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# Examining the Importance of Spatial Aspects of Travel Routes: A Multi-method Approach

**Abstract**

A well-designed travel route can increase tourists' satisfaction and revisit intentions by helping them explore popular or/and hidden places conveniently and thus better experiencing the destination. The popularity of travel route development has resulted in tourists using cities' infrastructure to enable travel from areas with well-structured accessibility to more inaccessible areas. Despite the importance of the accessibility of travel routes to enhance travel experiences, the tourism literature lacks an understanding of how travel routes should consider not only the physical distance between tourist destinations but also accessibility using mobility within smart tourism cities. Therefore, this research aims to examine the importance of considering accessibility in assessing a travel route. Drawing on the distance decay theory and the concept of the effective tourism exclusion zone (ETEZ), we argue that a travel route can be adopted when every part of the route is accessible in terms of time cost. To achieve the objective, this research adopted a multi-method approach. We explored how much developers consider accessibility when generating a travel route via a case study in study 1. An experiment, study 2, strengthened the results of study 1, presenting cause-and-effect relationships. This study provides theoretical and practical implications for developers of travel routes.

**Keywords** Travel route; Distance decay; Effective tourism exclusion zone; Smart tourism city; Destination marketing organization

## 1. Introduction

We have been compelled to lock down and abide by limitations on travel and transportation due to a global pandemic, COVID-19, for over two years. Although COVID-19-related dissatisfaction is still growing due to annoyance relating to the prevention of travel, COVID-19 also contributes to an exponential rise in people's desire to travel (Vidon & Rickly, 2018). As the desire to travel becomes more pressing, effective travel routes increase potential tourists' travel intention and tourists' satisfaction and revisit intentions by helping them experience their destinations in better ways (Cai et al., 2018; Roy & Gretzel, 2020). Travel routes have led tourists to explore a range of areas and have created unique experiences at their destinations (Olsen, 2003). A well-designed travel route can increase tourists' satisfaction and revisit intentions by helping them to explore popular or/and hidden places conveniently and thus better experience the destination (Cai et al., 2018). With tourists' need to increase convenience and gain useful information, travel routes have developed as tourism products in the tourism market, through tour operators (Jin et al., 2021).

From a Destination Marketing Organization's ("DMO" hereafter) perspective, travel routes can be a tool to manage destinations in a more balanced way because they can induce tourists to visit otherwise unknown areas (Roy & Gretzel, 2020). DMOs have developed travel routes to provide suggestions for tourists, and people use these travel routes for planning their trips. In the US and Canada, about 90% of city- and county-level DMOs are developing travel routes with various themes (e.g., heritage, culinary, or outdoors) for their tourists (National Travel Center, 2022). According to a recent survey, about 50% of tourists use travel routes developed by DMOs as a primary tool when planning their trips (DMA West Education & Research Foundation, 2021). The popularity of travel route development has resulted in tourists using the infrastructure of cities to move from areas with well-structured accessibility to more inaccessible areas. Even if the attractions on a travel route are attractive, a tourist cannot adopt the travel route if these attractions are not accessible in terms of time and location (Kurashima et al., 2013).

To address these issues, in recent years, there has been growing interest in the accessibility of travel routes from the perspective of smart tourism cities (Almobaideen et al., 2017; Gretzel & Koo, 2021; Wang, 2021). As prior research has emphasized the blending effect of tourists and residents sharing city infrastructure and services (Gretzel & Koo, 2021), developers of travel routes need to consider whether the component attractions are close enough together that tourists can follow a travel route without limitations, using the infrastructure available to residents (e.g., cities' public transportation systems) (Sarkar et al., 2021). Neglecting to account for the spatiotemporal cost required to move from one attraction to another can create a frustrating experience for tourists as they may spend an unnecessarily long time on the road, which could make them dissatisfied with the DMO and the destinations. To avoid such failures, developers of travel routes have to assess their travel routes in terms of the spatiotemporal distance between the listed attractions (Lim et al., 2019).

Despite the importance of accessibility of travel routes in enhancing the travel experience, the tourism literature lacks an understanding of how a travel route should be designed to include not only the physical distance between tourist destinations but also accessibility using mobility in smart tourism cities. Instead, the prior literature on tourism has emphasized other elements, such as an attraction's popularity or tourists' tastes (Renjith et al., 2020; Sarkar & Majumder, 2022), thereby prompting calls for more substantive and theoretically informed study that includes empirical analysis. To respond to this call, we advance the distance decay theory, which explains the inverse relationship between distance and tourist demand (Nekola & White, 1999; Mckercher & Lew, 2003). Furthermore, we believe applying an effective tourism exclusion zone viewpoint based on the distance decay theory accounts for how important the developers of travel routes consider accessibility when they design travel routes. Among the many elements related to accessibility, we focused on the time cost for each route: the amount of time taken to move from one attraction to another.

Therefore, this study addresses the significance of considering accessibility in assessing travel routes by focusing on the following research questions: 1) How much do developers of travel routes (i.e., DMOs) consider accessibility when developing travel routes from the perspectives of smart tourism cities? 2) How much do tourists prefer travel routes with accessibility compared to those without? To answer these questions, we adopted a multi-method approach using two studies: least cost path analysis and experimental.

In study 1, targeting all the travel routes developed by a province-level DMO in South Korea, we measured the time cost for every path on the travel routes by conducting least cost path analysis. We examined how many paths in the travel routes were not affordable in terms of time cost by using the concept of the effective tourism exclusion zone, based on the distance decay theory. In study 2, we confirmed how important it is for DMOs to consider accessibility in order to develop adoptable travel routes, by conducting an experiment. Targeting potential tourists in Korea, we examined how their preferences for hypothetical travel routes changed with the time cost for each path. This research contributes to the confirmation of the importance of the spatiotemporal distance between attractions in developing a travel route. Practically, the findings of this research can provide insights for travel route developers or operators with regard to travel route development.

## 2. Theoretical Background

### 2.1 Smart tourism destinations and travel routes

The idea of a smart destination, which primarily evolved from a smart city, has been discussed by academics (Park et al., 2020). Cities are complex systems interconnected by numerous people, businesses, various modes of transportation, communication networks, services, and utilities (Innes & Booher, 1999). The rapid growth faced by many cities has resulted in social and environmental problems such as traffic congestion, pollution, and social inequality (Vanolo, 2014). Thus, many governments are trying to introduce technology to all aspects of city operations to create more connected and intelligent designs, which can be understood as the background to smart city concepts (Lee et al., 2020). In the literature, the concept of smart cities usually deals with citizens' quality of life and emphasizes the importance of solving problems arising in their daily lives (Neirotti et al., 2014).

Preliminary work on smart cities in the tourism field focused on the importance of smart destinations, as cities must dynamically integrate technological platforms to enhance the touristic experience, taking into consideration travelers' unique preferences (Buhalis & Amaranggana, 2013). More recent evidence (Gretzel & Koo, 2021) highlights smart tourism cities, which are an integration of smart cities and smart destinations, considering a holistic approach to residents and tourists simultaneously. Since smart cities are a new development in tourist destinations, the infrastructure developed and managed for citizens in smart tourism cities is used by both citizens and tourists. In this respect, there has been growing interest in transportation and accessibility in smart tourism cities, from the perspective of travel route planning, from both academic researchers and tourist destination marketers. Wang (2021) tried to determine actual cases to solve route planning problems and stressed the importance of algorithm models, which consider the time and expense involved for tourists. Further, Almobaideen et al. (2017) modeled and simulated an approach called Geographical Routing for Mobile Tourists (GRMT) to select the best routes with tourism-related facilities.

From the perspective of DMOs as travel route developers, such organizations need to consider whether the component attractions are close enough together that tourists can follow a travel route without limitations using the infrastructure available to residents (e.g., cities' public transportation systems) (Sarkar et al., 2021). Neglecting to account for the spatiotemporal cost required to move from one attraction to another can create a frustrating experience for tourists as they could spend an unnecessarily long time on the road, which could make them dissatisfied with the DMO as the smart tourism cities. To avoid such failure, developers of travel routes have to assess their travel routes in terms of the spatiotemporal distance between the listed attractions, considering the infrastructure available in the relevant smart tourism cities (Lim et al., 2019).  Thus, this study aimed to evaluate the suitability of travel routes developed by tourism developers, specifically DMOs, and to address the implications for travel route management to ensure tourists have successful tourism experiences within smart tourism cities.

## 2.2 Aspects of a travel route that a DMO needs to consider

A travel route developed by a DMO helps tourists to plan their trips; particularly to specify their travel itinerary (Cai et al., 2018). From a DMO's perspective, a travel route can be a tool for achieving multiple goals. On the one hand, a travel route can increase tourists' satisfaction and revisit intentions by helping them better experience the destination (Cai et al., 2018). On the other, a travel route helps a DMO to manage its destinations in a more balanced way because it can induce tourists to visit otherwise unknown areas (Roy & Gretzel, 2020). To attain these multiple goals, a DMO should develop a well-designed travel route, which is desirable to tourists, by considering different aspects. In addition, using a well-designed travel route enhances the convenience of tourists, ultimately enabling smart tourism (Xiang & Fesenmaier, 2017). It is therefore necessary to develop a well-planned travel route that is desirable for tourists by understanding the factors related to the movement of tourists within a tourist destination (Kim, 2021).

The recent literature on travel route development has often suggested that destination attributes (e.g., an attraction's popularity) or tourists' personal interests should be considered to make travel routes more adoptable by tourists. Sarkar and Majumder (2022) proposed an algorithm for developing a travel route for group tours, which can maximize the interests of all members of the group. Konstantakis et al. (2020) examined the importance of considering tourists' preferences with regard to cultural heritage for developing a travel route recommender system for cultural travel. Yochum et al. (2020) suggested popular or special attractions as points of interest (POIs) that are required to be included in a travel route, and the positive effect of including such mandatory POIs in a travel route on tourists' perceptions of the route was determined.

Some research on travel route development has focused on the elements related to tourists' constraints, such as limited time budgets. Tenemaza et al. (2020) proposed a travel route recommendation system that can update the travel route according to a list of tourists' constraints in real time, including traffic conditions and weather forecasts. Zheng et al. (2017) argued that a more realistic travel route can be developed when the amount of time tourists spend at each attraction is considered. Lim et al. (2017)

suggested that the queuing time for each attraction should be considered as an additional constraint when developing a travel route. These studies have considered travel route development as maximizing the accessibility of a travel route: how to make a travel route more adoptable by tourists by considering the elements related to tourists' constraints, such as the distance traveled and expected cost, and the time taken (Medlik, 2012; Vansteenwegen et al., 2011)

The second stream of the literature has suggested that a DMO should develop a travel route by considering how to increase the accessibility of the travel route: How to make the spatial or temporal distance taken to complete a travel route more affordable to tourists (Khadaroo & Seetanah, 2008; Medlik, 2012). From tourists' perspectives, accessibility can be the priority aspect of a travel route when deciding whether to adopt it or not. However, compared to the desirability of a travel route, which the first stream of the literature has investigated, the accessibility of a travel route has been rarely studied as the main aspect.

### 2.3 Distance decay theory and effective tourism exclusion zone

The distance decay function has been recognized as a solid theory in geography to explain an inverse relationship between distance and volume (Losch, 1954; Nekola & White, 1999). This spatial relationship (or frictional effect) is based on the first law of geography, which states that things are usually related to one another, and the degree of relatedness is strongest for the nearest thing (Tobler, 1970). This concept is widely applied in many kinds of research to confirm the frictional relationship between distance and human movements. It is also noticeable in the tourism sector that distance affects a traveler's destination choice or travel intention (Cao et al., 2020; Schuckert & Wu, 2021; Wong et al., 2021).

Distance decay patterns have been expanded in the tourism context as follows: (1) *classic distance decay*: a decay curve where demand declines exponentially with distance, as predicted in the original model (Bull, 1991), which has demonstrated that tourism demand peaks when close to the origin; (2) *plateauing distance decay*: a plateauing curve where demand plateaus for some time before declining exponentially, which explains why travel demand does not necessarily decline within a certain distance from the origin (McKercher, 1998); and (3) *distance decay with a second peak*: a standard curve with additional secondary peaks some distance from the central peak (Mckercher & Lew, 2003), which explains tourists' decision making by considering 'pull factors' such as destination attractiveness as well as distance (i.e., travel time and money) (Hooper, 2015). The latter pattern suggests that destination choice is fundamentally affected by physical distance, but the effect can change with a tourist's purpose or destination attributes.

Regarding frictional relationships, empirical studies have commonly verified that travel intention decreases exponentially as physical distance increases, both in domestic and international travel settings (McKercher et al., 2008; Zhang et al., 2011). In a spatial setting, the importance of the effective tourism exclusion zone (ETEZ), which distorts the normal decay function, has been emphasized (Mckercher & Lew, 2003). An ETEZ, an area where tourism activities do not occur, is caused by political factors, geographical obstacles, lack of infrastructure and superstructures, or absence of attractions (McKercher, 2018). From the perspective of tourists, it suggests that a destination with low perceived accessibility can be regarded as an ETEZ. From a geographical point of view, the concept of an ETEZ is clear, but to the best of our knowledge, research on applying this concept to tourism route design as a criterion for analyzing travel routes is lacking. This is because an ETEZ is related to the psychological constraints caused by the movement of tourists (McKercher & Mak, 2019), so the criterion of ETEZ as a spatial range may vary depending on regional characteristics (i.e., in the context of South Korea in this study).

Intriguingly, Kwon and Kim (2015) analyzed demand elasticity (using visit counts of inbound travelers) according to the time distance of inbound tourists to identify ETEZs in South Korea. As shown in Figure 1, it was confirmed that the highest tourism demand occurred at a distance of 11.6 minutes from the origin, and in particular, tourism demand decreased exponentially to a distance of 75.2 minutes by car. Specifically, tourism demand by section, which shows a significant change in tourism demand, accounted for 18.7% of the total tourists in section 1 (11.6 minutes or less), 75.6% in section 2 (11.7 minutes or more, and 75.1 minutes or less), and 5.75% in section 3 (75.2 minutes or more). In other words, section 3 (involving travel time of 75.2 minutes or more), with little tourist demand, was proven to be an ETEZ. Our study aimed to evaluate effective travel routes within the South Korean context, and according to Kwon and Kim (2015), attractions within a travel time of 75.2 minutes were assumed to lie within an effective tourism zone.

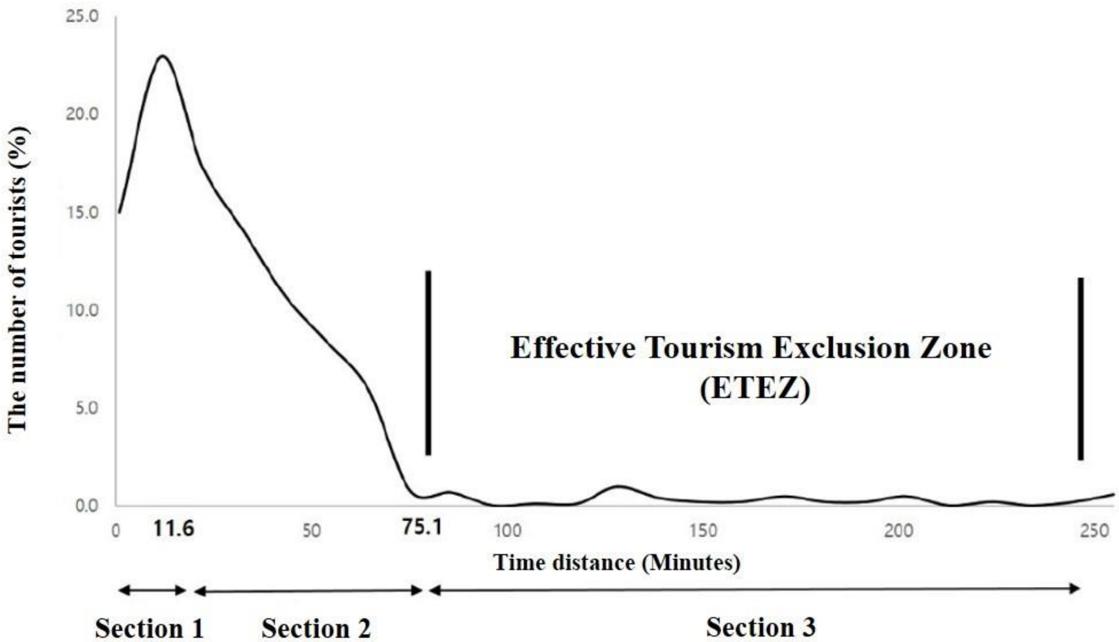


Figure 1. Distance decay pattern in the context of domestic tourists of South Korea (Adapted from Kwon and Kim (2015))

## 3. Methods

Following the literature guides (Gour et al., 2021; Lo & Lee, 2011; Wengel, 2020), we used a multi-method design to improve the relevance of tourism research to practice and to gain comprehensive results on accessibility when a DMO develops a travel route for prospective tourists. The section "Study 1 – Least cost path analysis" discusses least cost path analysis, involving data from 95 travel routes. We explored how much a targeting DMO considers the time cost for each path when developing a travel route, via a case study. Section "Study 2 – Experiment" describes the method used for the experiment, involving 154 participants, and its results. In study 2, we examined how important it is for DMOs to consider the time cost for each path when developing adoptable travel routes, via an experiment. Recruiting potential tourists from South Korea, we examined how their preferences for a travel route varied with the time cost for each path in the travel route.

### 3.1 Study region

As a target DMO, a province-level DMO in South Korea, the Gangwon Province Tourism Organization (GTO), was selected. Gangwon Province is one of the top tourist destinations in South Korea. A large part of the province is renowned for its beautiful scenery with deciduous/coniferous forests, mountains, ocean, historic sites, and old palaces. Gangwon Province consists of 4 areas covering 18 cities in total (peace area, abandoned mine area, east coast area, and inland area) based on the topographical conditions and geographic characteristics of each area (Figure 2) (Gangwon Province, 2021a). To reduce the regional deviations and promote the tourist attractions in each area, GTO has developed 95 travel routes that include intra-city and inter-city paths. Compared to other popular city-level or province-level destinations in South Korea, GTO has been more active in developing travel routes. The most popular Island destination in South Korea, Jeju Island, has 92 travel routes (https://www.visitjeju.net/en/recommendTour) while the capital of South Korea, Seoul, has only 16 itineraries (https://korean.visitseoul.net/mvp). For this reason, Gangwon Province was chosen as the research area. In study 1, we collected travel route data from the Gangwon Province website to explore how much the GTO considered the time cost for each path when developing its travel routes. In study 2, we opted for travel routes on the basis of real recommended travel routes in Gangwon Province as target stimuli for linking to study 1.

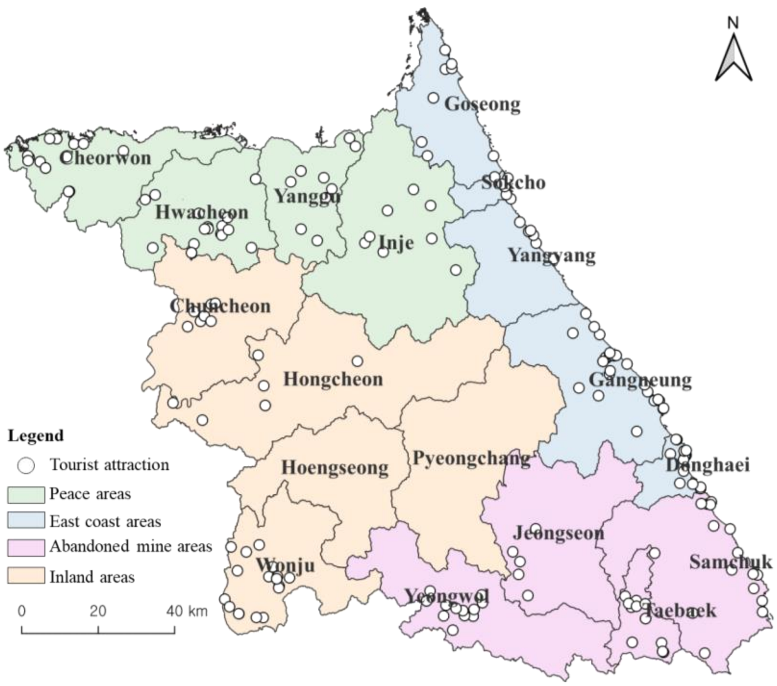


Figure 2. Classification of Gangwon Province

4. Study 1 – Least cost path analysis

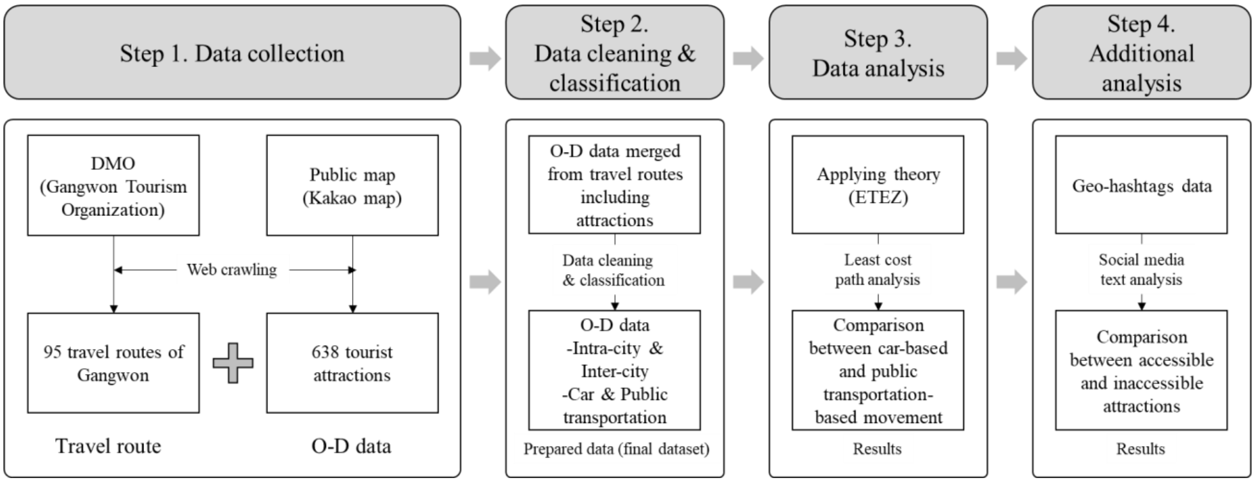


Figure 3. Methodological flowchart of path analysis

Figure 3 shows a flowchart of the methodology for study 1. A case study was conducted in study 1. After targeting the DMO (i.e., GTO), we collected all the travel routes it had developed and measured the time cost for each path in step 1. The second step was to classify the 95 travel routes as intra-city and inter-city based on the literature (Ahlfeldt, 2011; Álvarez-Díaz et al., 2017). In step 3, least cost path analysis was used, based on the ETEZ criteria, to determine how many routes were not accessible in terms of the time distance. Least cost path analysis is a method of analyzing the level of accessibility (e.g., least cost) of a specific path by partial ordering and calculating the required time and distance by car and public transportation (Bagli et al., 2011; Kim et al., 1970). We compared the travel time for each path against 75.2 minutes to determine whether the focal path included an ETEZ. Since a province of South Korea was selected as the geographical context of this study, we applied the ETEZ of domestic tourists in South Korea: areas further from the current location than 75.2 minutes by car represent the ETEZs of domestic tourists, at which point their tourism demand exponentially decreases (Kwon & Kim, 2015). Based on the comparison, we examined the number of paths that were not affordable, in terms of travel time by car and public transportation, to estimate how much GTO considered this form of accessibility when developing a travel route. The last step was to support the indications derived from the previous step by conducting an additional analysis using a geo-hashtag on Instagram.

## 4.1 Data collection, cleaning, and classification

We collected all the travel routes developed by GTO from its website (https://www.gangwon.to/gwtour/go_to_kangwondo/story_gangwondo_2) for 2 weeks in March 2022. A Python-based web crawler was used for obtaining data. While 95 travel routes were collected in total, 12 travel routes were excluded because they included attractions that do not appear on the most popular public map in South Korea (the Kakao Map) or whose addresses were incorrect. Kakao map, a web-based map service in South Korea, is one of the most popular map services, providing various services such as road views and navigation services (Hong, 2020). Accordingly, 83 travel routes were used for further analysis.

The 83 travel routes were refined into the format of an O (Origin) – D (Destination) dataset (i.e., an O-D dataset) based on the paths. For example, when a certain travel route from GTO was composed of 'gallery → beach → cafe → park', the travel route was considered as including 4 attractions and 3 paths (Table 1). From the 83 travel routes, 331 attractions and 447 paths were found after removing duplicates (i.e., the same attraction or route included in different travel routes). We marked all the paths on the Kakao Map and crawled the shortest time (in minutes) and distance (in kilometers) by car and public transportation through the map API.

Table 1. Example of O-D dataset

| Travel route | Path | O | D | Travel time | | Travel distance | |
|---|---|---|---|---|---|---|---|
| | | | | Car | Public Transportation | Car | Public Transportation |
| **1** | 1 | Gallery | Beach | 44 min | 92 min | 30 km | 34 km |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | Beach | Cafe | 74 min | 186 min | 83 km | 87 km |
| 3 | Cafe | Park | 62 min | 85 min | 75 km | 78 km |

We also classified each path as either an intra-city or inter-city path. Much work on the tourist flow or accessibility has been carried out in studies that have separately examined intra-city and inter-city levels for elaborating and maximizing their results on the impact of economic effects (Ahlfeldt, 2011; Álvarez-Díaz et al., 2017). Consequently, we also distinguished between intra-city paths and inter-city paths. An intra-city path refers to a path whose O and D are located within the same city. An inter-city path refers to a path whose O and D are located in different cities. If a travel route included any inter-city paths, it was classified as an inter-city travel route (Figure 4).

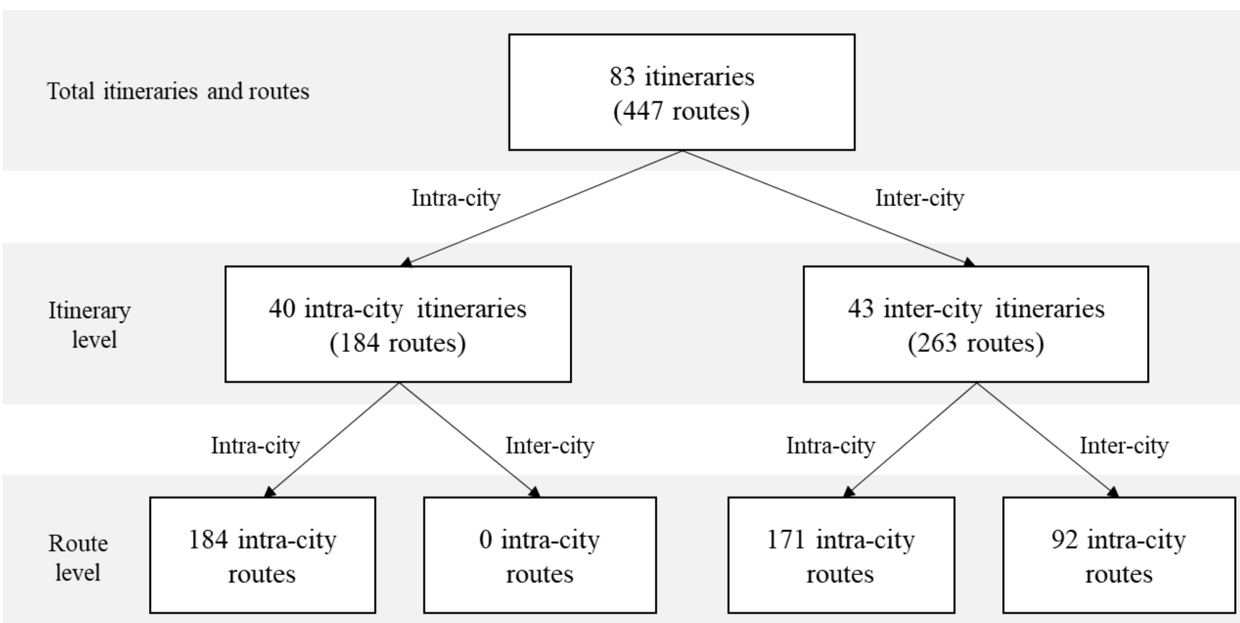


Figure 4. Classification of travel routes and paths

Of the 83 travel routes, 40 paths were classified as intra-city and the remainder as inter-city paths. The paths impossible to travel by public transportation were not added for the calculation of total travel time and distance. Therefore, it is possible that the travel time and distance for a car were less than those for public transportation. The results of the t-test on travel times and distance between the car and public transportation are provided in Table 2. We found that most of results of t-test had a statistically significant differences between private cars and public transportation in travel time and distances. In the case of intra-city travel routes, the result of the t-test showed no significant difference in travel distance between private cars and public transportation.

Table 2. Results of t-test for travel times and distances for intra-city and inter-city travel routes

| Travel routes | | | Mean | SD | t | df | Sig. |
|---|---|---|---|---|---|---|---|
| Total (n = 83) | Travel time | Car | 149.6 min | 124.1 min | -9.239 | 82 | .000 |
| | | Public Transportation* | 302.5 min | 246.5 min | | | |
| | Travel distance | Car | 110.9 km | 105.2 km | 4.941 | 82 | .000 |
| | | Public Transportation** | 63.0 km | 55.3 km | | | |
| Intra-city (n = 40) | Travel time | Car | 83.4 min | 67.5 min | -5.074 | 39 | .000 |
| | | Public Transportation* | 194.8 min | 1952 min | | | |
| | Travel distance | Car | 52.7 km | 47.3 km | 1.054 | 39 | .298 |
| | | Public Transportation** | 48.7 km | 53.7 km | | | |
| Inter-city (n = 43) | Travel time | Car | 211.1 min | 133.4 min | -8.226 | 42 | .000 |
| | | Public Transportation* | 402.8 min | 249.8 min | | | |
| | Travel distance | Car | 165.0 km | 115.3 km | 5.511 | 42 | .000 |
| | | Public Transportation** | 76.4 km | 54.5 km | | | |

* Note: Excluding travel times of routes impossible to travel using public transport

** Note: Excluding distances of routes impossible to travel using public transport

Table 3 shows the results of the t-test for travel times and distances between private cars and public transportation at the path level. Of the 447 paths, 92 were classified as inter-city paths, and the remainder as intra-city paths. The travel times and distances for paths impossible to travel by public transportation were excluded from the analysis. We found that there was a statistically significant difference between private cars and public transportation for travel times and distances at the path level.

Table 3. Results of t-test on travel times and distances for intra-city and inter-city paths

| Paths | | N | Mean | SD | t | df | Sig. |
|---|---|---|---|---|---|---|---|
| Total (n = 447) | | | | | | | |
| Travel time | Car | 446 | 28.2 min | 27.3 min | -24.054 | 365 | .000 |
| | Public Transportation* | 366 | 68.6 min | 52.1 min | | | |
| Travel distance | Car | 446 | 20.6 km | 25.3 km | -7.973 | 322 | .000 |
| | Public Transportation** | 323 | 16.2 km | 14.1 km | | | |
| Intra-city (n = 355) | | | | | | | |
| Travel time | Car | 354 | 20.8 min | 17.3 min | -2.009 | 284 | .000 |
| | Public Transportation* | 285 | 56.2 min | 41.2 min | | | |
| Travel distance | Car | 354 | 13.6 km | 14.7 km | -7.200 | 277 | .000 |
| | Public Transportation** | 278 | 14.5 km | 12.4 km | | | |
| Inter-city (n = 92) | | | | | | | |
| Travel time | Car | 92 | 52.7 min | 37.1 min | -13.957 | 80 | .000 |
| | Public Transportation* | 81 | 112.1 min | 61.8 min | | | |
| Travel distance | Car | 82 | 47.6 km | 36.7 km | -3.619 | 44 | .001 |
| | Public Transportation** | 45 | 26.5 km | 19.1 km | | | |

* Note: Excluding travel times of paths impossible to travel using public transport

** Note: Excluding distances of paths impossible to travel using public transport

4.2 Results: Intra-city travel routes

Figure 5 shows the results of the least cost path analysis, targeting 40 intra-city travel routes that included 184 paths in total. Each line on the map indicates a path from a travel route developed by GTO. The grey solid lines represent paths whose travel time is less than 11.6 minutes, and the black solid lines represent paths whose travel time is between 11.6 minutes and 75.1 minutes. Red solid lines represent paths whose travel time exceeds 75.2 minutes, and the red dotted lines represent focal paths that are not searchable on the Kakao Map.

The grey and black lines represent accessible paths in terms of time distance because their travel time is not over 75.2 minutes. However, the red lines show paths that domestic tourists in South Korea would be reluctant to consider because of their high time cost. In other words, the red lines represent paths including ETEZs, whose travel time is more than 75.2 minutes by either car or public transportation.

In the case of car use (the left-hand image in Figure 5), it was found that almost all the paths developed by GTO did not include ETEZs. Out of 184 routes, 183 were paths whose travel time was less than 75.2 minutes. Only one path appeared as impossible to travel to by car on the Kakao Map: the path from Deokpung Valley to the Freshwater Fish Exhibition Hall.

However, by public transportation (the right-hand image in Figure 5), about one in five paths appeared to include ETEZs. Of 183 paths, 33 were paths whose travel time was over 75.2 minutes using public transportation. Most of the paths including ETEZs were found in the peace area (11 routes) and the abandoned mine area (14 routes) (see Figure 2 for the areas). In addition, 34 paths were impossible to travel by public transportation according to the Kakao Map. Of the 34 non-searchable paths, 13 were in the east coast area, 8 in the abandoned mine area, 7 in the peace area, and 6 in the inland area (see Figure 2 for the areas).

These findings suggest that when tourists use public transportation to travel in Gangwon Province with travel routes developed by its DMO, they will encounter many paths that are not accessible in terms of time cost. Furthermore, tourists will find some paths impossible to travel by public transportation, according to the most popular public map in South Korea. Considering that over 36% of the paths developed by GTO are not accessible by public transportation, GTO's travel routes are not highly adoptable, especially by tourists using public transportation, which applies particularly to younger generations.

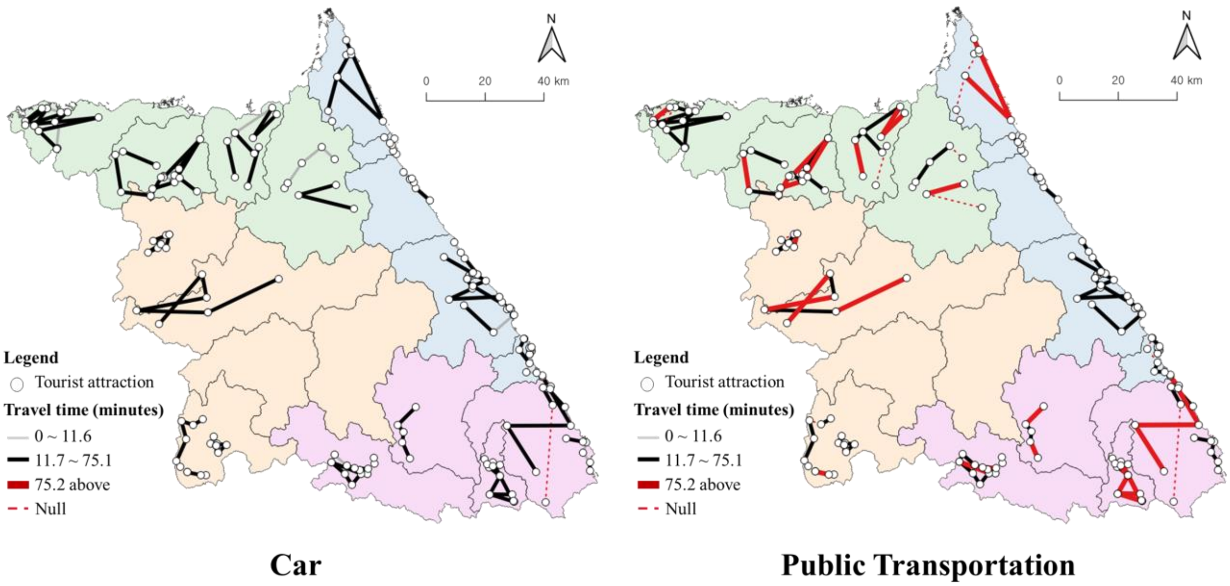


Figure 5. Travel time by car (left) and public transportation (right) for paths for intra-city travel routes

4.3 Results: Inter-city travel routes

Figures 6 and 7 show the results of the least cost path analysis targeting 43 inter-city travel routes that included 263 paths in total. While Figure 6 shows all four types of line, as described previously, Figure 7 shows only the red solid and red dotted lines to make it easy to see the paths that are not affordable in terms of time cost.

Compared to intra-city travel routes, more paths were found to include ETEZs or were revealed on searches to be impossible to travel by car or public transportation. While about 36% of the paths for intra-city travel routes were shown as being difficult to travel by public transportation, the rate was almost 90.1% for the paths in inter-city travel routes.

However, similar to the results of the least cost path analysis of intra-city travel routes, the inter-city travel routes were more difficult to travel using public transportation compared to the use of private cars. Of 263 paths for inter-city travel routes, 22 were ETEZs in the case of car use and 89 were ETEZs if public transportation was used. With regard to paths found on searches to be impossible to travel, none were found in the case of car use, but 47 paths were found if public transportation was used.

According to these findings, it would be more difficult for tourists to travel Gangwon Province with travel routes developed by its DMO when the travel routes include inter-city paths compared to when they include only intra-city ones. Similar to the results for intra-city paths, these findings indicate that the travel routes developed by GTO are not highly accessible to tourists using public transportation, which is common for younger generations.

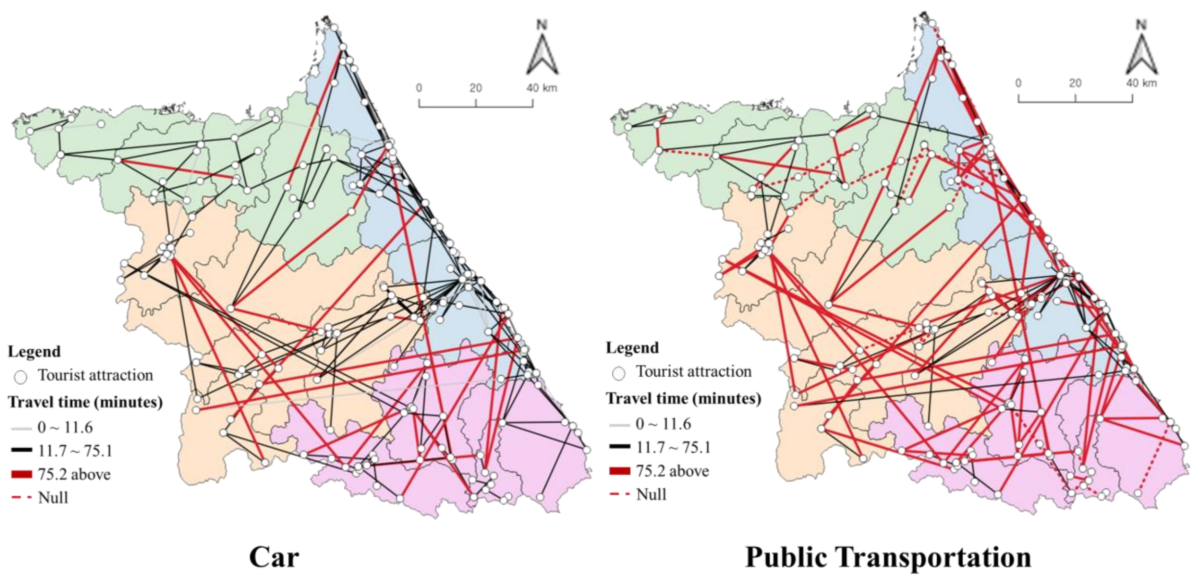


Figure 6. Travel time by car (left) and public transportation (right) for paths in inter-city travel routes.

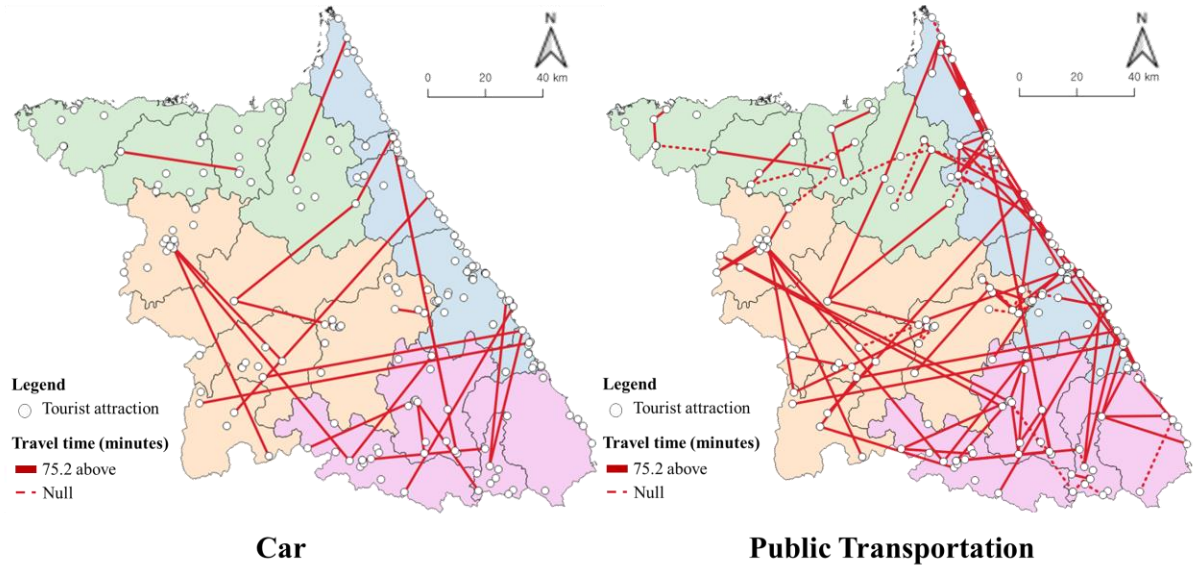


Figure 7. The paths in inter-city travel routes that included ETEZs or were searched as impossible to travel by car (left) and public transportation (right)

4.4 Additional analysis

The results of the least cost path analysis indicate that many travel routes prepared by GTO include attractions that are difficult for younger tourists to visit because these attractions are not accessible by public transportation. To add support to the indications derived from the least cost path analysis, this study conducted an additional analysis using geo-hashtags on Instagram. Social media users can annotate the geographical locations where their hashtags are posted, and these are known as geo-hashtags. The number of geo-hashtags that are annotated to a specific location have been used as an indication of the popularity of the location: The more geo-hashtags a location has, the more visitors the location has received (Clements et al., 2010). In South Korea, about 70% of users of Instagram are members of younger generations (i.e., less than 35 years of age) (Ahlgren, 2022). As such, the number of Instagram geo-hashtags annotated to a location may indicate how popular the location is with younger generations. If a specific location is difficult for younger generations to visit and thus not popular, the number of Instagram geo-hashtags annotated to the location is likely to be lower than the number for more accessible locations. We therefore analyzed the number of geo-hashtags annotated to the attractions included in GTO's travel routes to confirm whether the attractions included in the accessible paths had higher numbers of geo-hashtags than those on less accessible paths.

We categorized all the attractions of GTO's travel routes in terms of whether an attraction was included in an accessible path (accessible attractions hereafter) or not (inaccessible attractions hereafter). We randomly sampled five attractions from each category. We collected all the geo-hashtags annotated to each attraction on Instagram for 5 days in July 2022. A travel-tech startup company in South Korea, Nuua Inc. (https://www.nuua.ai/en/), managed the data collection process.

Table 4 shows the results of a t-test on accessible and inaccessible attractions. We found the average number of Instagram geo-hashtags annotated to accessible attractions was higher ($M = 906.2$, $SD = 500.1$, $t(8) = -3.908$, $p < 0.05$) than those annotated to inaccessible attractions. We also compared the average number of Instagram geo-hashtags that were related to travel (e.g., #GangwonTravel, #GangwonPlacesToGo, etc.) and found similar trends: the average number of travel-related geo-hashtags annotated to accessible attractions (79.4) was higher than for inaccessible attractions (7.4). The results showed that the average number of travel-related Instagram geo-hashtags annotated to accessible attractions was higher ($M = 79.4$, $SD = 32.7$, $t(8) = -4.891$, $p < 0.01$) than for inaccessible attractions. These findings indicated that accessible attractions are likely to be more visited by younger tourists than inaccessible attractions, supporting the results of the least cost path analysis.

Table 4. Results of t-test on Instagram geo-hashtags annotated to accessible and inaccessible attractions

| Attractions | Number of Instagram geo-hashtags | Total | Travel-related |
|---|---|---|---|
| Accessible attractions | Jumunjin Beach | 1541 | 89 |
| | Sun Cruise Hotel & Condo | 1087 | 103 |
| | Haslla Art World | 1008 | 103 |
| | Jeongdongjin Beach | 706 | 78 |

| | | | |
|---|---|---|---|
| | Sandglass park | 189 | 24 |
| | Mean | 906.2 | 79.4 |
| | SD | 500.1 | 32.7 |
| Inaccessible attractions | Gyeongpodae Beach | 59 | 9 |
| | Woljeongsa Temple | 39 | 10 |
| | Pyeongchang Mooee Arts Center | 34 | 11 |
| | Animation Museum | 17 | 5 |
| | Seongyojang House of Gangneung | 8 | 2 |
| | Mean | 31.4 | 7.4 |
| | SD | 19.9 | 3.8 |
| Results | t | -3.908 | -4.891 |
| | df | 8 | 8 |
| | Sig | .017* | .008** |

## 5. Study 2 – Experiment

5.1 Participants, procedure, and measurements

To test the effect of accessibility on preference for different time costs (above 75.2 minutes vs. under 75.2 minutes), we conducted an experimental study. Based on the literature and the results of the least cost path analysis from study 1, we expected that the preference for a travel route with no ETEZ (i.e., under 75.2 minutes) would be higher for potential tourists. To test this prediction, we measured how the preference for a travel route varied with the time cost for each path of the travel route. Given that the main goal of study 2 was to assess the effects of a travel route's accessibility, a within-subjects experiment was used across two conditions: a path in excess of 75.2 minutes and a path less than 75.2 minutes.

The participants in this study were 154 South Korean adults (Mean age = 38.24 years, SD = 11.32) over a period of 2 weeks in October 2022, from online communities in South Korea. We selected South Korea as the destination for study 2 to confirm the findings of study 1. Considering the gender ratio, we selected three online communities: 1) baseball community (yayongsa: https://cafe.daum.net/baseballsale), 2) cosmetic community (powder room: https://cafe.naver.com/cosmania) and 3) interior design tip community (lemon terrace: https://cafe.naver.com/remonterrace). Table 5 provides the demographic profile of the sample. Participants in this study were slightly skewed toward males in terms of gender (571.1 % male). The majority of the respondents were married (60.4%) and had a university degree (51.9%). Furthermore, 22.1% of the sample were employed in office management.

Table 5. Respondents profile.

| | | N (n=201) | Percentage (100%) |
|---|---|---|---|
| Gender | Male | 88 | 57.1 |
| | Female | 66 | 42.9 |

| | | | |
|---|---|---|---|
| Education | High school or below | 28 | 18.2 |
| | College degree | 21 | 13.6 |
| | Bachelor's degree | 80 | 51.9 |
| | Master's degree or higher | 25 | 16.2 |
| Occupation | Student | 25 | 16.2 |
| | Office management | 34 | 22.1 |
| | Sales service | 9 | 5.8 |
| | Technical post | 12 | 7.8 |
| | Specialist | 17 | 11.0 |
| | Public servant | 12 | 7.8 |
| | Housewife | 22 | 14.3 |
| | Simple labor | 5 | 3.2 |
| | Self-employment | 9 | 5.8 |
| | Other | 9 | 5.8 |

All participants were asked to imagine that they had a plan to travel to Gangwon Province, following a travel route provided by the GTO. All participants were exposed to two travel route options (i.e., option A: a travel route including a path in excess of 75.2 minutes, vs. option B: a travel route with all paths less than 75.2 minutes in duration), as shown in Figure 8. The two choices differed in terms of the time cost attributes were based on the literature (Kwon & Kim, 2015) and the findings of study 1. The order in which participants experienced travel route options was randomized to reduce impairment by order (Li et al., 2006). Possible sequences (i.e., A-B and B-A) existed. First, adapting from the measure of preference (Kim et al., 2021), participants were asked to rate their preference (i.e., Do you prefer this travel route?) using a 7-point scale (1 = definitely NO, 7 = definitely YES) for each option. Manipulation checks were also undertaken to check the manipulation of travel time. In particular, we asked the participants to rate "the extent to which you think the travel time is long" for accessibility of travel routes using a 7-point scale (1 = definitely NO, 7 = definitely YES) for each travel route option. Then, they were asked to state their previous visiting experience to Gangwon Province, to improve the internal validity of the experiment. The majority of participants (92.2%) had visiting experience in Gangwon Province.

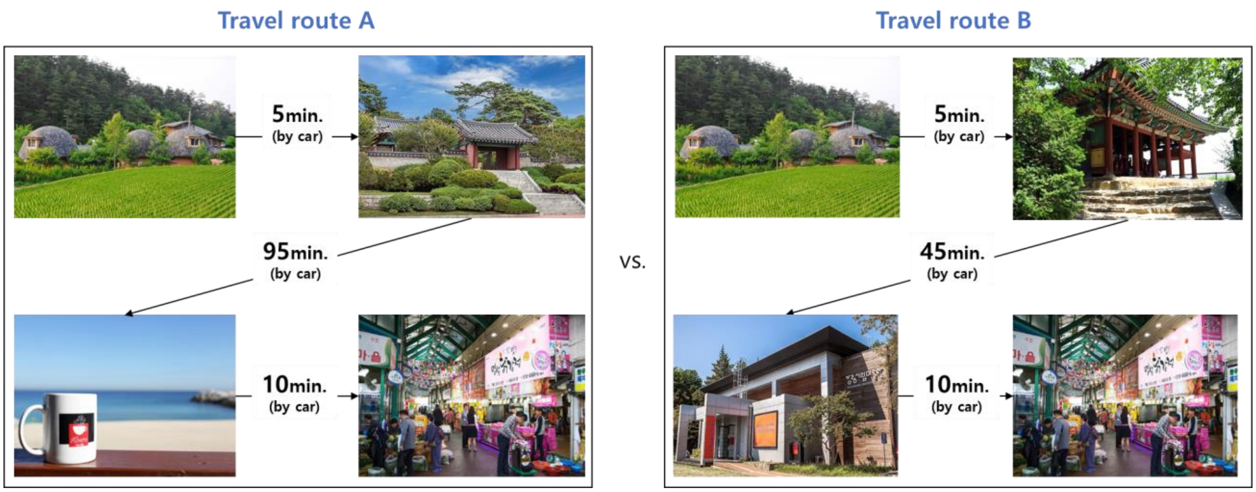


Figure 8. Stimuli for Study 2

5.2 Results

As shown in Figure 9, we found that participants' preference for travel route B (without ETEZ) was higher (Mean$_{_withough\ ETEZ}$ = 4.05, SD = 2.051; t = - .623, $p < 0.01$) compared to those in the travel route A condition (Mean$_{_with\ ETEZ}$ = 3.43, SD = 2.019). Considering that 'Travel route B' had no ETEZ (the paths were less than 75.2 minutes time cost), this result confirmed the prediction that was made based on the literature and the results of study 1. This result is very pertinent: tourists would be very reluctant to use a travel route without consideration of accessibility (i.e., time cost). Tourists tended to have a better attitude toward the travel route with accessibility than to the one with an inaccessible path from origin to destination. Therefore, the results of study 2 emphasized that DMOs should consider accessibility, specifically in terms of time cost, when developing travel routes for tourists.

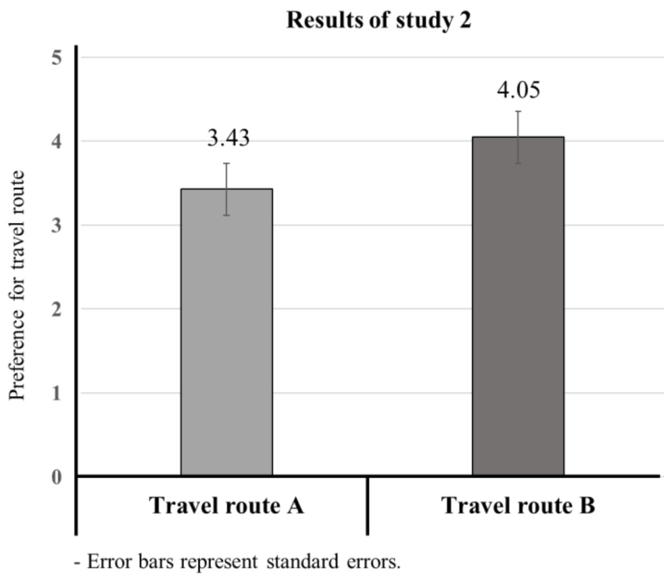


Figure 9. Results of study 2

## 6. Discussion and Implications

This research examined the importance of considering the time cost of every path when assessing a travel route developed by a DMO. To address the objectives, we posed two research questions: 1) How much do developers of travel routes (i.e., DMOs) consider accessibility when developing travel routes from the perspectives of smart tourism cities? 2) How much do tourists prefer travel routes with accessibility compared to those without? We conducted two studies, applying a multi-method approach to address these research questions. First, in study 1, we explored the extent to which a specific DMO considers the time cost of every path, using a case study. We evaluated the time cost of every path in the travel routes developed by a province-level DMO in South Korea (i.e., GTO), according to an ETEZ determined by the distance decay theory via least cost path analysis. We found that many paths in GTO's travel routes are difficult or even impossible to travel by public transportation. This suggests that the travel routes are not accessible by tourists using public transportation, which particularly affects younger generations. The findings of the additional analysis also indicated difficulty completing GTO's travel routes for tourists using public transportation. These findings are aligned with what Liu et al. (2020) argued: many existing travel routes are not well designed to enable tourists to achieve trips within feasible amounts of time (RQ 1).

In study 2, to address the second research question, we examined the importance of considering the time cost of every path for creating an adoptable travel route, using an experiment. We observed how tourists' preferences for a travel route varied according to the time cost of each path in the setting of travel in Gangwon Province, South Korea. We found that the time cost of every path of a travel route significantly affected tourists' preferences for the travel route: the longer the time required to complete any single path in a travel route, the less preferable the travel routes were for potential tourists. Along with previous studies examining the negative impact of time costs on tourists' intention to visit a location (Kah et al., 2016; Yim et al., 2021), this research proposes that developers of travel routes should make every path in a travel route accessible in terms of time cost (RQ 2).

## 6.1 Theoretical and methodological implications

This research provides the following theoretical and methodological implications. First, it contributes to the existing literature by extending the travel route development literature to the specific context of smart tourism cities, which involves the need for accessibility without limitations due to smart tourism cities' infrastructure influencing tourists' mobility. It is also worth noting that prior literature on tourism has examined other factors, such as tourists' preferences or the destination's popularity (Renjith et al., 2020; Sarkar & Majumder, 2022). While some studies have shown the importance of accessibility in travel route planning, there has been relatively little analysis of how much DMOs consider accessibility when developing travel routes. The current study first provided empirical evidence that most paths in the travel routes developed by a major DMO in South Korea are accessible to tourists using private cars, but many are not accessible to those using public transportation. Although prior research on smart tourism cities has emphasized sharing city infrastructure and services (Gretzel & Koo, 2021), our study exemplified another case that developers didn't consider: the accessibility of the city's infrastructure for developing travel routes. To correctly assess the accessibility of a travel route, the time cost measured for different transportation modes, including the mobility infrastructure of cities, needs to be considered. Because accessibility has been rarely discussed as the main aspect of a travel route, most existing research has used the spatiotemporal distance of a path in a travel route calculated only for private car use. However, from the perspective of smart tourism cities, it is essential for tourists to use the residents' infrastructure and services as such cities become new tourism destinations (Buhalis & Amaranggana, 2015; Gretzel & Koo, 2021). This research extends the literature on travel route development by examining the need to use different elements to assess travel routes in the smart tourism cities field, and by pointing out the need to further investigate the accessibility of travel routes.

Second, the most theoretical contribution of this research is the application of the theory of distance decay and an effective tourism exclusion zone (ETEZ), as developed by Mckercher and Lew (2003), to the literature in the context of tourists' perceptions of accessibility of a travel route. In the time since that research, tourism scholars have not fully used the potential of the theory for describing how important the developers of travel routes consider accessibility when they design travel routes (Cao et al., 2020; Schuckert & Wu, 2021; Wong et al., 2021). This study successfully applied the distance decay theory and the concept of ETEZ to address the significance of considering accessibility in assessing travel routes in Gangwon Province in South Korea, adopting a multi-method approach. More importantly, this research argues that tourists' preferences for a travel route are dependent on the time distance (i.e., accessibility of travel route) between the component attractions, and found a significant impact of distance on preferences, using an experiment. Drawing on the theory of distance decay and the concept of ETEZ, the results of study 2 confirmed that the longer the distance between attractions, the less attractive the travel route is to tourists. This finding confirmed the validity of the theory of distance decay in understanding tourists' perceptions of a travel route. This study suggests that (1) travel routes developed by DMOs should be well designed to enable tourists to achieve trips within the timeframe that they find comfortable (i.e., not ETEZ); and (2) the accessibility of a travel route significantly influences tourists' perception of the travel route: the longer the time required to complete any single path in a travel route, the less preferable the travel route is for potential .  multi-method approach also contributes to the literature by examining possible the importance of travel routes' accessibility inducing the travel behavior of potential tourists.

Finally, from a methodological perspective, the current research used a multi-method approach which is an advantage over past methodologies used in the related research literature that could examine how many paths in the travel routes were not affordable or reveal the causal relationship between the accessibility and tourists' preferences of travel routes. This research combined least cost path analysis (study 1), hashtag analysis (additional analysis of study 1), and experimental design to explain how a DMO's travel route can be made more adoptable for tourists. The existing research on developing a travel route recommendation system has focused on explaining what types of new data can be included in the system through data-driven analysis (Renjith et al., 2020; Sarkar & Majumder, 2022). However, most previous research has barely considered tourists' reactions to a travel route recommendation system when measuring the system's performance, and such a lack of potential user input has been noted as a limitation

(Halder et al., 2022). To overcome these limitations, our research using multi-method studies reaffirms the previous knowledge (Mckercher & Lew, 2003; Renjith et al., 2020; Sarkar & Majumder, 2022) and empirically offers evidence that shows an understanding of how the travel route should involve not only the physical distance between tourist destinations but also accessibility, using the mobility of smart tourism cities. The example of Gangwon Province in the current research shows how much accessibility is given consideration by route developers and motivates an epistemological discussion on tourists' preferences for travel routes and the impact of accessibility in decision-making. With a clear causality established by our experimental design in this research, the power of travel routes' accessibility should be noted by the tourism industry, confirming the need for researchers to examine tourists' reactions to a travel route recommendation system when measuring the system's performance. Therefore, the use of a multi-method approach contributes to improving the relevance of tourism research to practice and gaining a comprehensive understanding of the accessibility of travel routes.

### 6.2 Practical implications

This research suggests to developers or operators the importance of accessibility when developing or assessing travel routes. Our results suggest how developers (e.g., DMOs and tour operators) can improve the accessibility of a travel route and make it adoptable by different segments of the tourist population. For instance, Gangwon Province, which was the study area, has suffered from regional imbalances in its tourism economy and has attempted to address the problem by developing itineraries recommending relatively unknown areas of Gangwon Province (Gangwon-Province, 2021b). It is important for DMOs to encourage different tourist market segments to adopt these itineraries and, subsequently, to visit less popular regions of the province. The findings of this research provide a possible strategy to achieve this goal: if developers of travel routes make every route in an itinerary achievable by private cars and public transportation, different types of tourists, especially those primarily using public transportation (e.g., younger tourists), will be able to adopt the itinerary more easily.

From a broad perspective, developers could derive an additional rule about developing a travel route from this research. According to our findings, tourists' preferences for a travel route are significantly affected by the time cost of the travel route at the path level: even if all other paths are temporally accessible, if there is a path whose time cost is high, the whole travel route may be less preferred by tourists. The previous research on travel route development has advised DMOs to assess their travel routes as a whole by considering the total number of attractions or total temporal or spatial distance in the travel route (Li et al., 2016; Xu & Xu, 2022). This research adds to the practical implications of the existing studies by encouraging developers and operators to design or assess their travel routes not only at the travel route level but also at the path level.

### 6.3 Limitations and future research

Despite the theoretical and practical implications of this research, there are several limitations to be addressed in future studies. First, the findings of this research are difficult to generalize because the results are limited to specific geographic areas (i.e., Gangwon Province). Compared to GTO, other DMOs in South Korea, other countries, and other tour operators could have different levels of expertise in developing travel routes. The importance of the accessibility of a travel route may be either more or less recognized depending on the cultural backgrounds of potential tourists. It is also important to note that the sample in study 2 was comprised of Korean residents. We suggest that there could be systematic differences such as the influence of tourists' origins, which would make extrapolating the results to other contexts challenging. To overcome these issues of generalization, we conducted an additional experiment to replicate study 2 using US participants (see Appendix A). As in study 2, the result of the additional experiment was similar in that the preference for travel route B (without ETEZ) was higher compared to travel route A (with ETEZ).

Second, this research used the time cost to represent the accessibility of a travel route, without considering other related elements, such as the spatial distance or the monetary cost (Herszenhut et al., 2022; Kurashima et al., 2013). As argued in this research, the accessibility of a travel route can be correctly assessed when a variety of elements are adopted. Further studies need to use more diverse elements related to the accessibility of a travel route. Finally, since this study explored only tourists' preferences for travel routes without ETEZ or with ETEZ, a future study needs to adopt more variables, such as the popularity of a specific attraction, or travel companions' interests (Renjith et al., 2020; Sarkar & Majumder, 2022). Tourists' preferences for the hypothetical travel route examined in the experiment could be affected by factors other than the time cost of the path. It would be interesting to compare results to identify other variables.

## References


Ahlfeldt, G. M. (2011). The train has left the station: Do markets value intracity access to intercity rail connections?. *German Economic Review, 12*(3), 312-335.

Ahlgren, M. (2022). 40+ Instagram Statistics & Facts for 2022. *Website Rating.* Retrieved from https://www.websiterating.com/research/instagram-statistics/#chapter-2

Almobaideen, W., Krayshan, R., Allan, M., & Saadeh, M. (2017). Internet of Things: Geographical Routing based on healthcare centers vicinity for mobile smart tourism destination. *Technological Forecasting and Social Change, 123*, 342-350.

Álvarez-Díaz, M., D'Hombres, B., & Ghisetti, C. (2017). Modelling inter-and intra-regional tourism flows in Spain– a spatial econometric approach. *Regional Statistics, 7*(2), 3-34

Bagli, S., Geneletti, D., & Orsi, F. (2011). Routeing of power lines through least-cost path analysis and multicriteria evaluation to minimise environmental impacts. *Environmental Impact Assessment Review, 31*(3), 234-239.

Buhalis, D., & Amaranggana, A. (2013). *Smart tourism destinations enhancing tourism experience through personalisation of services.* Information and communication technologies in tourism 2014, Springer: Cham.

Bull, A. (1991). *The Economics of Travel and Tourism*. Melbourne: Pitman.

Cai, G., Lee, K., & Lee, I. (2018). Itinerary recommender system with semantic trajectory pattern mining from geo-tagged photos. *Expert Systems with Applications, 94*, 32-40.

Cao, J., Zhang, J., Wang, C., Hu, H., & Yu, P. (2020). How far is the ideal destination? Distance desire, ways to explore the antinomy of distance effects in tourist destination choice. *Journal of Travel Research, 59*(4), 614-630.

Clements, M., Serdyukov, P., De Vries, A. P., & Reinders, M. J. (2010). *Using flickr geotags to predict user travel behaviour.* Paper presented at the Proceedings of the 33rd International ACM SIGIR Conference on Research and Development in Information Retrieval.

DMA West Education & Research Foundation. (2021). The impact of DMO visitor guides: 2020-2021 DMO visitor guide readership & conversion study. *DMA West.* Retrieved from https://www.dmawest.org/files/5216/3613/2036/Executive_Summary_-_2020-2021_Visitor_Guide_Readership_Study_-_110521.pdf

Del Vecchio, P., Mele, G., Ndou, V., & Secundo, G. (2018). Creating value from social big data: Implications for smart tourism destinations. *Information Processing & Management, 54*(5), 847-860.

Gangwon-Province. (2021a). 2021-2040 Gangwon Comprehensive Plan. *Gangwon-Province.* Retrieved from https://www.provin.gangwon.kr/upload/pdf/gangwon2021-2040.pdf

Gangwon-Province. (2021b). Pilot Proejct of Balanced Development of Regions in the Province. *Official Blog of Gangwon-Province.* Retrieved from https://blog.naver.com/gwdoraeyo/222367773718

Gour, A., Aggarwal, S., & Erdem, M. (2021). Reading between the lines: analyzing online reviews by using a multi-method Web-analytics approach. *International Journal of Contemporary Hospitality Management, 33*(2), 490-512.

Gretzel, U. (2021). Conceptualizing the Smart Tourism Mindset: Fostering Utopian Thinking in Smart Tourism Development. *Journal of Smart Tourism, 1*(1), 3-8.

Gretzel, U., & Koo, C. (2021). Smart tourism cities: a duality of place where technology supports the convergence of touristic and residential experiences. *Asia Pacific Journal of Tourism Research, 26*(4), 352-364

Gretzel, U., Sigala, M., Xiang, Z., & Koo, C. (2015). Smart tourism: foundations and developments. *Electronic markets, 25*(3), 179-188.

Halder, S., Lim, K. H., Chan, J., & Zhang, X. (2022). Efficient itinerary recommendation via personalized POI selection and pruning. *Knowledge and Information Systems, 64*(4), 963-993.

He, S. (2022). Research on tourism route recommendation strategy based on convolutional neural network and collaborative filtering algorithm. *Security and Communication Networks, 2022*.

Herszenhut, D., Pereira, R. H., da Silva Portugal, L., & de Sousa Oliveira, M. H. (2022). The impact of transit monetary costs on transport inequality. *Journal of Transport Geography, 99*, 103309.

Hong, S. Y. (2020). Linguistic landscapes on street-level images. *ISPRS International Journal of Geo-Information, 9*(1), 57.

Hooper, J. (2015). A destination too far? Modelling destination accessibility and distance decay in tourism. *GeoJournal, 80*(1), 33-46.

Innes, J. E., & Booher, D. E. (1999). Metropolitan development as a complex system: A new approach to sustainability. *Economic Development Quarterly, 13*(2), 141-156.

Jin, Q., Hu, H., Su, X., & Morrison, A. M. (2021). The Influence of the characteristics of online itinerary on purchasing behavior. *Land, 10*(9), 936-954.

Kah, J. A., Lee, C.-K., & Lee, S.-H. (2016). Spatial–temporal distances in travel intention–behavior. *Annals of Tourism Research, 57*, 160-175.

Khadaroo, J., & Seetanah, B. (2008). The role of transport infrastructure in international tourism development: A gravity model approach. *Tourism Management, 29*(5), 831-840.

Kim, E., Kohout, L., Dubrosky, B., & Bandler, W. (1970). Use of fuzzy relations for affordability de-cisions in high technology. *WIT Transactions on Information and Communication Technologies, 16*.

Kim, J. (2021). Spatial Multicriteria Decision Analysis: A Powerful Tool for Participatory Decision-Making in Community-based Tourism Research. *Journal of Smart Tourism, 1*(4), 3-7.

Kim, S. S., Kim, J., Badu-Baiden, F., Giroux, M., & Choi, Y. (2021). Preference for robot service or human service in hotels? Impacts of the COVID-19 pandemic. *International Journal of Hospitality Management, 93,* 102795.

Konstantakis, M., Alexandridis, G., & Caridakis, G. (2020). A personalized heritage-oriented recommender system based on extended cultural tourist typologies. *Big Data and Cognitive Computing, 4*(2), 12.

Kurashima, T., Iwata, T., Irie, G., & Fujimura, K. (2013). Travel route recommendation using geotagged photos. *Knowledge and Information Systems, 37*(1), 37-60.

Kwon, J. Y., & Kim, E. (2015). Analysis of Tourism Demand Elasticities by Travel Time Distance in Korea. *Journal of the Korean Regional Science Association, 31*(1), 65-81.

Lee, P., Hunter, W. C., & Chung, N. (2020). Smart tourism city: Developments and transformations. *Sustainability, 12*(10), 3958.

Li, S., Walters, G., Packer, J., & Scott, N. (2018). Using skin conductance and facial electromyography to measure emotional responses to tourism advertising. *Current Issues in Tourism, 21*(15), 1761-1783.

Li, X., Zhou, J., & Zhao, X. (2016). Travel itinerary problem. *Transportation Research Part B: Methodological, 91*, 332-343.

Lim, K. H., Chan, J., Karunasekera, S., & Leckie, C. (2017). *Personalized itinerary recommendation with queuing time awareness.* Paper presented at the Proceedings of the 40th International ACM SIGIR Conference on Research and Development in Information Retrieval.

Lim, K. H., Chan, J., Karunasekera, S., & Leckie, C. (2019). Tour recommendation and trip planning using location-based social media: A survey. *Knowledge and Information Systems, 60*(3), 1247-1275.

Liu, J., Wood, K. L., & Lim, K. H. (2020). *Strategic and Crowd-Aware Itinerary Recommendation.* Paper presented at the Joint European Conference on Machine Learning and Knowledge Discovery in Databases.

Lo, A. S., & Lee, C. Y. (2011). Motivations and perceived value of volunteer tourists from Hong Kong. *Tourism Management, 32*(2), 326-334.

Losch, A. (1954). *Economics of location.*

Masiero, L., & Hrankai, R. (2022). Modeling tourist accessibility to peripheral attractions. *Annals of Tourism Research, 92*, 103343.

McKercher, B. (1998). The effect of distance decay on visitor mlx at coastal destinations. *Pacific Tourism Review, 2*(3-4), 215-223.

McKercher, B. (2018). The impact of distance on tourism: a tourism geography law. *Tourism Geographies, 20*(5), 905-909.

McKercher, B., Chan, A., & Lam, C. (2008). The impact of distance on international tourist movements. *Journal of Travel Research, 47*(2), 208-224.

Mckercher, B., & Lew, A. A. (2003). Distance decay and the impact of effective tourism exclusion zones on international travel flows. *Journal of Travel Research, 42*(2), 159-165.

McKercher, B., & Mak, B. (2019). The impact of distance on international tourism demand. *Tourism Management Perspectives, 31,* 340-347.

Medlik, S. (2012). *Dictionary of Travel, Tourism and Hospitality*. New York: Routledge.

Mehmood, F., Ahmad, S., & Kim, D. (2019). Design and development of a real-time optimal route recommendation system using big data for tourists in Jeju Island. *Electronics, 8*(5), 506.

National Travel Center. (2022). 2022 Road trip survey. *National Travel Center.* Retrieved from https://irp.cdn-website.com/201e5aa2/files/uploaded/National%20Travel%20Center%20Road.Travel%202022%20DMO%20Survey%20Results%20-%20Final%20Report.pdf

Nekola, J. C., & White, P. S. (1999). The distance decay of similarity in biogeography and ecology. *Journal of Biogeography, 26*(4), 867-878.

Neirotti, P., De Marco, A., Cagliano, A. C., Mangano, G., & Scorrano, F. (2014). Current trends in Smart City initiatives: Some stylised facts. *Cities, 38*, 25-36.

Olsen, M. (2003). Tourism themed routes: A Queensland perspective. *Journal of Vacation* Marketing, *9*(4), 331-341.

Păcurar, C. M., Albu, R.-G., & Păcurar, V. D. (2021). Tourist route optimization in the context of Covid-19 pandemic. *Sustainability, 13*(10), 5492.

Park, S. (2021). Big data in smart tourism: a perspective article. *Journal of Smart Tourism, 1*(3), 3-5.

Park, S., Xu, Y., Jiang, L., Chen, Z., & Huang, S. (2020). Spatial structures of tourism destinations: A trajectory data mining approach leveraging mobile big data. *Annals of Tourism Research, 84,* 102973.

Rani, S., Kholidah, K. N., & Huda, S. N. (2018). *A development of travel itinerary planning application using traveling salesman problem and k-means clustering approach.* Paper presented at the Proceedings of the 2018 7th International Conference on Software and Computer Applications.

Renjith, S., Sreekumar, A., & Jathavedan, M. (2020). An extensive study on the evolution of context-aware personalized travel recommender systems. *Information Processing & Management, 57*(1), 102078.

Roy, N., & Gretzel, U. (2020). Themed route marketing in India. *Anatolia, 31*(2), 304-315.

Sarkar, J. L., & Majumder, A. (2022). gTour: Multiple itinerary recommendation engine for group of tourists. *Expert Systems with Applications, 191*, 116190.

Sarkar, J. L., Majumder, A., Panigrahi, C. R., Ramasamy, V., & Mall, R. (2021). *TRIPTOUR: A Multi-itinerary Tourist Recommendation Engine Based on POI Visits Interval.* Paper presented at the 2021 12th International Conference on Computing Communication and Networking Technologies (ICCCNT).

Schuckert, M., & Wu, J. S. (2021). Are neighbour tourists more sensitive to crowding? The impact of distance on the crowding-out effect in tourism. *Tourism Management, 82*, 104185.

Tenemaza, M., Luján-Mora, S., De Antonio, A., & Ramirez, J. (2020). Improving itinerary recommendations for tourists through metaheuristic algorithms: an optimization proposal. *IEEE Access, 8*, 79003-79023.

Tobler, W. R. (1970). A computer movie simulating urban growth in the Detroit region. *Economic Geography, 46*, 234-240.

Vansteenwegen, P., Souffriau, W., Berghe, G. V., & Van Oudheusden, D. (2011). The city trip planner: An expert system for tourists. *Expert Systems with Applications, 38*(6), 6540-6546.

Vanolo, A. (2014). Smartmentality: The smart city as disciplinary strategy. *Urban studies, 51*(5), 883-898.

Vidon, E. S., & Rickly, J. M. (2018). Alienation and anxiety in tourism motivation. *Annals of Tourism Research, 69*, 65-75.

Vu, H. Q., Li, G., Law, R., & Zhang, Y. (2018). Travel diaries analysis by sequential rule mining. *Journal of Travel Research, 57*(3), 399-413.

Wang, C. (2021). *Research on Smart Tourism Route Planning Based on Ant Colony Algorithm.* Paper presented at the proceedings of 2021 2nd Artificial Intelligence and Complex Systems Conference.

Wengel, Y. (2020). LEGO®Serious Play®in multi-method tourism research. *International Journal of Contemporary Hospitality Management, 32*(4), 1605-1623.

Wong, I. A., Zhang, G., Zhang, Y., & Huang, G. I. (2021). The dual distance model of tourism movement in intra-regional travel. *Current Issues in Tourism, 24*(9), 1190-1198.

Xiang, Z., & Fesenmaier, D. R. (2017). *Big data analytics, tourism design and smart tourism,* Sringer: Cham.

Xu, J., & Xu, J. (2022). *Research on the design of online travel service recommendation system based on data analysis.* Paper presented at the International Conference on Cognitive based Information Processing and Applications (CIPA 2021).

Yang, E., Kim, J., Pennington-Gray, L., & Ash, K. (2021). Does tourism matter in measuring community resilience?. *Annals of Tourism Research, 89*, 103222.

Yim, B. H., Lyberger, M. R., & Song, D. (2021). Push–pull analysis: The mediating role of promotion types relative to visit intention to a sports museum. *International Journal of Sports Marketing and Sponsorship*.

Yochum, P., Chang, L., Gu, T., Zhu, M., & Chen, H. (2020). *A genetic algorithm for travel itinerary recommendation with mandatory points-of-interest.* Paper presented at the International Conference on Intelligent Information Processing.

Zhang, Y., Xu, J.-H., & Zhuang, P.-J. (2011). The spatial relationship of tourist distribution in Chinese cities. *Tourism Geographies, 13*(1), 75-90.

Zheng, W., Liao, Z., & Qin, J. (2017). Using a four-step heuristic algorithm to design personalized day tour route within a tourist attraction. *Tourism Management, 62*, 335-349.

**Appendix A.**

Additional experimental study

The purpose of the additional experimental study was to replicate the empirical findings from South Korea in another country, namely the US, to increase the external validity of our findings. The participants in this study were 201 US adults from an online panel (Amazon Mechanical Turk). Table 5 provides the demographic profile of the sample. Participants in this study were slightly skewed toward male in terms of gender (55.7% male). The majority of the respondents were in the 30-49 years age bracket (62.7%) and had a university degree (56.2%). Furthermore, 19.9% of the sample were employed in office management.

Table 5. Respondents profile.

| | | N (n=201) | Percentage (100%) |
|---|---|---|---|
| Gender | Male | 112 | 55.7 |
| | Female | 89 | 44.3 |
| Age | 20-29 | 23 | 11.4 |
| | 30-39 | 77 | 38.3 |
| | 40-49 | 49 | 24.4 |
| | 50-59 | 34 | 16.9 |
| | 60-69 | 16 | 8.0 |
| | 70 and over | 2 | 1.0 |
| Education | High school or below | 44 | 21.9 |
| | College's degree | 44 | 21.9 |
| | Bachelor's degree | 77 | 38.3 |
| | Master's degree or higher | 36 | 17.9 |
| Occupation | Student | 5 | 2.5 |
| | Office management | 40 | 19.9 |

| | | | |
|---|---|---|---|
| | Sales service | 22 | 10.9 |
| | Technical post | 33 | 16.4 |
| | Specialist | 20 | 10.0 |
| | Public servant | 15 | 7.5 |
| | Housewife | 13 | 6.5 |
| | Other | 53 | 26.4 |

Since Florida is a destination with abundant tourism resources (such as beaches and theme parks), similar to Gangwon Province (Yang et al., 2021), we chose Florida as the destination for the tourist itinerary scenario for study 2. All participants were asked to imagine that they had a plan to travel to Florida, following a travel itinerary provided by the Florida Tourism Marketing Organization. All participants were exposed to two itinerary options (i.e., option A: an itinerary including a route in excess of 75.2 minutes, vs. option B: an itinerary with all routes less than 75.2 minutes in duration), as shown in Figure 10. The two choices differed in terms of the time cost attributes examined, based on the literature and the findings of study 1. The order in which participants experienced the tourist itinerary options was randomized to reduce impairment by order (Li et al., 2006). Possible sequences (i.e., A-B and B-A) existed. Finally, participants were asked to rate their preference (i.e., Do you prefer this travel itinerary?) using a 7-point scale (1 = definitely NO, 7 = definitely YES) for each option.


Figure 10. Itinerary options

As shown in Figure 11, we found that participants' preference for itinerary B (without ETEZ) was higher (Mean = 4.94, SD = 1.696) compared to the itinerary A condition (M = 4.08, SD = 1.779; t = -5.610, p < 0.001) (Table 10). Considering that 'Itinerary B' had no ETEZ (the routes were less than 75.2 minutes time cost), this result confirmed the prediction that was made based on the literature and the results of study 1. This result is very pertinent: tourists would be very reluctant to use an itinerary without consideration of accessibility (i.e., time cost). Tourists tended to have a better attitude toward an itinerary with accessibility than to one with an inaccessible route from origin to destination. Therefore, the results of this additional study emphasized that DMOs should consider accessibility, specifically in terms of time cost, when developing itineraries for tourists.

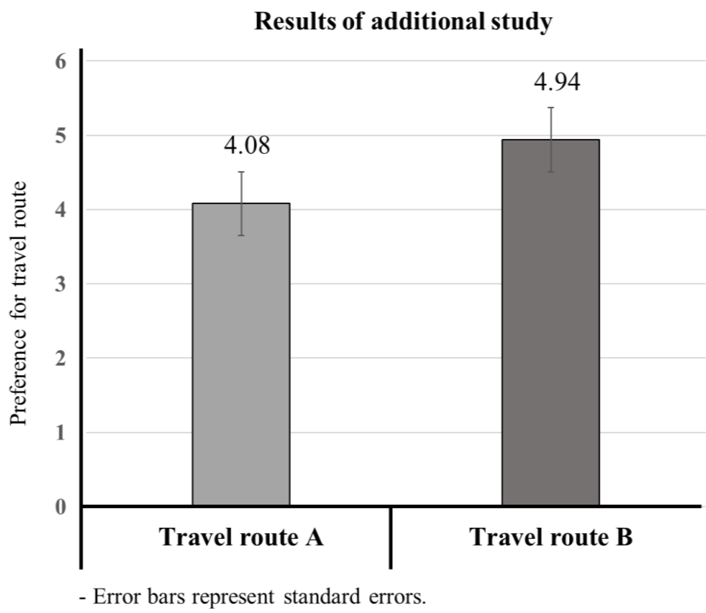


Figure 11. Results of additional study (Appendix)