the study.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

Appendix A. Pictures from site visit

Fig. A.1. Uzun Çarşı on the site visit

Fig. A.2. Antakya city center on June 5th, 2023.

Appendix B. Interview Protocol

1 Introductions
    a Introduction of the Project team
    b Overview of the research and the project
2 Getting to know the interviewee and their experience during and after the earthquake
    a Obtaining information about the participant's age, education, occupation, marital status, economic situation before the earthquake, duration of residence in this city, etc.
    b Participant's experience of the February 6 earthquake (during the earthquake and immediately after the earthquake).
    c Participant's experience after the earthquake such as problems that were encountered, including rescue operations, housing and infrastructure related problems.
3 Obtaining insights about the resilient reconstruction strategies for Antakya, Hatay.
    a Participant's perspective on building Antakya, Hatay as a resilient, strong, and inclusive community.

b Participants' insights on the recovery timeframe, actors that should be involved in, responsibilities, site selection and financial processes.

c Participant's views on the strengths of Antakya, Hatay province/villages during the reconstruction process including cultural, economic, political, physical?

d Participant's opinions on the potential opportunities of Antakya, Hatay province/villages during the reconstruction process such as creating a resilient city, improving infrastructure?

e Participant's reflections on the potential difficulties that might be encountered during the reconstruction process including cultural, economic, political, physical?

4 Closure

a Room for additional comments and questions
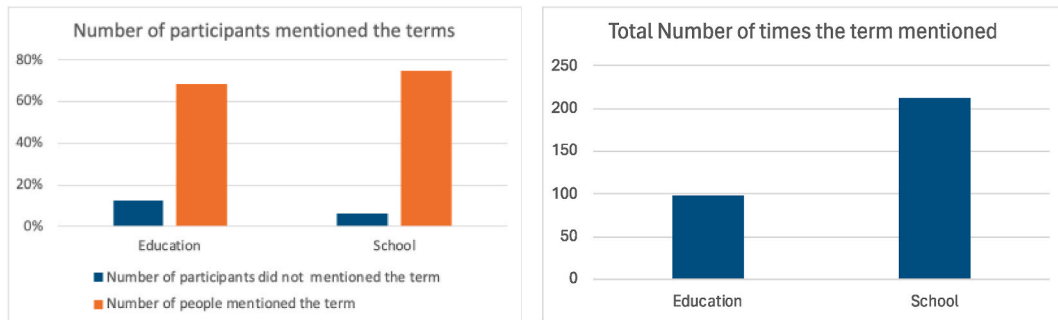
Appendix C. Statistics from interviews

Fig. C.1. Frequency and participant mention of key terms in interviews: The right chart displays the total number of times the terms 'education' and 'school' were mentioned across all interviews, while the left chart shows the number of participants who mentioned these terms during the focus groups and in-depth interviews.
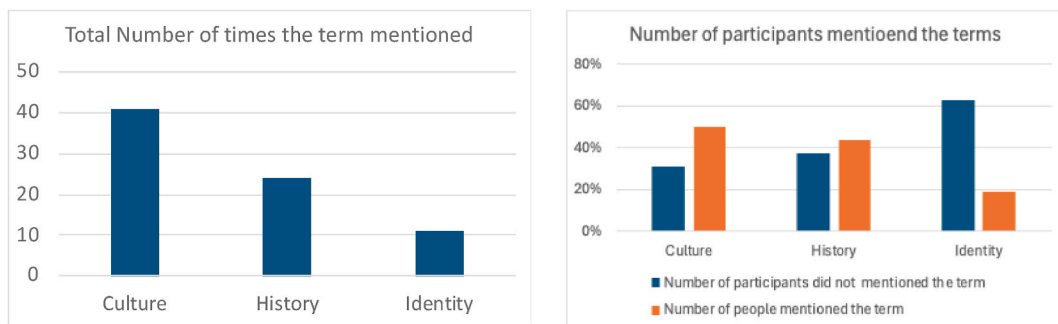

Fig. C.2. Frequency and participant mention of key terms in interviews: the left chart displays the total number of times the terms "culture", "history" and "school" were mentioned across all interviews, while the right chart shows the number of participants who mentioned these terms during the focus groups and in-depth interviews.

Data availability

The data that has been used is confidential.

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