

CITY TOURISM APPLICATION FUNCTIONALITY FROM THE PERSPECTIVE OF TOURIST EXPERIENCE AND TECHNOLOGY ACCEPTANCE MODELS

Katarzyna PAWLAK

Military University of Technology, Warsaw; katarzyna.pawlak@wat.edu.pl, ORCID: 0000-0002-1781-1059

Purpose: The purpose of the article is to identify the city tourism app functions affecting the process of users' technology adoption. The article presents the issues related to tourism apps and the role thereof in building tourist experience, as well as selected models of technology acceptance. The paper goes on to discuss the results of a survey of selected Polish cities' tourism applications.

Design/methodology/approach: For the purpose of the study, a critical analysis of the literature on the subject was carried out, followed by analysis of selected applications and a qualitative study of application users' comments. The study was conducted in accordance with the constructivist grounded theory. The process of user comment coding and analysis involved the use of the ATLAS.ti qualitative data analysis software.

Findings: Based on the critical analysis of the literature and the survey of selected applications, a city tourism app functionality assessment model has been proposed. The need for urban app changes, to enhance the tourist experience, has been indicated as well.

Research limitations/implications: The subject of the study comprised official city tourism applications. The survey encompassed applications which met the following criteria: the apps surveyed were official city apps, the potential thereof were tourists, the apps have been rated and commented.

Practical implications: The results of the study can serve to increase the effectiveness of the promotional activities implemented by cities employing such applications to form relations with tourists. To a limited extent, they can also serve to facilitate the designing of apps intended for city residents.

Social implications: The article draws attention to the issues of user involvement in the process of city tourism app development. The sphere of city applications can become a platform for tourist interaction, while the apps themselves can improve the quality of the tourists' experience as well as their functioning in the city.

Originality/value: The article fills the research gap in the studies on city tourism apps. It draws attention to the necessity of taking the following into account when designing such applications: the specifics of the tourist experience as a process, consideration of the app as an element of the tourist's technological experience, accentuation of those app functions, which are crucial from the perspective of the app acceptance process.

Keywords: mobile apps, city tourism apps, tourist experience, technology acceptance process, technology adoption process.

Paper category: Research paper.

1. Introduction

The rapid development of mobile technologies and the increase in users' digital competence have been fostering organizations' use of mobile devices as a tool for communication, sales and consumer relationship building. Daily use of mobile devices and apps has become a habit for the modern consumer (Dorcic et al., 2018). Consumers use mobile apps to make purchases, browse social media, listen to music and watch movies. When traveling for tourism, consumers also turn to a range of mobile apps which help them plan and execute their trips.

Mobile apps are perfectly suited to the peculiarities of urban tourism, where tourists usually opt for a short stay in particular city and want to quickly obtain information about the city, its history, economy, and the residents' culture and customs (Zawadzki, 2018). Cities, especially those with a rich tourist offer, are among the most visited tourist destinations (Papinska-Kacperek, 2016; Beluszko, 2015; Chmielewski et al., 2022).

Tourists have a range of technologies at their disposal to help them get acquainted with a given city's offer: making it easier to navigate the city, develop sightseeing itineraries, book accommodation, check historical monument and restaurant recommendations. City apps developed for tourists, which can serve as an alternative to many individual tools, are one such technological innovation.

The article attempts to determine what functions and elements a city app should include in order to be a useful tool for tourists and to contribute to the city's promotional goals. It discusses the role of such apps in the tourist experience as well as examines what main functions and elements a city tourism app should include in order to increase its acceptability to tourists, taking the level of the technological experience offered and the functions performed at different stages of the tourist experience into account, from the perspective of selected theories of information technology (mobile application) adaptation.

The purpose of the article is to investigate what functions a city's tourism app should include in order to serve as a useful tool for the tourists. To determine these functions, the following tasks were necessary:

1. Examination of the role of a city tourism app in the tourism process, at various stages thereof.
2. Identification of the role of a city tourism app in the process of building different levels of a tourist's technological experience.
3. Identification of the factors which are of key significance from the perspective of the technology (application) acceptance process, resulting in a proposal of an application assessment model.
4. Assessment of selected city apps (Polish cities) in terms of the realized tourist experience building and application acceptance functions.

5. Development and proposal of a city tourism app assessment model: identification of the main categories to be included at the stage of city tourism app design, which can be serve as measurement scale elements in quantitative studies.

The research objectives were implemented based on a critical analysis of the literature on the subject and an analysis of the city apps, including user comments, developed for the largest cities in Poland.

2. City tourism applications as a tool for building tourist experience

2.1. Mobile apps in tourism

Mobile apps are a type of software designed for mobile devices, mainly cell phones and tablets. These are either paid or free of charge software solutions, the vast majority of which are available vis Google Play (for Android devices), iTunes App Store (for iOS) and Windows Phone Market (for Windows Phone operating system) (Seweryn, 2014). Some applications also use micropayments - such apps provide additional features only after a fee is paid.

Mobile applications, using the technical capabilities of a mobile device, can enable a very wide range of functions, such as game playing, information browsing, listening to music, establishment of contacts and communication with friends, or purchase making. In practice, most of the available apps combine the functions listed.

Mobile applications can be divided according to the manner of the development thereof:

1. Native applications - developed in a specific programming language for a particular mobile device operating system (e.g., Java or Kotlin for Android, Swift or Objective-C for iOS). These apps are tailored to a specific operating system, by which they gain wide access to the mobile device's features and resources: camera, GPS, microphone, calendar, clock, address book. They work smoothly, efficiently, in online, offline and mixed modes. The disadvantage of the solution entails the longer time and cost of developing applications compatible with different systems.
2. Responsive (web) applications - special versions of websites, which are adapted for mobile devices. They do not require different versions for different operating systems. They are a cheaper, faster solution, but the capabilities of this type of applications are less.
3. Hybrid applications - applications consisting of native and web app elements. They are compatible with all mobile device operating systems, with possible use of both the functionality and the resources of the mobile device (e.g., camera, GPS, calendar, etc.). They can run slower than native apps (Manczak, Bajak, 2021), however.

Based on the possible application thereof, mobile apps can be divided into personal, informational, transactional, location-based, business and entertainment apps. Each of these types finds application in tourism (Piechota, 2014), including the city apps developed for tourists.

Typically, urban tourism apps are intended to facilitate the planning of a visit to a given city and enhance the tourist's experience during the stay. Such apps also aid the users in the choice of the tourist attractions, restaurants, hotels, cultural events, as well as simplify sightseeing route planning. They provide city information, photographs, audio and video content. They enable the users to navigate the city, by offering sightseeing routes and maps with marked objects (e.g., bus/subway stops). They often include local guides with hospital, pharmacy, ATM, parking lot or city bike rental addresses and locations. Such apps can be of practical use not only for tourists, but for residents as well (Papinska-Kacperek, 2016).

Development of city tourism apps can be commissioned by city authorities or such public institutions as museums, associations, and tourism organizations. They are usually made available to users free of charge, through Google Play, App Store and WP Market, or via government office and other public institution websites. Museum apps installed for a fee, for instance, can be an exception. Such apps are also developed as 'grassroots' initiatives and made available free of charge via public data platforms (Papinska-Kacperek; Polanska, 2016).

A large number of tourism apps are developed by various private entities or associations (e.g., hotels and restaurants) wanting to promote their services in this way. Most of such apps are free of charge, while the system maintenance is financed by the fees charged for in-app advertisements or for inclusion of advertised institutions' full offers in given categories of facilities (e.g., restaurants). Companies such as Amistad sp. z o.o. (apps for the cities of Toruń, Bydgoszcz, Gdynia), Alles Web (Toruń, Warsaw, Poznań), Clearvision sp. z o.o. (Krakow, Warsaw, Zakopane) or SmartGuide s.r.o. (Krakow, Warsaw) specialize in development of commercial city applications.

The city tourism applications financed by local governments can serve such purposes as:

1. Collection of information on the users, their characteristics, and behavior during their stay, via analysis of the GPS module data. The collected data allow personalization of the tourist communication and offer.
2. Promotion of the city (region) and its offer, as well as sales activation - based on the collected user data, such apps allow targeting the users with personalized marketing, taking user location and preferences into account. In addition to providing the tourists with city-related information, such apps can be used to promote local tourist businesses, by offering various types of city cards entitling to catering, hotel service and city guide discounts, etc.

3. Tourist traffic management - information on the tourists' location allows the apps to track their sightseeing routes or the places visited, including the time spent at those locations. Based on such data, tour route times can be estimated, users can be suggested different routes and encouraged to visit less frequented locations. City apps can also be used in various critical situations tourists may encounter, e.g., to help manage their city navigation and communicate necessary information (Dorcic et al., 2018; Kachniewska, 2019).

2.2. The role of tourism apps in tourist experience

Modern tourists reach for tourism apps (including city apps) and other modern IT tools at different stages of their travels, with different intensities (Dziadkiewicz, 2020).

At the stage of travel arrangements, tourists need to make a number of decisions regarding the destination, place of departure, attractions to be visited. They acquaint themselves with the city descriptions by browsing online sources (e.g., travel blogger sites, social media groups dedicated to tourism, city websites, websites of individual tourist attractions), rather than by using traditional book city guides (Figure 1). In this stage, tourists turn to the tools facilitating travel route planning (maps, carrier websites, hotel service aggregators, such as booking.com, or recommendation websites dedicated to individual tourism). They then book the travel services, using various organizations' websites and applications, which store information on the tourists' transactions, tickets, reservations, discounts and special entitlements.

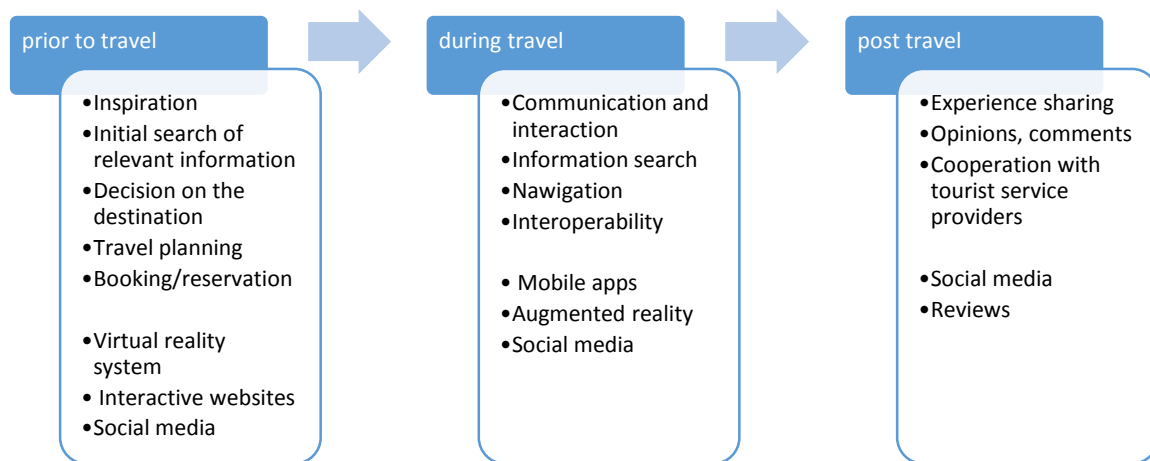


Figure 1. New technologies in the tourist travel process.

Source: Neuhofer et al., 2014, p. 2.

At the destination, the apps and social media supporting the tourists during their stay are of utmost importance. Modern technologies help navigate the city, choose a restaurant, based on other tourists' recommendations, take advantage of discounts and city cards, or learn about the history of a given city and individual sites, via QR codes and augmented reality technology. Owing to modern technologies, part of the travel arrangement and information gathering process can even take place at the destination (Beluszko, 2015; Niemczyk, 2017).

Post-travel, tourists share their impressions and opinions with others both face-to-face, but also through modern technologies, by posting travel photos and descriptions on social media, sending photos via instant messaging, posting reviews in various apps and social media. The reviews and opinions shared can serve as an important source of information for future tourists.

Mobile apps and other modern technologies can be used at various stages of travel, with different intensity. Based on the level of modern technology use, several levels of tourist experience can be distinguished (Neuhofer et al., 2014):

1. Conventional experience – tourists make little or no use of new technologies, and are characterized by low involvement in creating the tourism experience.
2. Technology-assisted experience) – tourists use new technologies to a limited extent. New technologies assist the tourist experience by facilitating communication, web browsing, accommodation and ticket booking. Tourists do not use new technologies to co-create the experience or interact with other participants. Tourist involvement and experience co-creation remain at a low level.
3. Technology-enhanced experience –technology using tourists actively participate in the creation of their experience and interact with other participants – they comment and share their experiences. The level of tourist involvement is high.
4. Technology-empowered experience – high degree of the tourists’ use of the available technological solutions, and high involvement in the experience co-creation. At this level of tourist experience, technology must exist in order for the experience to occur, as it constitutes an integral part of the experience, combining all travel stages, various travelers, as well as online and offline experience.

Urban tourism apps can include elements supporting tourist experience at different levels, which enrich his/her experience as well as enhance his/her involvement and satisfaction as a user (Neuhofer et al., 2014). At the lowest level - conventional experience - tourists make little or no use of the apps. These are tourists who use off-the-shelf solutions, travel agencies, and organized tours.

At a higher level - tourists use apps facilitating travel planning and function during the stay in a particular city. Apps which offer this type of experience mainly function as:

1. Mobile travel guides, featuring:
 - a) Descriptions of tourist sites, usually grouped into categories. Such descriptions can include audio and video files, links to the stie/monument/facility websites.
 - b) Descriptions and lists of accommodation facilities, eating establishments, sports facilities, etc.
 - c) Ready-to-use suggestions for sightseeing routes and hiking/biking trails, as well as trip planners, maps with marked tourist facilities.

- d) Information on events (cultural, sports, business) taking place in the city, as well as news.
- e) City guides - parking zone and parking lot information, taxicab stands, hospital and emergency room information (Dorcic et al., 2018; Papinska-Kacperek, 2016).

Such applications should be available in several languages and possibly include simple, useful, tourism-related phrases.

2. Sales activation support - an app offering tourists financial benefits, as well as enabling purchase of various types of 'city cards' entitling to unrestricted use of public transportation, discounted or free-of-charge public/tourist attractions, discounts on food services. Purchases via such apps are cheaper and facilitate sightseeing – e.g., tourists do not waste time in ticket office queues at busy tourist attractions.
3. City navigation support - city apps can include features typical of location-based applications (e.g., Google Maps), supplemented with elements serving particular needs of urban tourists, e.g., preference of walking routes, or route planning inclusive of tourist attractions, restaurants, cafes, as suggested routes are not personalized.

Technology-enriched applications include basic functions typical of lower-level applications. They also take the social functions, consisting of tourist and app user interaction, into account, in order to increase the involvement thereof through:

1. experience sharing, in the form of ratings, comments, photo and video posting,
2. inclusion of objects/sites/facilities previously not featured in the application, generation and sharing of personalized routes,
3. acquaintance with other tourists' ratings and reviews, participation in user discussions (Dorcic et al., 2018; Kachniewska, 2019).

These 'social elements' alter the tourist experience by enriching passive app reception with elements of application resource co-creation. As a result, users can contribute to altering the tourists' decisions, as well as foster 'off-the-beaten-path' tourism or other forms of urban exploration, which can promote the tourists' re-visits to a given city (Papinska-Kacperek, 2016).

Other consumers' opinions serve as an important source of information for tourists, while interaction with other participants enriches the tourist experience with additional values and increases one's satisfaction with their stay. It is thus important to facilitate the tourists' expression of opinions, not only by provision of such technical opportunities, but also by rewarding tourists for their activity with points or discounts in a gamification program (Dorcic et al., 2018).

At the level of technology-driven experience – a city tourism application still performs informational, social and sales functions, but in a disparate manner. Technologies enabling the collection and processing of user data are used to create systems recommending personalized information, services and products to tourists, tailored to their characteristics, preferences and behaviors.

Such recommendation systems can use (Chen, 2019):

1. Content Filtering – by analyzing the user preferences, information search history and choices made, e.g., the tourist attractions visited, other solutions are offered, consistent with the consumers' previous preferences. The disadvantage of such recommendations is that they offer a very narrow set of similar information and products.
2. Collaborative Filtering – deals with the preferences of user groups of similar characteristics and behaviors. Based on an analysis of their behavior, solutions tailored to users with similar characteristics are proposed.
3. Hybrid Filtering – a combination of recommendations based on the user's past behavior and the behavior of other users with similar characteristics.
4. Demographic Filtering – the system divides users into groups of similar demographic characteristics and tracks their preferences and behaviors regarding each category.

A personalized recommendation system typically uses more than one of the above methods.

A recommendation system based on location data increases user satisfaction, by including recommended tourist attractions and the ratings thereof, sightseeing routes, restaurants, public transportation, community networks. Other users' opinions and ratings can be shared, based on an algorithm accounting for the social and geographic distance between users, which affects the relevance of such recommendations as well as promotes user interaction. A recommendation system that offers personalized guidance at the time of decision-making can improve a tourist's quality of life, by suggesting tourist attractions, facilities, services, which can be of actual interest to him/her (Chen, 2019).

Tourist experience can be also enhanced through the use of augmented reality (AR), i.e., a system synthesizing the real world with a computer-generated world (Dorcic et al., 2018). Based on geolocation data, device orientation (accelerometer data) and camera or QR-code-derived images, real-time 3D graphics are generated, which merge real images with the past or future appearance of given objects (Kaczorowska-Spychalska, 2015). Another application of augmented reality entails consolidation of a camera image with plotted points meeting specific search criteria, e.g., museum facilities, restaurants, hotels, etc. (Papinska-Kacperek, 2016).

Augmented reality often constitutes an important element of urban games, combining city images with the virtual world of a game. Urban game is a form of play, implemented within urban space in real time (Beluszko, 2015). Game participants compete for a prize, by performing individual tasks specified by the game scenario, e.g., finding a particular tourist object. The tasks can be completed individually or in groups (Mazurkiewicz, 2015). Urban games are used to promote cities and knowledge thereof, in combination with interactive play. Game scenarios can pertain to various assets of a given city, its history, monuments, nature (Beluszko, 2015). Simple urban game schemes are also applicable at lower levels of tourist experience. When the organizer's goal is to increase the participants' involvement and enhance the associated emotions, however, augmented reality and gamification mechanisms are employed (Mazurkiewicz, 2015).

2.3. Selected models of technology acceptance

The design and development of a city application should involve special attention to the features increasing the potential tourists' acceptance and use thereof. A number of technology adoption models, including the Technology Acceptance Model (TAM) and its later modifications, the Unified Theory of Acceptance and Use of Technology (UTAUT) model, and the D&M Information System Success Model (D&M ISSM) (Diamond et al., 2018) can be used to study the impact of information technology (mobile application) features on technology acceptance. The models presented in Table 1 have been developed on the basis of previous theories, including the Theory of Reasoned Action (TPA) (Ajzen, Fishbein, 2000) and the Theory of Planned Behavior (TPB) (Ajzen, 1991).

I. Ajzen and M. Fishbein assumed that future usage behavior (e.g., application usage) can be inferred based on the study of behavioral intentions. Intention is the result of the user's attitudes toward a given behavior and toward the perceived social impact of that behavior (Diamond et al., 2018). Attitude - a positive or negative assessment - is instead shaped based on the perceived technology characteristics (Alsamydai, 2014).

Table 1.
Selected technology acceptance models

| No. | Model, author, source | Categories (Determinants of technology acceptance) | Effects sought |
|-----|---|---|--|
| 1 | TAM (Technology Acceptance Model) Davis 1985, p. 24 | Perceived Usefulness Perceived Ease of Use X1,X2,X3 (design features) | Attitude Toward Using Actual System Use |
| 2. | TAM2 (Technology Acceptance Model2) Venkatesh, Davis, 2000, pp. 186-204 | Perceived Usefulness Perceived Ease of Use - Subjective Norm - Image - Job Relevance - Output Quality - Result Demonstrability modifying variables: - Previous experience - Voluntariness (use of technology) | Intention to Use Usage Behavior |
| 3. | TAM3 (Technology Acceptance Model3) Venkatesh, Bala, 2008, pp. 273-315 | Additional determinants of perceived ease of use were introduced into the TAM 2 model (above): - Computer Self- efficacy - Perception of External Control - Computer Anxiety - Computer Playfulness - Perceived Enjoyment - Objective Usability | Behavioral Intention Usage Behavior |
| 4. | Moon, Kim 2001, pp. 217-230 (TAM modification) | Perceived Usefulness Perceived Ease of Use Perceived Playfulness | Attitude toward Using Behavioral Intention to Use Actual Usage |
| 5. | Shin, Kim 2008, pp. 378-384 (combination of TAM and Flow Theory) | Perceived Usefulness Perceived Synchronicity Perceived Enjoyment Perceived Involvement Flow | User Intention |

Cont. table 1.

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|-----|---|--|--|
| 6. | Wu, Wang, 2005, pp. 719-729 (TAM modification) | Perceived Usefulness Perceived Ease of Use Perceived Risk Cost Compatibility | Behavioral Intention to Use Actual Use |
| 7. | UTAUT (Unified Theory of Acceptance and Use of Technology), Venkatesh et al., 2003, pp. 425-478 | Performance Expectancy Effort Expectancy Social Influence Facilitating Condition modifying variables: Gender Age Experience Voluntariness of Use | Behavioral Intention Usage Behavior |
| 8. | D&M Information System Success Model (primary version) DeLone, McLean, 1992, pp. 60-95 | System Quality Information Quality | Use User Satisfaction Individual Impact Organizational Impact |
| 9. | D&M Information System Success Model (expanded version) DeLone, McLean, 2003, pp. 9-30 | Information Quality System Quality Service Quality | Intention to Use/ Use User Satisfaction Net Benefits |
| 10. | Alsamydai, 2014, pp. 2038-2051 (combination of TAM and D&M ISSM) | Quality factors: - Information Quality - Services Quality - System Quality Perceived Ease of Use Experience) Perceived Usefulness | Attitude Towards Using Behavioral Intention to Use Use |
| 11. | Chen, Tsai, 2019, pp. 628-638 (combination of TAM and D&M ISSM) | Information Quality System Quality Perceived Convenience of Use Perceived Usefulness Perceived Ease of Use | Intention to Use |
| 12. | NPD-TAM New Product Development TAM Diamond et al., 2018, pp. 400-409 | Perceived Usefulness Perceived Ease of Use Trustworthiness: Privacy and Security Expectations; Quality and Reliability Expectations Compatibility Factors: Actual Self Compatibility, Wish Self Compatibility and Ought Self Compatibility; Self Perspective Compatibility, Other Perspective Compatibility | Behavioral Intention |

Source: own compilation based on: Davis, 1985, p. 24; Venkatesh, Davis, 2000, pp. 186-204; Venkatesh, Bala, 2008, pp. 273-315; Moon, Kim, 2001, pp. 217-230; Shin, Kim, 2008, pp. 378-384; Wu, Wang, 2005, pp. 719-729; Venkatesh et al., 2003, pp. 425-478; DeLone, McLean, 1992, pp. 60-95; DeLone, McLean, 2003, pp. 9-30; Alsamydai, 2014, pp. 2038-2051; Chen, Tsai, 2019, pp. 628-638; Diamond et al., 2018, pp. 400-409.

Most technology acceptance models are used to measure the impact of the factors being tested on purchase intention. Some models are based on the assumption that the process of new technology acceptance can be cyclical. Under the influence of trial use, users shape their attitudes toward the technology and decide to use it (DeLone, McLean, 2003).

When assessing given technology, users pay attention to the perceived usefulness and ease of use thereof. In most models, both categories are present (Gromadka, 2020) (Table 1).

Perceived usefulness is defined as the degree to which a person believes he/she can benefit from using the technology (Alsamydai, 2014). These benefits derive from such given technology's characteristics as:

1. information quality - an application is useful to a user if it provides information which is complete, reliable, up-to-date, easy to understand and personalized,
2. system quality - refers to the fit between the application and the tasks users believe it should perform, i.e., the ease of information search and the quality of the results obtained, e.g., personalized recommendations,
3. service quality - refers to the overall support the technology provider delivers to the service recipient (DeLone, McLean, 1992, 2003; Venkatesh, Davis, 2000; Venkatesh et al., 2003; Chen, Tsai, 2019).

Most technology acceptance models include a category of perceived ease of use (Table 1). Perceived ease of use is defined as the degree to which a person believes that the use of particular technology is free of physical and mental effort (Alsamydai, 2014). Perceived ease of use significantly affects the attitudes toward technology through two main mechanisms: self-efficacy and instrumentality. This means that the easier a system is to use, the greater the user's sense of efficacy should be. Perceived ease of use can also improve a given person's performance as well as affect the perceived usefulness of the technology (Alsamydai, 2014).

Perceived ease of use is dependent on the user's characteristics, his/her ability to use the technology, including concerns and willingness to use the technology (Venkatesh, Bala, 2008). Ease of use is also associated with the convenience of application use, although this category is separable in the model developed by C.C. Chen and J.L. Tsai (2019).

Some authors also separate the cost of technology use from this category, namely all the frustrating experiences encountered while using the technology, e.g., when app performance is too slow, content is outdated, links are missing (Wu, Wang, 2005). Experiences of this type can lower the user's confidence in the technology, increase the perceived risks and user concerns regarding e.g., the security of in-app data and transactions (Diamond et al., 2018; Wu, Wang, 2005; Venkatesh, Bala, 2008).

One important category to be considered and studied while developing tourism apps entails the contentment and enjoyment (playfulness) users derive from using a given city app (Dorcic et al., 2018). In J.W. Moon and Y.G. Kim's (2001) model, perceived playfulness is understood through three dimensions:

1. concentration - denotes the degree of the user's focus on the technology and preoccupation with it,
2. curiosity - determines how much the application content stimulates the user's cognitive curiosity and encourages him/her to explore the given app,
3. enjoyment - the user's involvement, for the enjoyment and pleasure of using the given application, rather than for the rewards (Moon, Kim, 2001).

D.H. Shin and W.Y. Kim (2008) further supplement the ‘enjoyment of use’ category with the state of flow - a state of mental elation. While enjoyment of use can lead to greater user involvement and subsequent purchase intention, the state of flow, i.e., the state of engrossment in the technology being used, directly affects the intention to use it.

The ISSM D&M model (DeLone, McLean, 2003) also includes a category of net gains. The comparison of gains and losses has been present in the theories of Fishbein and Ajzen (TPA, TPB). When users recognize more benefits than costs, they are more likely to accept the technology and their satisfaction increases. The ‘net benefits’ in the ISSM's D&M model are not limited to the balance of the positive and negative impacts of the technology on customers, but also include other stakeholders, the local community as a whole. In the case of a tourism app, its positive and negative impact can be measured in relation to both the tourists and internal city stakeholders, by examining, for example, its impact on the sales of local tourism enterprises’ services, on the positive image of the city, etc. The postulate to measure the impact of technology not only on the users but on organizations as well emerged in the earlier version of the D&M ISSM model (DeLone, McLean, 2003). The authors proposed to determine the impact of technology on users and organizations - in the case of city applications this pertains to the city and its stakeholders – separately.

Depending on the city's offer, its objectives, and the app's affiliation with other means of marketing communication, different categories should be developed and tested at the stage application development.

3. Survey of selected Polish cities’ tourism applications

3.1. Survey methods

In order to identify the key functions of a city tourism app, the official apps of the largest tourist cities in Poland were surveyed. Application users’ comments were collected and subjected to qualitative analysis.

Information on the following aspects was sought:

- app popularity among users (number of downloads, user comments, positive and negative ratings, administrators’ reactions),
- technology, tools offered by app (level of technological experience),
- app features indicated by users.

The study covered the largest tourist cities in Poland. The list was compiled on the basis of a Central Statistical Office (CSO) report (Tourism in 2021, 2022), the rankings published on tourism portals, and the list of the Polish cities which are members of the Eurocities network - an association of large European cities. Only city-hall-owned apps or, in the absence of such,

applications owned by a public city institution or association were selected for the study. The data on the apps was derived from Google Play - the largest online platform selling mobile apps - and the cities' official websites, social media accounts, as well as directly through analysis of the apps themselves. Other sources of information entailed the results of studies compiled in other scientific publications (Zawadzki, 2018; Manczak, Bajak, 2021; Pawlowska-Legwand, 2019).

Cities which did not have an official mobile app, or whose existing app served the residents only, e.g., to submit applications, check the time and place of waste collection, obtain information on the projects submitted as part of civic budgets, were removed from the list of the 24 largest tourist cities. Survey of the for Toruń and Budgoszcz apps was abandoned as well, despite the fact that both applications serve the function of a tourist guide, due to a too small number downloads (500+ people) and the lack of user comments and ratings.

The remaining apps were surveyed to determine the elements used to build the tourist experience as well as subjected to qualitative analysis - user comments in the apps surveyed. In accordance with the principles of the grounded theory, the comments text was subjected to coding - open coding first, followed by analytical coding. As a result of the operations carried out the in-vivo codes (grouping, division into categories), several main categories were extracted (Sokolowska et al., 2022). These main categories were counted and classified.

3.2. Survey results and discussion

The applications included in the study differ in the time of creation, number of downloads and functions fulfilled: from the simplest - offering information or sales functions only (Gdansk), to applications enriched with augmented reality (Warsaw, Lublin, Olsztyn). The characteristics of the selected applications and the classified user comments are presented in Tables 2 and 3.

The Turystyczny Lublin [Tourist Lublin] app is characterized by the largest number of functions. It performs all informational functions, but in addition, it stands out from the other apps in terms of graphics, use of augmented reality, and the attempted linking of the app with social media. Its use, however, raises many problems, i.e., the application runs too slowly or stops after clicking on links to other sites. The app had been developed several months earlier and since then has been promoted via the city's website and social media. It has received only about a dozen comments, nearly half of which pertain to technical issues: primarily the app's slow operation and the problems with codes, links. Nevertheless, users do mention its advantages: it facilitates navigation, the information provided is of interest and use not only for tourists, but the residents as well. They also praise its visual side and the inclusion of augmented reality. According to the users, the app is useful for both tourists and residents, although it needs to be fine-tuned.

A different type of application is Kraków.pl, which primarily offers informational and navigational functions. It was developed in 2013 at the earliest, and functions as a guide to the city. It can serve as an essential tool when visiting Cracow, as it entails a practical, comprehensive collection of tourist information. The app does not offer any additional features, however, nor does it provide pleasure from exploring the app itself. As with most city apps, it lacks financial incentives: tourist card and discounts for using local businesses, e.g., restaurants, hotels, guides.

The Kraków.pl app is the most frequently downloaded and commented on city application. Every third comment, however, refers to technical problems experienced by its users. These issues mostly concern problems with updating the application, downloading data, as well as starting, stopping the application. Complaints about its unintuitive use and problems with in-app links and notifications are less frequent. One very important issue entails the quality of information. The app serves as a detailed guide for its users, including the city residents, who indicate errors in the content resulting from the lack of updates: errors regarding public transportation, ticket prices, street changes, parking zones, missing events. Other users pinpoint that the application has expanded their knowledge of the city, while the information itself is interesting, rich, and useful in sightseeing.

According to some users, navigation and orientation via the app is not very clear, while others believe that the app has helped them to get around the city and find tourist sites. The visual side of the Kraków.pl application is under criticism, however, and are no positive comments in this regard. The users have criticized the quality of the photos, the color scheme used, and the object description text included. Despite these shortcomings, more than half of the users have complimented the application, most often finding it useful for both tourists and residents.

Information functions, albeit to a limited extent, are also fulfilled by the Metropolia Bydgoszcz app. The application still needs to be refined, however, both in terms of the information presented as well as the content, graphics and photo structure. The function of an information guide for tourists is also fulfilled to a very limited extent. In addition to information regarding historical monuments and accommodation, it does not contain other relevant information tourists need, such as public transportation info, including ticket prices, or food facility info. The users also pointed to the lack of up-to-date content.

The only app offering sales functions is the application of the Gdansk City Hall - the Karta Turysty [Tourist Card], which offers purchase of one of several types of tourist cards entitling users to a number of attractions, including promotional offers for the purchase of tickets to various tourist attractions as well as discounts for the use of food and beverage services. The app is also used by the residents to purchase public transportation passes and season tickets. Nevertheless, its usefulness as a mobile tourist guide is limited.

Another application - Visit Olsztyn - was intended to provide a higher-end technology experience. In 2014, after its launch, the app was rated very well as a comprehensive tool, and highly recommended to other users. It was also complimented on its use of augmented reality. The last time the app was updated was in 2017, however, and since then it has been criticized for technical problems - including the inability to launch the app.

Such problems have not been experienced by users of the Wasza Warszawa [Your Warsaw] app - the app does not cause major technical problems. It was developed in 2018 for the History Meeting House (a cultural institution of the city of Warsaw) and has been bringing both tourists and residents closer to important moments of the city's twentieth-century history.

The app includes photos, short biographies of key historical figures, recordings, routes leading to historically important places, interactive maps, as well as urban games using augmented reality technology. The app does not act as a typical tourist mobile guide, nevertheless, the users' assessments are mostly positive.

According to the users, *the app allows one to learn about Warsaw, and its history in particular*, the information provided is presented in an interesting manner, but the app needs to be supplemented with information on a greater number of objects/sites and important events (e.g., the years 39-45).

Table 2.

Specification of selected Polish cities' tourism applications

| Application characteristics and elements | Cracow | Warsaw | Lublin | Olsztyn | Bydgoszcz | Gdansk |
|--|---------------------------|---|--|----------------------------|---|---|
| Application name, owner | Kraków.pl City Hall | Wasza Warszawa [Your Warsaw] History Meeting House | Turystyczny Lublin [Tourist Lublin] City Hall | Visit Olsztyn City Hall | Metropolia Bydgoszcz Stowarzyszenie Metropolia Bydgoszcz* [Bydgoszcz Metropolia Association] | Karta Turysty [Tourist Card] Stowarzyszenie Gdańska Organizacja Turystyczna [Gdansk Convention Bureau] |
| Date of activation (Date of last update) | 6.08.2013 (14.03.2022) | 2.07.2018 (18.05.2022) | 12.05.2022 (22.06.2022) | 27.03.2014 (15.09.2017) | 17.10.2018 (12.04.2019) | 9.08.2019 (25.07.2022) |
| Number of downloads | 50 thousand + | 5000+ | 1000+ | 1000+ | 1000+ | 1000+ |
| Rating | 3.6 | 4.2 | 3.9 | 3.0 | 3.6 | 4.3 |
| Information functions: Information on historical monuments, food routes, communication | Featured | Featured | Featured | Featured | Featured | None |
| Information functions: Current events and news | Featured | None | Featured | Featured | Featured | None |

Cont. table 2.

| | | | | | | |
|---|----------|----------|--------------------|----------|------|----------|
| Communication and navigation: Support: Maps and navigation, public transportation information, parking lots | Featured | Featured | Featured | Featured | None | None |
| Tourist cards - sightseeing and communication passes | None | None | None | None | None | Featured |
| Social functions (Ability to comment, ratings, social media) | None | None | Featured (limited) | None | None | None |
| Augmented Reality | None | Featured | Featured | Featured | None | None |
| Urban games | None | Featured | None | None | None | None |
| Attractive visuals, voiceover | None | Featured | Featured | None | None | None |

* Metropolia Bydgoszcz is the owner of the Metropolia Bydgoszcz Association for the city of Bydgoszcz and surrounding towns

Source: own compilation.

Table 3.

Number of app user comments on comment-extracted categories

| Application functions, elements | Cracow | Warsaw | Lublin | Bydgoszcz | Olsztyn | Gdansk | Total |
|--|--------|--------|--------|-----------|---------|--------|-------|
| System quality (technical issues) | 29 | 2 | 5 | - | 13 | - | 49 |
| Information quality | 36 | 7 | 2 | 2 | 5 | - | 52 |
| City navigation | 16 | 1 | 3 | - | - | - | 20 |
| Benefits (financial and other) | 2 | - | - | - | - | 2 | 4 |
| Trust (concerns regarding data security, content manipulation) | 3 | 1 | - | - | 1 | - | 5 |
| Enjoyment (visuals, AR, urban games) | 6 | 1 | 3 | - | 1 | - | 11 |
| Application usability (usefulness) | 51 | 9 | 7 | 1 | 8 | 2 | 78 |
| Involvement | 16 | - | 4 | - | 4 | - | 24 |
| User reaction | 239 | 37 | 4 | 6 | 6 | 8 | 59 |
| Administrator reaction | 6 | 1 | 3 | - | - | - | 10 |
| Positive assessment | 49 | 8 | 6 | 1 | 7 | - | 76 |
| Negative assessment | 47 | 4 | 5 | 2 | 16 | 2 | 71 |

Source: own compilation.

Based on the comparison of selected applications' features and user comments (Table 2 and 3), it should be concluded that the official apps examined offer low-level technological experience to tourists. The applications mainly perform informational and navigational functions. At this level of the experience offered (technology-assisted experience), the apps should also encourage the use of local tourism-related businesses (e.g., restaurants, hotels, city guides).

The applications did not provide the users with the options of comment posting, facility rating, new route suggesting, etc. They therefore do not perform social functions. Only one app included social media links. The inefficiency in terms of the users' ability to co-create the content limits the tourists' use of the apps to the stages of city visit preparation and execution. They applications are thus not used at the 'post-travel' stage, and do not interact as an informal source with other tourists who are in the city or are just planning their visit.

This inefficiency also means that communication with the audience (users) takes place in the apps as a one-way communication process, where the sender pummels the passive receiver. Internet users increasingly expect a different model – a process of multilateral communication, in which the content recipients participate in addition to the sender [Wiktor, 2013]. Application users are not treated as partners in communication and sources of information; their app assessments, critical comments or suggestions for improvements are usually ignored by the application administrators (Table 3).

What is more, the apps are not integrated with the cities' other online means of communication. Usually, they are not promoted via the cities' official websites and social media channels. The comment analysis carried out shows that users expect the apps serve as a tool for ongoing communication, while most apps are too infrequently updated. In extreme cases, the apps contain outdated content or are not technically adapted at all to software changes in mobile devices (e.g., the Olsztyn app).

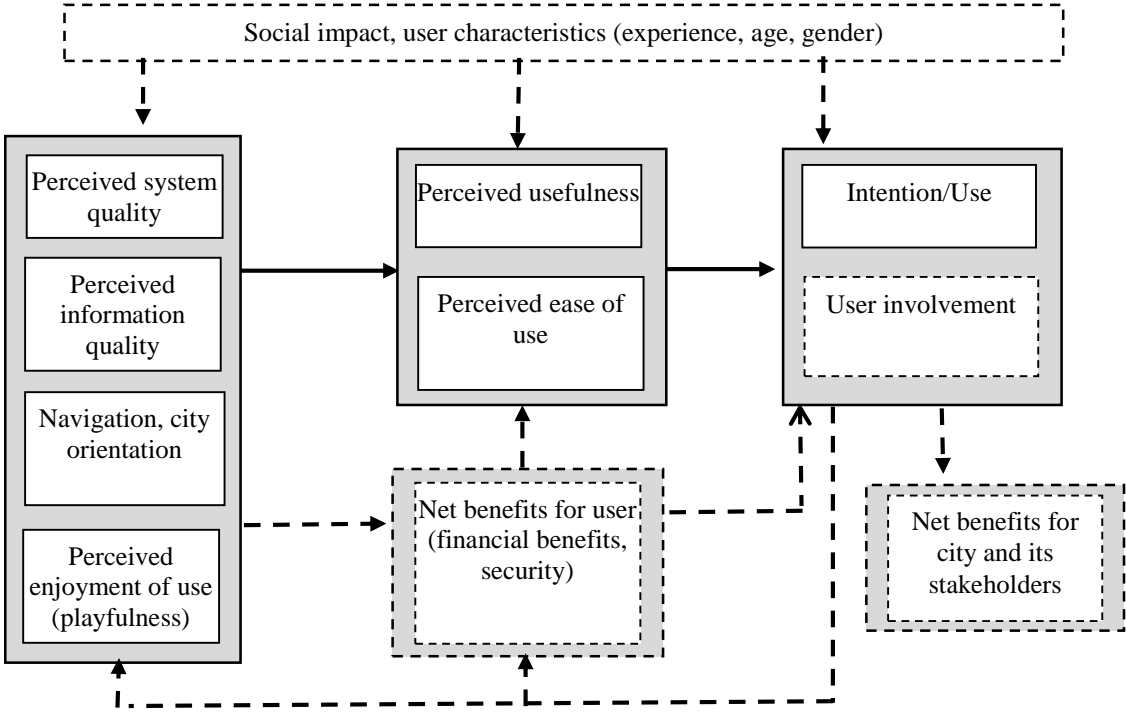


Figure 2. Model of city tourism application assessment.

Source: own compilation.

Some of the applications examined featured such elements as urban games and augmented reality, which were of interest to the users. Augmented reality and urban games can constitute part of technology-driven experience, increasing the enjoyment of technology use and city exploring. Such applications then become virtual travel companions, inspiring city exploration, suggesting personalized solutions, but they require efficient recommendation systems and lower-level functions – informational and social functions. In the case of the apps surveyed, augmented reality and urban games generated numerous technical problems for tourists and lacked social functions (e.g., the urban games in the Your Warsaw app in which only one user participates).

The apps selected were assessed against categories commonly used in technology acceptance models. Based on the grouped comments, it can be indicated that the primary categories to be included in the study of city apps include:

1. Perceived system quality - official city apps often fail to meet basic technical criteria. Users encounter problems with launching the apps, data updates, links to non-existent pages.
2. Perceived information quality - a criterion very important for users. In combination with the system quality criterion, it determines the usefulness of such applications as Kraków.pl.
3. Navigation and orientation in the city - a category of high importance for tourists, which should be separated from the information quality category. It refers to the navigation system used, interactive maps included in the application, the ability to search for nearby objects and information on public transportation.
4. Perceived enjoyment of use - although to a lesser extent, users did take notice of the additional elements (voiceover, visual side of the app, and augmented reality).

Users were less likely to pay attention to application trust issues (data security, information trust). Figure 2 suggests additional categories, based on the literature analysis: net benefits to the user and the organization, and user involvement. These categories were not present in the comments, as the surveyed apps did not typically include financial incentives or social features.

The impact of the above categories on the perceived usefulness and ease of use can be modified by the app-using tourist's experience, his/her age, gender and social influence (provided that the app includes social features).

The proposed categories of variables, as well as the dependencies between those variables, should be empirically verified in a quantitative study of city apps offering different levels of technological experience to tourists.

4. Conclusion

The design and development of a city tourism application needs to incorporate both the tourists' perspective, who expect a useful tool facilitating sightseeing, as well as the role of the application in the city's promotion system. It is imperative to determine what functions the app will perform, in order to increase its chances of acceptance and use by tourists at various stages of travel: preparation, implementation and post-travel. It is also necessary to determine the level of technological experience the app will offer to tourists, taking the city's capabilities and tourists' expectations into account.

The largest Polish cities' use of tourism apps for promotion is insufficient. The majority of cities do not provide applications offering sightseeing assistance to tourists, while the existing solutions contain many errors, preventing seamless use thereof. Future solutions for cities should be subjected to testing, taking the main categories identified in the study into account: perceived system quality, perceived information quality, the navigation and city orientation solutions offered, and the enjoyment a potential user can derive from using the app. A preliminary survey of the application developed will help avoid many mistakes as well as increase the likelihood of the app being used by tourists and the chances of achieving the city's promotional goals.

The use of intelligent recommendation systems, augmented reality, and participant interaction ensuring solutions will increase user involvement. Actively participating tourists who become involved in the process of experience co-creation, with other participants, help broaden and enhance the tourism experience. As ICT technologies are further developed and their penetration into everyday life continues, travel services will have to reach higher and higher levels in the integrating of experience and modern technologies.

References

1. Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, Vol. 50, Iss. 2, pp. 179-211, doi: 10.1016/0749-5978(91)90020-T.
2. Ajzen, I., Fishbein, M. (2000). Attitudes and the Attitude-Behavior Relation: Reasoned and Automatic Processes. *European Review of Social Psychology*, Vol. 11, pp. 1-33. doi: 10.1080/14792779943000116
3. Alsamydai, M. (2014). Adaptation of the Technology Acceptance Model (TAM) to the Use of Mobile Banking Services. *International Review of Management and Business Research*, Vol. 3, Iss. 4, pp. 2039-2051.

4. Bieluszko, K. (2015). Media elektroniczne jako narzędzie promocji turystycznej miasta, *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu, Gospodarka turystyczna w regionie. Przedsiębiorstwo. Samorząd. Współpraca*, Vol. 379, pp. 259-268, doi: 10.15611/pn.2015.379.25.
5. Chen, C., Tsai, J. (2019). Determinants of behavioral intention to use the personalized location-based mobile tourism application: An empirical study by integrating TAM with ISSM. *Future Generation Computer Systems*, Vol. 96, Iss. C, pp. 628-638, doi: 10.1016/j.future.2017.02.028.
6. Chmielewski, M., Pioch, J., Płoska, R. (2022). Infrastructure projects and transport exclusion –case study of the Pomorska Kolej Metropolitalna. *Zeszyty Naukowe Politechniki Śląskiej. Organizacja i Zarządzanie*, No. 156, pp. 99-115. doi: 10.29119/1641-3466.2022.156.7.
7. Davis, F. (1985). *A Technology Acceptance Model for Empirically Testing New End-User Information Systems: Theory and Results*. Massachusetts Institute of Technology.
8. DeLone, W.H., McLean, E.R. (1992). Information Systems Success: The Quest for the Dependent Variable. *Information Systems Research*, Vol. 3, Iss. 1, pp. 60-95, doi: 10.1287/isre.3.1.60.
9. DeLone, W.H., McLean, E.R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems*, Vol. 19, No. 4, pp. 9-30, doi: 10.1080/07421222.2003.11045748.
10. Diamond, L., Busch, M., Jilch, V., Tscheligi, M. (2018). *Using technology acceptance models for product development: case study of a smart payment card*, pp. 400-409, doi: 10.1145/3236112.3236175.
11. Dorcis, J., Komsic, J., Suzana, M. (2018). Mobile technologies and applications towards smart tourism – state of the art. *Tourism Review*, Vol. 74, No. 1, pp. 82-103, doi: 10.1108/TR-07-2017-0121.
12. Dziadkiewicz, A. (2020). *Design Management. Uwarunkowania i efekty wdrożenia w przedsiębiorstwie*. Gdańsk: Wydawnictwo Uniwersytetu Gdańskiego.
13. Główny Urząd Statystyczny (2022). *Turystyka w 2021 r.*
14. Gromadka, D. (2020). Model akceptacji technologii – krytyczna analiza piśmiennictwa, *Akademia Zarządzania*, Vol. 4, pp. 187-207. Retrieved from: <http://depot.ceon.pl/handle/123456789/18622>, 30.10.2022.
15. Kachniewska, M. (2019). Tworzenie wartości dodanej na bazie kontekstowych aplikacji mobilnych (przypadek branży turystycznej). *Kwartalnik Nauk o Przedsiębiorstwie*, No. 3, pp. 15-24, doi: 10.5604/01.3001.0013.4780.
16. Kaczorowska-Spychalska, D. (2015). Media interaktywne w kreowaniu wizerunku miast. *Przedsiębiorczość i Zarządzanie*, Vol. 16, Iss. 3, No. 1, pp. 87-110. Retrieved from: <http://piz.san.edu.pl/docs/e-XVI-3-1.pdf>.

17. Manczak, I., Bajak, M. (2021). Turystyczne aplikacje mobilne – ocena funkcjonalności oprogramowania VisitMalopolska. *Tourism, Vol. 31, Iss. 1*, pp. 29-38, doi: 10.18778/0867-5856.31.1.04.
18. Mazurkiewicz, B. (2015). Gry miejskie oparte na lokalizacji jako sposób promocji miasta. *Handel Wewnętrzny, Iss. 4(357)*, pp. 328-336. Retrieved from: <http://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.desklight-926c6459-be9d-43c0-b617-03d20b35cb29>.
19. Moon, J.W., Kim, Y.G. (2001). Extending the TAM for a World-Wide-Web context. *Information & Management, Vol. 38, Iss. 4*, pp. 217-230. doi:10.1016/s0378-7206(00)00061-6.
20. Neuhofer, B., Buhalis, D., Ladkin, A. (2014). A typology of technology-enhanced tourism experiences. *International Journal of Tourism Research, Vol. 16, Iss. 4*, pp. 340-350. doi: 10.1002/jtr.1958.
21. Niemczyk, A. (2017). Aplikacje mobilne jako determinanta zachowań turystycznych (na przykładzie Krakowa). *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu, No. 473*, pp. 370-380. doi: 10.15611/pn.2017.473.34.
22. Papińska-Kacperk, J. (2016). Miejskie aplikacje mobilne w turystyce kulturowej w Polsce, *Turystyka Kulturowa, Iss. 2*, pp. 67-85. Retrieved form: <http://turystykakulturowa.org/ojs/index.php/tk/article/view/720/646>.
23. Pawłowska-Legwand, A. (2019). Wykorzystanie technologii informacyjno-komunikacyjnych w dostępie do informacji i usług turystycznych w świetle wyników badań przeprowadzonych wśród polskich turystów w województwie małopolskim. *Tourism, Vol. 29, Iss. 2*, pp. 109-117. doi: 10.18778/0867-5856.29.2.22.
24. Piechota, N. (2014). Lokalizacyjna aplikacja mobilna jako narzędzie badań ruchu turystycznego w miastach. *Studia Oeconomica Posnaniensia, Vol. 2, No. 1(262)*, pp. 115-133.
25. Seweryn, R. (2014). Korzystanie z usług przewodnickich w dobie rozwoju nowoczesnych technologii na przykładzie Krakowa. *Zeszyty Naukowe Uniwersytetu Szczecińskiego. Problemy Zarządzania, Finansów i Marketingu, nr 35*, pp. 61-73. Retrieved from: http://www.wzieu.pl/zn/824/ZN_824.pdf.
26. Shin, D.H., Kim, W.Y. (2008). Applying the Technology Acceptance Model and Flow Theory to Cyworld User Behavior: Implication of the Web2.0 User Acceptance. *CyberPsychology & Behavior, Vol. 11, Iss. 3*, pp. 378-382. doi:10.1089/cpb.2007.0117.
27. Sokołowska E., Pawlak K., Hajduk G., Dziadkiewicz A. (2022). City brand equity, a marketing perspective. *Cities, Vol. 130*, doi: 10.1016/j.cities.2022.103936.
28. Urząd Komunikacji Elektronicznej (2021). *Badania opinii publicznej w zakresie funkcjonowania rynku usług telekomunikacyjnych oraz preferencji konsumentów: raport z badania klientów indywidualnych*. Retrieved form: <https://www.uke.gov.pl/akt/badanie-konsumenckie-2021-klienci-indywidualni,410.html>.

29. Venkatesh, V., Bala, H. (2008), Technology acceptance model 3 and a research agenda on interventions. *Decision sciences*, Vol. 39, No. 2, pp. 273-315. doi: 10.1111/j.1540-5915.2008.00192.x.
30. Venkatesh, V., Davis, F.D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*. Vol. 46, No. 2, pp 186-204. doi: 10.1287/mnsc.46.2.186.11926.
31. Venkatesh, V., Morris, M.G., Davis, G.B., Davis, F.D. (2003). User acceptance of information technology: Toward a unified view, *MIS Quarterly*, Vol. 27, Iss. 3, pp. 425-478. doi: 10.2307/30036540.
32. Wiktor, J.W. (2013). *Komunikacja marketingowa: modele, struktury, formy przekazu*. Warszawa: PWN.
33. Wu, J.H., Wang, S.C. (2005). What drives mobile commerce? *Information & Management*, Vol. 42, Iss. 5, pp. 719-729. doi:10.1016/j.im.2004.07.001.
34. Zawadzki, P. (2018). Aplikacje mobilne jako element systemu informacji turystycznej. *Zeszyty Naukowe Uniwersytetu Ekonomicznego w Krakowie*, nr 4(976), pp. 85-101. doi: 10.15678/ZNUEK.2018.0976.0406.