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INTEGRATING MOBILITY AS A SERVICE AND TOURISM: A REVIEW OF THE WORLD'S TOP TRAVEL APPS

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ABSTRACT · Local governments across the globe are progressively adopting Mobility as a Service (MaaS) to address the challenges posed by urban mobility. However, by focusing primarily on transportation, they may overlook its broader potential, including integration with tourism services. This study investigates the feasibility and current state of combining MaaS functionalities with tourism-related features in a single digital platform. A review of the most downloaded travel applications on app stores was conducted, with a focus on their technical characteristics and levels of MaaS integration. The assessment of each application was conducted utilising a bespoke MaaS indicator, which was derived through the aggregation of two distinct metrics: the prevailing level of MaaS integration and the number of transport modes encompassed. Concomitantly with the mean user rating, this indicator was utilised to perform a pioneering quantitative SWOT analysis. The results of the study indicate the existence of a gap in the market, as no existing application effectively integrates both MaaS and tourism functionalities. The study emphasises the strategic significance for local authorities in developing such integrated platforms to enhance user experience and augment the monetisation potential of MaaS.

KEYWORDS · MaaS, Tourism, Travel Apps, Quantitative SWOT, "MaaS-Tourism" bundles.

1. INTRODUCTION

THE innovative concept of Mobility as a Service (MaaS) is gaining ground around the world to address urban mobility issues and make public transport more inclusive, accessible and seamless. MaaS provides a real alternative to car use for users, allowing them to plan their jour-

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ney by choosing the most suitable route, booking their preferred means of transport and paying for the ride through a single mobile application (Hensher *et al.* 2023).

Municipalities around the world are currently attempting to integrate MaaS into their urban transport system, with varying degrees of success. Currently, only a small number of fully operational MaaS systems are active in a few contexts, while the majority of case studies are limited to trials.

Public Transport Authorities (PTAs) are now focusing their efforts on developing MaaS applications that have the potential to revolutionise urban transport, missing out on the additional potential of this new technology. If properly developed, the MaaS ecosystem can be integrated into several sectors and contribute to their development. In the case of tourism, where mobility is a fundamental requirement (Fusté-Forné and Michael 2023), this technology has the potential to enhance tourist satisfaction (Kim *et al.* 2023) and act as a driver of growth.

Tourism is a key driver of economic expansion and social progress for many countries (Yu *et al.* 2023) and, despite the slowdown caused by Covid-19, is growing exponentially year after year (Rasoolimanesh *et al.* 2023). The literature identifies a number of challenges faced by tourists in foreign cities, the most important of which relate to the use of public transport, the difficulty of obtaining accurate and detailed information about the main attractions to be visited and differences in payment habits (Karvonen 2018).

Due to the relatively recent development of MaaS technology, there has been little analysis of the integration of MaaS and tourism in the academic literature. At the heart of this concept is the possibility for tourists to combine two key elements of their trip in a single app: planning visits to new places and activities, and having access to the entire mobility offer of the city.

This would allow users to purchase attraction and transport tickets from the same app, saving time and making the user experience (UX) more fluid and intuitive.

A multitude of travel apps are currently available on both the Play Store (Google) and the App Store (Apple), offering separate services and thus providing the tourists with an incomplete experience: the aim of this paper is to outline the relevance of developing a new typology of apps that integrate the information related to booking and payment of hotels, restaurants and must-see activities, the benefits of a MaaS platform to ac-

cess them seamlessly, and the possibility to purchase all-inclusive "MaaS-Tourism" packages.

The few studies on the subject confirm the desirability of users and stakeholders to integrate tourism features into MaaS applications (Li *et al.* 2022; Leung *et al.* 2022). In Southeast Asia, numerous super-apps based on the concept of Mobility as a Feature (MaaF) have emerged in recent years: apps that originally provided only ride-sharing services are expanding their offerings to include services not strictly related to their own core business (e.g. food delivery, financial services, shopping, etc.) (Hasselwander 2023). Users really appreciate these super apps because they can fulfil all their needs within the same app: this greatly improves their user experience (Yu 2023). The implementation of tourism features within these super-applications seems to be only the next step.

Given the originality of the topic in the literature, this manuscript carries out a review of the main travel apps in 2022, divided by selected categories, conducting an analysis of their main technical characteristics and showing their functionality from a MaaS point of view. Furthermore, from the relationship between the rating of each app and a specifically built MaaS indicator, it was possible to create an innovative quantitative SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis, capable of showing the strengths and weaknesses of the apps currently in place and the urgency of creating new "MaaS - Tourism apps".

In contrast to earlier pilot projects, including WHIM in Helsinki and the MyHelsinki WeChat mini-program (detailed below), this study does not concentrate on a single local implementation. Instead, it proposes a scalable and comparative analytical framework. By examining a broad selection of globally used travel applications through a quantitative lens, it provides a generalisable methodology to assess the current state and future potential of MaaS-tourism integration, thus offering a more systematic contribution to the field.

This study is divided into 5 sections. "Introduction" states the main objectives of this paper, and the research gaps it aims to fill. Section 2 provides background research on the state of the art of MaaS and its relationship to tourism. Section 3 describes the methods by which the applications were selected, evaluated and entered into the quantitative SWOT matrix. The results of this analysis are presented in section 4 and discussed together with limitations and future agenda in section 5.

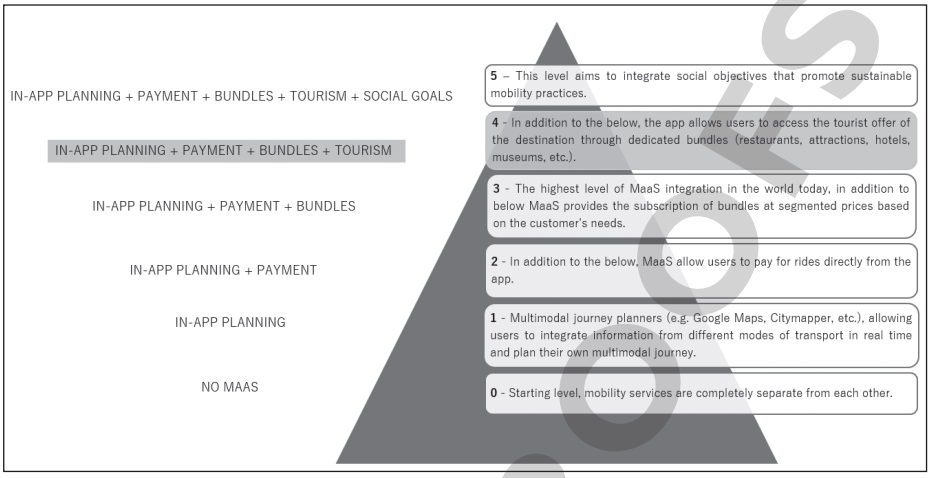
2. Background research

In order to understand the relevance of the convergence of MaaS and tourism sectors, it is first necessary to define the concept of MaaS and its levels of integration as identified in the literature.

MaaS has been defined by the International Association for Public Transport Authorities (UITP) as *"the integration of, and access to, different transport services (…) in one single digital mobility offer, with active mobility and an efficient public transport system as its basis. This tailormade service suggests the most suitable solutions based on the user's travel needs. MaaS is available anytime and offers integrated planning, booking and payment, as well as en route information to provide easy mobility and enable life without having to own a car"* (UITP 2019).

The main objective of MaaS is to replace private cars with more sustainable means of transport in order to reduce air and noise pollution, traffic accidents and health costs, and to allow pedestrians to reclaim urban space from cars (Caballini *et al.* 2023). MaaS provides users with a seamless travel experience, reducing the hassle and wasted time of "app-hopping" - switching between multiple apps to plan, book, and pay for different parts of a journey (AISBL 2018).

Sochor *et al.* (2018) introduced five different cumulative MaaS integration levels, i.e. the upper level includes what is already present in the lower level and integrates a new functionality. Thus, the MaaS integration levels oscillate between 0 (the state where transport services are separated) and 4 (the inclusion of sustainable social policies in the MaaS app). Further literature in the following years reported and confirmed this concept (Lyons *et al.* 2019; Sochor 2021; Alyavina *et al.* 2022; Mulley *et al.* 2023). The five levels of MaaS integration are outlined in Figure 1: the MaaS-tourism integration level has been added to the traditional hierarchy identified in the literature, as proposed by this study. This new integration step is therefore placed after level 3 of MaaS, as in order to include the tourism offer in the MaaS application, it must first provide the planning, payment and subscription functions.



Source: own elaboration based on Sochor *et al.* (2018).

FIGURE 1. MaaS levels of integration including tourism.

2. 1. *Literature review*

An analysis of the academic literature shows that the relationship between the tourism sector and Mobility as a Service has not yet been well explored.

The benefits of integrating MaaS and tourism features into the same app have been well established in the literature for many years: on an economic level, bundling multiple services or products is advantageous for the seller, as it increases profits by reaching customers with different tastes (Stigler 1963). This practice is already used in many sectors, such as food retailing, television, tour operators (Hu *et al.* 2022).

Csutora and Zsoka (2023) note that crises (e.g. the 2008-2010 financial crisis and the Covid-19 pandemic) provide opportunities to change people's attitudes towards travel and act as catalysts for the sustainable transition of tourism (Viana-Lora *et al.* 2023). Younger generations, in particular, are keen to travel in a climate-friendly way and are concerned about the economic and social sustainability of their holiday destinations (Schönherr *et al.* 2023).

To confirm the above, the Automobile Club Association (together with nine automobile clubs affiliated to the International Automobile Federation) conducted a survey in Europe between November 2019 and February 2020 to assess the level of appreciation and potential use of an app collecting all modes of transport by European citizens.

The results show the willingness to change of European citizens, who are ready to experience new technologies in the field of transport: 57.3% of European users already have 1 or 2 mobility apps on their smartphone, 74.9% of them already use route planning apps to get around in foreign cities (71.9% in the city where they live), around 30% of them use apps related to public transport, and finally, an app that includes all public and private means of transport would be welcomed by 69.5% of respondents (FIA 2020). These data show how the introduction of MaaS technology combined with tourism services would be accepted and would find fertile ground among European citizens.

(Martinčević *et al.* 2021) conducted a survey in Croatia, based on the aforementioned data published by FIA, in order to assess the familiarity of Croatian citizens with the concept of MaaS and, consequently, the level of acceptance of such a service. The results showed that only 2% of the respondents to the online questionnaires knew what MaaS was. Most of them said that they would be in favour of implementing a service that allows users to plan, book and pay for transport directly from a single app. This survey showed that there is still a great deal of ignorance about MaaS technology, but at the same time a general willingness to use it if it is applied. In an effort to extend their research, (Martinčević *et al.* 2022) have shown that there is a statistically significant relationship between the idea of MaaS tourism and a multimodal mindset, and that this relationship depends on how satisfied users are with transport applications.

Given the mobility issues on the island, with high car dependency, high numbers of tourist car rentals and road congestion, and to encourage a shift towards more sustainable transport, the University of Malta developed the MyMaltaPlan app in 2019, which shows tourists the main attractions, how to reach them and how to organise their trip according to their preferences. Maas *et al.* (2021) conducted a field study to understand the behavioural habits of tourists and their relationship with the use of modern technologies while on holiday. The results show that the vast majority of respondents habitually use their smartphones to book and pay for transport services while on holiday, and that the use of public transport is higher than that of rental cars. In addition, tourists have identified, as enabling factors for sustainable mobility, that transport infrastructures must be better, safer and with stricter speed limits.

In Australia, an interesting study was conducted on the relationship between tourism and MaaS in the state of Queensland. Leung *et al.* (2023) conducted interviews with stakeholders in the tourist areas of Townsville,

Rockhampton-Yeppoon and Gladstone, from whose responses a qualitative SWOT analysis could be conducted. Respondents confirmed that a successful MaaS platform must integrate other tourism-related services (restaurants, hotels, museums, etc.) in addition to transport.

Kim *et al.* (2021) used a web-based stated preference survey to investigate whether tourists on Jeju Island (Korea) prefer to travel via 'tour mode bundles' (as in the case of MaaS) or with individual trips. The results of this work show that the interaction of different transport modes is the solution preferred by tourists, paving the way for the integration of MaaS in the tourism sector. This result was also obtained by Kim *et al.* (2023) on a broader basis, by studying the travel preferences of tourists in 10 Korean cities.

Also in Taiwan, the preferences of 491 tourists for mobility packages offered by MaaS were analysed using a latent class choice model. The results of this work indicate the existence of a specific MaaS market for tourists and a heterogeneity of preferences among different tourist classes in Taiwan. Three categories of tourists were identified in relation to MaaS: sceptics (19.9%), supporters (58.6%) and enthusiasts (21.5%).

Lastly, Signorile *et al.* (2018) extended the relationship between MaaS and tourism outside the city, proposing the application of this approach on an interregional scale: the aim is to satisfy the tourist flows that from Milan, the capital of the Lombardy region, reach the tourist alpine areas of the Autonomous Province of Trento to the east and of the Aosta Valley to the west. The results show that in order to achieve a shift towards a more inclusive and sustainable mobility, there are still several challenges to be met: one of the most relevant concerns the need for stakeholders in the tourism sector to update their mobility offer, adapting it to the constantly evolving tourist demand.

2. 2. *Worldwide key examples*

There have already been a few attempts around the world to integrate MaaS and tourism into a single application: so far, these have been trials that lasted a few years and were then abandoned for various reasons. This section presents the main case studies.

2. 2. 1. The case of Helsinki, Finland

The first city in Europe to develop the Tourism-MaaS concept was Helsinki, the capital of Finland. The company in charge of tourism in the Finnish capital is Helsinki Marketing Ltd. (a municipality-controlled company), and in recent years it has been evaluating different solutions to

attract an increasing number of tourists from around the world. The corporate strategy is based on two key concepts: digitalised and sustainable tourism (Eberhardt 2019).

In particular, the City of Helsinki has targeted the growing number of Chinese tourists in the city: the outbound Chinese tourism market has boomed in recent years as a result of a rapidly growing middle class. Chinese tourists often make a stopover at Helsinki airport to reach other destinations in Western Europe, such as Paris and London, or to visit Lapland in the north. The Finnish capital's goal is to take advantage of its geographical location and keep Chinese tourists in the city for a few days: in 2017 alone, the number of trips made by Chinese tourists in Helsinki increased by 63%, which also led to a 126% increase in annual spending in the city compared to 2016 (Visit Finland 2023).

Helsinki Marketing Ltd therefore decided at the end of 2017 to start a collaboration with the Chinese company Tencent, owner of the Chinese super-app WeChat, to jointly develop an app that could make the stay of Chinese tourists in Helsinki as comfortable as possible. Research was conducted to understand the strengths and weaknesses of the Chinese tourist experience in Helsinki, and the results of this analysis showed that the main criticisms were related to the confusing use of public transport, difficulties with payment methods (especially the new generations of Chinese usually pay almost everything at home through their WeChat account on their mobile phones), and the willingness of Chinese tourists to live tourist experiences recommended by locals without following traditional tourist guides. Based on these results, the MyHelsinki WeChat Mini Program app was built to try to solve these problems in order to provide Chinese tourists with a complete travel experience and make them feel perfectly at home. The app allowed users to share recommendations on activities and attractions from users who had experienced them firsthand, the complete mobility offer was prepared by the locally based Whim MaaS app, which allowed tourists to make their trips in a fully integrated way, and finally, Chinese tourists were able to pay through their WeChat account (Karvonen 2018).

2. 2. 2. Other European case studies

Mio Trentino is an application created by the tourism office of the Trentino-Alto Adige Autonomous Region in Italy. As reported by Leung *et al.* (2022), the app is designed to provide useful information and services about Trentino, a very attractive mountain tourism destination. The app

is able to provide tourist information such as guides, maps, itineraries, weather, events and useful information on attractions, events, restaurants and accommodation. The app also provides information on public transport timetables and routes, such as buses and trains, and allows users to plan their journeys using the Journey Planner. For this reason, Mio Trentino is currently a Level 1 MaaS app, as tourists can only plan their trips, but are then forced to change apps to proceed with booking and payment.

Another example of the combination of MaaS and tourism comes from northern Finland, specifically the Lapland ski resort of Ylläs. The local destination marketing organization (DMO) launched a MaaS Level 2 trial called Ylläs Tiketti in 2017 to provide tourists with a seamless travel experience, allowing them to book and pay for public transport and tickets events directly from the app (Teppo 2019; Liu *et al.* 2020). This service was suspended in 2019 due to lack of funding (Leung *et al.* 2022).

2. 2. 3. Worldwide event-related apps

At a global level, some apps have been developed over time for specific events, showing a minimal level of integration between MaaS and tourism, and have been removed from app stores after the event. Events that attract thousands of visitors from around the world need to promote sustainable ways to get to and from the venues (Martins *et al.* 2022). The Tokyo Olympic Games was supposed to be an app developed specifically for spectators of the Tokyo 2020 Olympics (later to be held in 2021), but it was never launched due to a complete lack of audience as a result of Covid-19 restrictions. The Dubai Expo 2020 app, a Destination-specific app for the World Expo to be held in Dubai between 1 October 2021 and 31 March 2022, had a MaaS Level 1 and provided spectators with a travel planner to get to the exhibition pavilions. The same characteristics had the RioGo app, developed by technology provider SkedGo during the 2016 Olympic Games in Rio de Janeiro, and the official Asian Games 2018 app, developed by Moovit; both are no longer usable.

Finally, the GoYunnan app, developed by Tencent to promote tourism in China's Yunnan province and a precursor to the MyHelsinki project, also integrated mobility and tourism at a very basic level.

3. Materials and Methods

The purpose of this article is to provide an in-depth review of the most important travel apps worldwide. Furthermore, this study aims to analyze the technical characteristics of the selected apps and their relation-

ship with MaaS by studying the level of integration of each transport mode. An innovative quantitative SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis was then carried out, comparing the rating of each app with a MaaS indicator specifically designed to consider the level of MaaS and the number of transport modes included.

3.1. *Data collection*

Based on the different purposes of the travel apps available on the Google Play Store and the App Store, 4 different categories were identified (Table 1).

Table 1. Categories of travel applications identified.

Typology of apps	Description
Destination-specific	Destination-specific apps are officially developed and managed by the destination management organization (DMO) of a specific country / city / event to promote local tourism and attractions.
Transport and navigation	Transport and navigation applications are mobile apps that provide a range of services related to mobility and transport. These applications help users locate and navigate a variety of transport modes, including cycling and walking routes, as well as buses, trains, taxis, ride-sharing services and more. They provide options such as route planning and real-time location monitoring (MaaS Level 1).
Online Travel Agencies	Online travel agencies (OTAs) are web-based platforms that let customers reserve a range of travel-related services, including hotels, flights, rental cars, and vacation packages. Through the collection of their offers on a platform that is accessible to searches, they serve as a bridge between customers and travel suppliers. Users may compare and book a variety of travel alternatives conveniently through OTAs, which frequently offer attractive rates and promotions.
MaaS	MaaS apps are platforms that integrate different modes of transport and allow users to plan, book and pay for their journeys.

Source: own elaboration.

A total of 20 travel apps were selected for the purposes of this research: 5 for each of the 4 abovementioned categories.

Each app was first examined from a technical point of view, indicating the name, the seller, the presence in the Google Play Store and the App Store, the average rating obtained in both stores and the release date of the app (data not provided by the App Store). Each app was then rated

based on its relationship to MaaS. All modes of transport that can be included into MaaS, as identified by Kriswardhana and Esztergár-Kiss (2023), were given a different value depending on the degree of MaaS integration within the app (Table 2), as per Sochor *et al.* (2018).

Table 2. Values assigned to modes of transportation.

Value	Description
X	Mode of transport not included in the app
0	It is only possible to access information about one mode of transport. For journey planning, booking and payment there is a link to third party applications
1	The app provides a journey planner for the mode of transport
2	The app allows users to plan, book and pay for a specific mode of transport
3	The app offers bundles for a specific mode of transport
4	The app includes social policies

Source: own elaboration.

Furthermore, the present analysis exclusively incorporates English-language apps, thus ensuring consistent evaluation and reflecting the prevalent usage patterns of international tourists who often rely on English as a default language when using travel-related digital services.

In addition, for each app the maximum level of MaaS integration achieved across all available transport modes, the prevailing level of MaaS integration and the number of transport modes included were provided.

In order to evaluate the level of MaaS integration in each application in a consistent and comparative manner, a composite index termed the MaaS Indicator was constructed. The indicator under consideration integrates two dimensions:

- *The prevailing MaaS level* across all transport modes included in the application is as follows
- *The number of transport modes* that are supported.

The formula (1) is expressed as follows:

(1) **MaaS Indicator** = [(Prevailing MaaS Level × 6) + (Number of Transport Modes × 2)] / (6 + 2)

This weighted average places greater emphasis on the qualitative depth of integration (i.e. the extent to which MaaS features are advanced) than

on the quantitative breadth (i.e. the number of transport modes offered). The rationale for the weights (6 and 2) stems from the assumption, as evidenced by literature on MaaS system complexity (Sochor *et al.* 2018; Kriswardhana and Esztergár-Kiss 2023), that implementing higher levels of integration (e.g. bundling, subscriptions, payment systems) is substantially more challenging and impactful than merely including more transport options.

3. 2. *SWOT analysis*

The methods and strategy used for the SWOT analysis are fairly standardized and shared among researchers.

The quantitative SWOT analysis proposed in this study represents an original attempt to position travel applications based on both their average user rating and a custom-developed MaaS integration indicator. The method has been purposely simplified for the purposes of clarity and replicability, and it aligns conceptually with the broader family of multi-criteria decision-making (MCDA) tools.

The rationale underpinning the assignment of weights to the criteria (6 for prevailing MaaS level, 2 for number of transport modes) aligns with the priority weighting mechanisms employed in methodologies such as the Analytic Hierarchy Process (AHP), wherein decision-makers articulate the relative importance of criteria. Furthermore, the ultimate disposition of applications within the SWOT quadrants – predicated on their performance across two pivotal indicators – can be theoretically analogous to TOPSIS, a methodology that evaluates alternatives based on their distance from an optimal solution.

In academic literature, qualitative analysis has also been jointly used in the tourism and transport sectors: both to assess the impact of a new transport system on tourists' behavior (Kharitiyatun *et al.* 2023), and to investigate the relationship between MaaS and tourism (Leung *et al.* 2023).

The originality of this research lies in the proposal of a quantitative SWOT analysis: to the best of our knowledge, this type of methodology is completely new in literature and was developed specifically for this study. By using the numerical values of the app ratings and the MaaS indicator, it was possible to compare the two factors and place each app in the right quadrant of the SWOT matrix.

Applying the methods of SWOT analysis to the present case, the content of the four areas of analysis can be summarized as follows:

- Optimal – including all travel apps that already have both a fairly high rating and MaaS integration;
- Potential – which includes all travel apps that have fairly high ratings but still have a limited level of MaaS integration. These apps have the potential to improve through better MaaS integration;
- Indifferent – these are travel apps with fairly low ratings and MaaS integration levels. The managers of these apps may not be taking advantage of the opportunities that better MaaS integration would bring to their ratings;
- Negative – these are apps with very low ratings and MaaS integration scores. App operators do not believe in the MaaS system.

For each application analyzed within the study areas, it was decided to perform a double quantitative evaluation and therefore two parameters were identified:

1. the average rating obtained by the apps on the two stores examined;
2. the MaaS indicator specifically constructed and based on the weighted average of "Prevailing MaaS level" and "Modes of transport".

For the purposes of this research, the following scoring matrix was used for the two factors under consideration (Table 3).

Table 3. Scoring matrix applied for SWOT analysis evaluation.

KEY FACTOR	RATING	SCORE
APP AVERAGE RATING	VERY BAD	0 – 2.4
	BAD	2.5 – 2.9
	GOOD	3 – 3.9
	VERY GOOD	4 – 4.4
	EXCELLENT	4.5 - 5
MAAS INDICATOR	TRANSPORT NOT INCLUDED	0
	LOW	0.1 – 1.9
	MEDIUM	2 – 2.9
	HIGH	3 – 3.9
	VERY HIGH	4

Source: own elaboration.

To clearly define the criteria used to assign each app to one of the four SWOT quadrants, we introduce the following classification rules, based on the two key variables (Table 4): average app rating and the MaaS Indicator.

Table 4. Classification rules for SWOT matrix positioning.

QUADRANT	RATING (AVG)	MAAS INDICATOR	INTERPRETATION
Optimal	≥ 3.0 (Good or higher)	≥ 2.0 (Medium or higher)	Apps with high user appreciation and solid MaaS integration
Potential	≥ 3.0	< 2.0	Well-rated apps with low MaaS integration, showing potential for growth
Indifferent	< 3.0	< 2.0	Apps with both low ratings and weak MaaS integration
Negative	< 3.0	≥ 2.0	Technically strong apps with poor user reception

These threshold values align with the scoring system introduced in Table 3 and ensure replicability in the app classification process.

4. Findings

This section presents the results of the analysis carried out in the following steps: review of travel applications, data collection and SWOT analysis.

4. 1. *Review of travel apps*

The review process of the travel apps led to the following results. Below are the selection criteria and the selected apps description.

4. 1. 1. Destination-specific apps

Based on the top 30 most visited cities in the world in 2022, according to Euromonitor International (2022), the top 5 cities in the ranking presenting official Destination-specific apps were selected for this research: Dubai, Amsterdam, London, Berlin and New York.

Visit Dubai

MaaS Level 0 app, as the app provides the user with information about different modes of transport in the city, but forces them to use another app for both route planning (Level 1) and ticket purchase (Level 2). Specifically, the Visit Dubai app provides tourists with information on public transport (buses, trams, Palm Monorail, metro, water buses, abras, fer-

ries and air-conditioned ferries), taxis, water taxis and ride-hailing services (Uber, Rta and Careem): to plan the route and purchase the ticket for all these MSPs (Mobility Service Providers), the app redirects the user to the official website of the Roads and Transport Authority, from where it is possible to proceed with the aforementioned actions.

I Amsterdam City Card

The 'I amsterdam City Card' app is not a real official tourism app, as its use requires the purchase of a special City Card, which gives free access to many attractions and the use of public transport for a fixed fee on a daily or multi-day basis. The City Card gives free access to all GVB public transport vehicles (trams, buses, metro, ferries). Tourists can also use the app to find out about bicycle hire throughout the city. For both the purchase of the City Card, which gives access to public transport, and the rental of bicycles, the app redirects users to other third-party websites. For this reason, this app is MaaS Level 0.

Visit London Official Guide

The official London tourism app can be classified as MaaS Level 0, where only a few MSPs are included and it is not possible to buy tickets or plan trips directly from the app. The transport app only provides users with a map of London's transport system, which can be filtered according to the type of transport required (Underground, Night, Bus and Rail), with an indication (without link) of the website to contact for timetables and to buy tickets (tfl.gov.uk). The app also includes some information on bike and e-bike hire, cable cars and airport connections. In each of these cases, the app allows the tourist to see the location of the vehicles on the map but redirects to an external site/app for planning (TFL Journey Planner, Google Maps and City Mapper) and buying tickets. In addition, for cable cars and ferries, the app redirects users to buy tickets directly to the official London Tourist Board website.

Going Local Berlin

The Berlin app Going Local Berlin is a MaaS Level 0 app exclusively for public transport. The app lists numerous attractions with the indication of the website where users can find all the information and buy tickets. In addition, the app provides a link to the official website of BVG, Berlin's public transport company, for each attraction. It should be noted that a

Level 3 MaaS platform called Jelbi, managed by BVG, is already active in Berlin: the link in the Going Local Berlin app refers only to the BVG, but without any connection to Jelbi, thus missing the opportunity to associate excellent MaaS with tourism.

I Love NY

New York City's official tourism app, I Love NY, which also includes attractions in other areas of New York State, does not offer any kind of MaaS as it does not provide information on transport. The only option for users is to select the attraction of interest and access transport information via an external link, but tourists must then download another app to plan and purchase tickets for their trip.

4. 1. 2. Transport and navigation apps

The 5 "Transport and navigation apps" selected for this research represent the most downloaded travel apps in 2022 (Apptopia/a, 2023), by aggregated[1] number of downloads: the top 10 also includes travel apps belonging to other categories, which were therefore discarded for this research. The selection process therefore resulted in Google Maps (113 million downloads in 2022), Uber (107 million), Where is my Train (46 million), inDrive (41 million) and AutoNavi (37 million).

Google Maps

Released in 2005 for browsers and in September 2008 for the Google Play store, Google Maps is the most downloaded navigation application in the world (more than 10 billion). At the moment, it is only the most famous and used journey planner by tourists from all over the world (MaaS Level 1), but it seems to want to enter the MaaS universe in the near future. To this end, in 2020 the company acquired Hamburger Hochbahn, the public transport operator in Hamburg, Germany: at the moment, users planning a trip can plan their route on Google Maps, but are then redirected to the official HVV app to buy tickets. With Google's recent development of Google Wallet for increasingly efficient and secure transactions, it is easy to imagine that the company will also integrate ticket purchase and booking functions into its app in the coming years.

[1] Both on Google Play Store and App Store.

Uber

Uber is one of the most downloaded ride-hailing apps in the world (more than 500 million downloads) and provides only one mode of transport, ride-hailing: this platform connects drivers, people who use their own car, with users who want to get from A to B. For this specific mode of transport, Uber can be considered a Level 3 MaaS app, as the user, without ever leaving the app, has the possibility to plan his route (MaaS Level 1), buy transport (MaaS Level 2) and enjoy specific discounts (MaaS Level 3). In addition, from December 2022, the user experience for passengers/tourists has been further enhanced with the addition of Uber Travel, which is a new feature: by accessing users' emails and diaries, Uber automatically reorganizes their bookings based on flight, restaurant and hotel changes or delays. Uber is also a true super-app, allowing users to have food, groceries, alcohol, mini-markets, pharmacies, pet supplies and flowers delivered to their homes: users select their products and pay directly from the app.

Where is my train

"Where is my train" is an app developed in India to improve the lives of Indian commuters who travel by train every day. The app is one of the most downloaded transport apps in 2022 (more than 100 million downloads) and one of the most popular. This app is MaaS Level 1 exclusively related to the railway transport mode, as it provides passengers with a lot of information about live train position, delays, schedule changes, etc. The success of this app is also due to the possibility of using the services offline, without the need for Internet or GPS. "Where is my train" also allows people to check the availability of seats on board the train by consulting the official Indian Railways website, without leaving the app.

inDrive

inDrive is an app that allows users to request and book a taxi or private car directly from their smartphone. Unlike traditional ride-hailing apps (such as Uber), inDrive allows users to negotiate the fare with the driver. Users must create an account on the app by registering their name and payment details: then, when ready to book a trip, they specify the starting point, the desired destination and the price they are willing to pay for the ride. At this point, users can negotiate the price of the trip with the driver

and try to reach an agreement that satisfies both parties. At the end of the trip, the driver is paid directly through the app using the payment method associated with the account.

inDrive is therefore an app that offers passengers the opportunity to save on travel costs by allowing them to negotiate the price of transport. In addition to ride-hailing services, the app can also be used to send and receive parcels up to 20kg or to book a truck for a move. inDrive is a Level 3 MaaS app for ride-hailing services only, not including other MSPs.

AutoNavi

AutoNavi is a Chinese application developed by Alibaba that provides navigation and digital map services to more than 700 million users in China. The application uses satellite positioning to provide real-time driving directions and traffic information. Through the application, users can also perform actions such as address search, turn-by-turn voice navigation, view detailed maps and plan alternative routes based on traffic conditions. The application also displays useful information such as petrol stations, car parks and points of interest along the route. In addition, AutoNavi includes real-time location sharing and allows users to find and book taxis (MaaS Level 2), as well as public transport services such as bus, train and metro information (MaaS Level 1). AutoNavi is very popular in China for its accuracy and reliability of driving directions: the app has been selling China mapping services to Google since 2006. Finally, it is important to note that the app is mainly in Chinese and some basic knowledge of the Chinese language may be required to make full use of it.

4. 1. 3. Online Travel Agencies apps

Based on the most downloaded OTA apps worldwide in 2022, by aggregated number of downloads (Apptopia/b, 2023), the top 5 apps in the ranking were selected for this study: Booking.com (80 million), Airbnb (52 million), Expedia (27 million), Agoda (21 million) and Vrbo (20 million).

Booking.com

Booking.com is a global accommodation and travel booking application. Booking.com allows users to search and book more than 1.5 million accommodation options such as hotels, holiday rentals, apartments, hostels and bed & breakfasts anywhere in the world. The way the app works is

simple: users enter their destination and the dates they want to stay, and Booking.com displays a list of accommodation available in that area for those dates. Users can then filter the results to find the option that best suits their needs based on criteria such as price, guest rating, amenities offered and other features. Once the desired accommodation has been selected, the app allows users to book and pay directly. Recently, the app has also offered users three modes of transport to organize their travel: air, taxi and rental car, all three options with a Level 3 of MaaS.

Airbnb

Airbnb is an online platform that allows people to rent or find accommodations around the world. Users, after creating their account, can search for accommodations based on destination, dates and number of guests. Once a suitable accommodation has been found, users send a booking request to the accommodation owner who can accept or decline the booking. Airbnb also offers a number of additional services such as guided experiences and restaurant reservations to further enrich users' travel experience. However, these extra services do not include transport: for this reason, the app does not feature any type of MaaS.

Expedia

Airbnb is an online platform that allows people to rent or find accommodations around the world. Users, after creating their account, can search for accommodations based on destination, dates and number of guests. Once a suitable accommodation has been found, users send a booking request to the accommodation owner who can accept or decline the booking. Airbnb also offers a number of additional services such as guided experiences and restaurant reservations to further enrich users' travel experience. However, these extra services do not include transport: for this reason, the app does not feature any type of MaaS.

Agoda

Agoda is an Asian app that offers booking services for hotels, holiday rentals, flights and other accommodation around the world. It is one of the leading companies in the online hotel booking industry, offering a wide range of accommodation options at competitive prices. Agoda is available in multiple languages and currencies, making it easy for people of different nationalities to book accommodation while travelling. Agoda is

a super app that allows users to use MaaS Level 3 for buses, trains and ferries (currently only in Asia), airport transfers and flights. For car rentals, the app, in partnership with Rental Cars (part of the same group), allows users to compare different options and redirects them to third party sites for payment (Level 1 of MaaS).

Vrbo

Vrbo is an app that allows vacation home owners to rent out their properties to tourists and travelers. Users can book accommodations around the world through the app, which offers a large selection of holiday homes, apartments, villas and other short-stay accommodations. The platform also offers tools to help owners manage reservations, including availability calendars, rate management and payment systems. Vrbo is a brand of Expedia Group, one of the leading companies in the online travel industry. Like Airbnb, Vrbo also does not include any transportation options in its services.

4. 1. 4. MaaS apps

Lyko (2022), one of the main technology providers in the MaaS sector, has produced a report on the 10 MaaS apps in the world (all Level 2 or 3) with the lowest number of deep links (redirects to third-party sites) for users' payment and booking processes. For the purposes of this research, 5 MaaS apps were selected that cover operational areas of increasing size: Jelbi (City of Berlin), WHIM (Greater Tokyo), Île-de-France Mobilités (Île-de-France region), SNFC Connect (France) and Free Now (supranational).

Jelbi

Jelbi is a Level 3 MaaS application developed jointly by BVG (Berlin's public transport authority) and Lithuanian technology provider Trafi, operational since 2019. The application allows users to book different modes of transport, such as bikes, scooters and car sharing, through a single platform. It also provides real-time information on public transport, including buses, trams and trains, allowing users to plan their journeys efficiently. The app offers users different all-inclusive subscription methods through a flat rate payment: for example, the daily ticket (€9.50), the 7-day ticket (€39.00) and the monthly ticket (€91.00). Although there are 7 modes of transport included in the app, the total number of operators is 12, as some

operators compete for the same mode of transport: for example, e-scooter sharing, where TIER, Voi and Lime are currently present.

WHIM

WHIM in 2022 was the reference MaaS app on a global scale, before going bankrupt in 2024. Active in Helsinki since 2017, the company had expanded over time to Turku, Vienna, Switzerland (the world's first regional MaaS), Greater Tokyo, Belgium and the West Midlands of the Kingdom United. The app allowed users to plan, book and pay for trips using a variety of transport options, which in the case of Helsinki included public transport, taxis, car rentals, bike sharing services, electric scooters, while in Tokyo so far this excluded public transport. The app was MaaS Level 3 as it allowed users to subscribe to monthly packages that combine different transportation services into a single subscription. For example, a user could subscribe to a package including public transport, bicycle rental and taxis.

Île-de-France Mobilités

IDFM (Île-de-France Mobilités) is the MaaS app for the Paris region and the official sponsor of the forthcoming Paris 2024 Olympic Games. The app replaces the previous Via Navigo, launched in 2012, and now includes 15 operators from 6 different transport modes: public transport (IDFM and OrlyBus), regional (Transilien) and national (SNCF) trains, bike-sharing (4 operators), carpooling (5 operators), car-sharing (2 operators) and free-floating scooters (1 operator). This application is currently MaaS Level 2 as it does not offer packages or discounts to users.

SNFC Connect (ex "Assistant SNFC")

After 18 months of development, SNFC released this app on 25 January 2022 in an effort to consolidate several apps into one. The former version of SNFC Assistant, which was released in 2019 and served as France's first MaaS implementation, has been replaced by SNFC Connect. This app allows people to book and pay for trains, buses such as Blablacar or Flixbus, rental cars and carpooling. In contrast, the previous app, SNFC Assistant, was able to offer a full MaaS service. It aimed to combine all available transport modes, such as buses and trains, as well as self-service bikes and scooters, taxis and VTCs, car-pooling services, etc. in a single application to optimize a specific door-to-door journey. At the moment this MaaS Level 2 app includes only trains, car rental and taxis.

Free Now

Free Now (formerly MyTaxi), created by the collaboration of the German brands BMW and Daimler, is a supranational mobility super-app present in several European countries (Germany, Italy, Greece, Spain, France, United Kingdom, Ireland, Austria and Poland) and able to include in its offer numerous mobility options that vary according to the geographical context (taxis, car sharing, scooters, e-bikes and electric scooters). Free Now is therefore a Level 2 MaaS application, with the next step being the introduction of public transport, which has always been considered the backbone of MaaS (Smith *et al.* 2018).

4. 2. *Travel apps data collection*

This section presents the results of the data collection of the selected travel apps. Table 5 shows the first phase of the study, i.e. the analysis of the technical characteristics of each travel app (name, seller, presence in app stores, release date and rating). The rating column is highlighted since it is one of the two factors used to construct the quantitative SWOT analysis.

TABLE 5. Technical analysis of the characteristics of travel apps.

	APP	SELLER	PLAY STORE	APP STORE	RELEASED ON	RATING (AVG)
DESTINATION-SPECIFIC APPS	Visit Dubai	Dubai Department of Tourism and Commerce Marketing	P	P	19-Dec-14	3.5
	I amsterdam City Card	Amsterdam&partners	P	P	24-Apr-19	2.7
	Visit London Official Guide	London & Partners Ltd	P		31-May-17	4.6
	Going Local Berlin	Berlin Tourismus & Kongress GmbH	P	P	17-Feb-15	3.8
	I Love NY	NYS Office of Information Technology Services	P	P	5-Feb-15	3.3
TRANSPORT AND NAVIGATION APPS	**APP**	**# Aggregated Downloads 2022 (mln)**	**SELLER**	**PLAY STORE**	**APP STORE**	**RELEASED ON (Google Play Store)**	**RATING (AVG)**
	Google Maps	113	GOOGLE LLC	P	P	Sep-08	4.3
	Uber	107	Uber Technologies, Inc.	P	P	28-Oct-10	4.8
	Where is my Train	46	Sigmoid Labs and its affiliates	P	P	13-May-21	4.5
	inDrive	41	Suol Innovations LTD	P	P	18-May-15	4.8
	AutoNavi	37	AutoNavi Information Technology Co. Ltd.	P	P	7-Sep-10	3.8
OTA APPS	**APP**	**# Aggregated Downloads 2022 (mln)**	**SELLER**	**PLAY STORE**	**APP STORE**	**RELEASED ON (Google Play Store)**	**RATING (AVG)**
	Booking.com	80	Booking.com Hotels & Vacation Rentals	P	P	4-Feb-11	4.7
	Airbnb	52	Airbnb, Inc.	P	P	17-Jan-12	4.7
	Expedia	27	Expedia, Inc.	P	P	10-May-11	4.7
	Agoda	21	Agoda.com	P	P	6-Jul-11	4.7
	Vrbo	20	HomeAway.com, Inc.	P	P	16-Jun-17	4.8

MAAS APPS	OPERATIVE AREA	APP	SELLER	PLAY STORE	APP STORE	RELEASED ON (Google Play Store)	RATING (AVG)
	Berlin	Jelbi	Berliner Verkehrsbetriebe (BVG)	P	P	10-Jun-19	4.4
	Greater Tokyo	WHIM	MaaS Global Oy	P	P	12-Nov-17	3.3 (Not present on Google Play Store)
	Île-de-France Mobilités	Île-de-France Mobilités	Île-de-France Mobilités	P	P	3-Feb-12	4.6
	France	SNFC Connect (ex Assistant SNFC)	SNCF Connect & Tech	P	P	28-Jun-16	4.6
	Germany	Free Now	Intelligent Apps GmbH	P	P	27-Oct-10	4.5

Source: own elaboration.

Table 6 shows the second phase of the review process: the analysis of the relationship between travel apps and MaaS. For each app, the level of MaaS integration of the transport modes has been indicated. In addition, the maximum level of MaaS integration achieved by each app for the modes it offers, the most used level of integration and the number of modes present on its platform have been reported in the column. Finally, the MaaS indicator has been highlighted, which is made up of the weighted average of the "Prevailing MaaS level" and "Modes of transport", with the first factor having a weight of 6 and the second of 2.

TABLE 6. Analysis of the MaaS integration level of the identified travel apps.

DESTINATION-SPECIFIC APPS	APP	PUBLIC TRANSPORT	RENTAL CARS	CAR SHARING	RIDE HAILING	AIRPORT TRANSFER	TAXI	MOPEDS/E-MOPEDS SHARING	BIKES/E-BIKES SHARING	E-SCOOTERS SHARING	FERRIES	TRAIN	COACH	OTHER	MAX MAAS LEVEL REACHED	Prevailing MaaS Level	Modes of transport	MaaS Indicator
	Visit Dubai	0	X	X	0	X	0	X	X	X	0	X	X		0	0	4	1
	I amsterdam City Card	0	X	X	X	X	X	X	0	X	0	X	X		0	0	3	0.75
	Visit London Official Guide	0	X	X	X	0	X	X	0	X	0	X	X		0	0	4	1
	Going Local Berlin	0	X	X	X	0	X	X	X	X	0	X	X		0	0	3	0.75
	I Love NY	X	X	X	X	X	X	X	X	X	X	X	X		X	X	0	0

MaaS Indicator	3.25	2.5	1	2.5	3.25
Modes of transport	10	1	1	1	10
Prevailing MaaS Level	1	3	1	3	1
MAX MAAS LEVEL REACHED	1	3	1	3	2
OTHER		Food, groceries, alcohol, minimarket, pharmacy, pet supplies, flowers.		Parcels up to 20kg and trucks for moves.	
COACH	X	X	X	X	X
TRAIN	X	X	1	X	X
FERRIES	1	X	X	X	1
E-SCOOTERS SHARING	1	X	X	X	1
BIKES/E-BIKES SHARING	1	X	X	X	1
MOPEDS/E-MOPEDS SHARING	1	X	X	X	1
TAXI	1	X	X	X	2
AIRPORT TRANSFER	1	X	X	X	1
RIDE HAILING	1	3	X	3	1
CAR SHARING	1	X	X	X	1
RENTAL CARS	1	X	X	X	1
PUBLIC TRANSPORT	1	X	X	X	1
APP	Google Maps	Uber	Where is my Train	inDrive	AutoNavi
TRANSPORT AND NAVIGATION APPS					

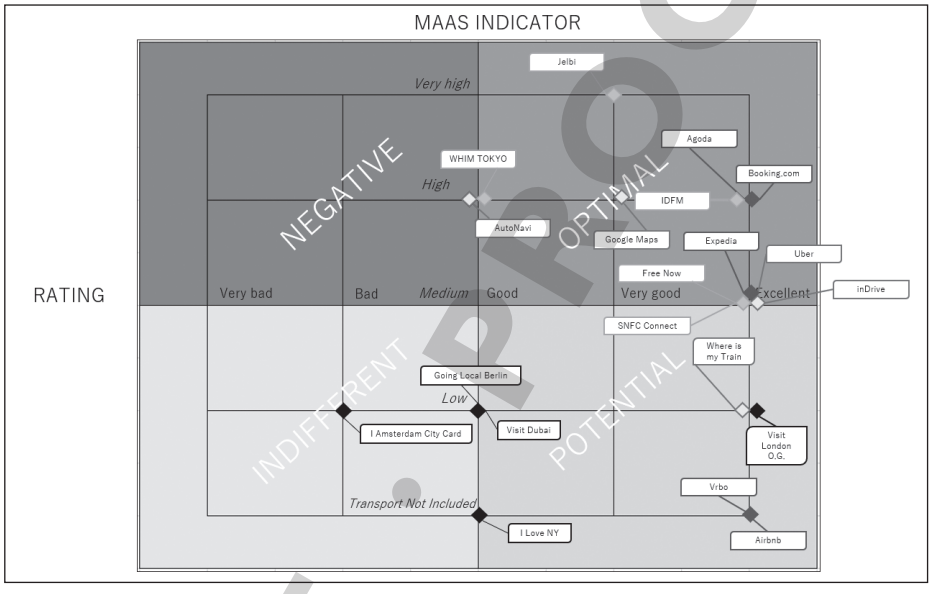
MaaS Indicator	3	0	2.75	3.25	0
Modes of transport	3	0	2	4	0
Prevailing MaaS Level	3	X	3	3	X
MAX MAAS LEVEL REACHED	3	X	3	3	X
OTHER	Flights		Flights	Flights	
COACH	X	X	X	X	X
TRAIN	X	X	X	X	X
FERRIES	X	X	X	3	X
E-SCOOTERS SHARING	X	X	X	X	X
BIKES/E-BIKES SHARING	X	X	X	X	X
MOPEDS/E-MOPEDS SHARING	X	X	X	X	X
TAXI	3	X	X	X	X
AIRPORT TRANSFER	X	X	X	3	X
RIDE HAILING	X	X	X	X	X
CAR SHARING	X	X	X	X	X
RENTAL CARS	3	X	3	1	X
PUBLIC TRANSPORT	X	X	X	3	X
APP	Booking.com	Airbnb	Expedia	Agoda	Vrbo
OTA APPS					

MAAS APPS	APP	PUBLIC TRANSPORT	RENTAL CARS	CAR SHARING	RIDE HAILING	AIRPORT TRANSFER	TAXI	MOPEDS/E-MOPEDS SHARING	BIKES/E-BIKES SHARING	E-SCOOTERS SHARING	FERRIES	TRAIN	COACH	OTHER	MAAS LEVEL	Prevailing MaaS Level	Modes of transport	MaaS Indicator
	Jelbi	3	X	3	X	X	3	3	3	3	3	X	X		3	3	7	4
	WHIM	X	X	3	X	X	3	X	3	X	X	X	X	Shared Shuttle	3	3	4	3.25
	Île-de-France Mobilités	2	X	2	2	X	X	X	2	2	X	2	X		2	2	6	3
	SNFC Connect (ex Assistant SNFC)	2	2	X	X	X	2	X	X	X	X	2	X		2	2	4	2.5
	Free Now	X	X	2	X	X	2	2	2	2	X	X	X		2	2	5	2.75

Source: own elaboration.

4. 3. *Quantitative SWOT analysis*

The second step of the research concerns the construction of a quantitative SWOT analysis by examining the "Rating" and "MaaS Indicator" factors of the 20 travel apps studied (Figure 2). Table 7 shows the colour legend.



Source: own elaboration.

Figure 2. Quantitative SWOT analysis.

Table 7. Colour legend.

DESTINATION SPECIFIC APPS	
TRANSPORT AND NAV. APPS	
OTAs APPS	
MAAS APPS	

Source: own elaboration.

A comparative analysis of the four app categories reveals distinct positioning patterns within the SWOT matrix. MaaS apps and OTAs most frequently fall into the Optimal quadrant, indicating strong user approval and solid integration levels. The efficacy of transport and navigation applications is equivocal, frequently achieving optimal or potential ratings.

In contrast, destination-specific apps are predominantly in the Indifferent or Potential zones, indicating limited integration despite acceptable ratings. This suggests that public-sector developers should consider allocating greater resources to the integration of MaaS features, while private platforms could enhance value through the implementation of deeper integration and service bundling.

5. Discussion and conclusions

The process of reviewing the main travel apps available in the Google Play Store and the App Store has allowed important information to be gathered about these apps, their tourism features and their level of MaaS integration. From the data obtained, the average rating of the apps was considered, as well as the MaaS indicator, which was constructed through the weighted average of the prevailing level of MaaS integration of the apps and the number of transport modes included in the platform. Using these two factors, a quantitative SWOT analysis was constructed, in which the 20 travel apps analysed were positioned.

The results show that the Destination-specific apps all have a low or non-existent level of MaaS integration (I Love NY) and the rating varies between good and bad (except Visit London Official Guide). These apps aim to promote local tourism, attract new visitors and provide a seamless user experience for tourists: integrating a MaaS platform into the app would concretely help to achieve these objectives and significantly improve their rating (i.e. user appreciation).

This is confirmed in the literature (FIA 2020; MaaS *et al.* 2021), which shows that tourists are in favour of and ready to adopt new applications that both simplify the planning and payment process and provide a sustainable and active transport system. The cooperation of all stakeholders involved, both in the transport and tourism sector, is the crucial factor for the final implementation of this new type of apps: managing the full integration of these services is the most difficult challenge, as the planning of the tourist offer and the transport system often diverge (Martinčević *et al.* 2021).

The transport and navigation apps are all positioned in the optimal quadrant of the matrix (except for Where is my Train): the apps with an excellent rating (Uber and inDrive) have a medium MaaS level, as they provide a very high level of MaaS integration (Level 3), but only for one mode of transport (ride-hailing). AutoNavi, on the other hand, includes many modes of transport (10), but with a MaaS integration level always

equal to 1, except for taxis (Level 2): however, the rating of this Chinese app is only good. Google Maps also includes 10 modes of transport with a predominant MaaS integration level of 1, but enjoys a more favourable rating than AutoNavi. Transport and navigation apps do not currently include tourism features directly. However, they often sell their geo-referencing data to tourism operators who need to improve the search and booking process for hotels and restaurants on their sites and apps (Google Maps is a leader in integrating its platform with third party sites and apps).

The online travel agency apps all have excellent ratings, confirming the high value users place on this type of app, whose global market is growing rapidly (STATISTA 2019). With the exception of Vrbo and Airbnb, which do not have transport capabilities, the others are placed in the optimal quadrant of the matrix. Booking.com, Agoda and Expedia have a rather high prevailing level of MaaS integration (3), but a reduced number of transport modes (3, 2 and 4 respectively). The literature has studied users' willingness to book on OTA platforms (Jamrozy and Lawonk 2017; Lei *et al.* 2019), confirming that users' intention to book trips through OTA apps is higher when they perceive that they will derive monetary value and perceived service quality from the purchase on them (Talwar *et al.* 2020).

For this reason, the goal of OTAs apps is to provide MaaS 3 integration level services for as many transport modes as possible: in this way, they avoid redirecting users to third-party sites and apps, and increase their revenues and the collection of strategic business data.

The MaaS applications are all placed in the optimal quadrant of the SWOT matrix, as they all naturally have MaaS integration levels of at least 2 and high rating levels (greater than or equal to good). In overall terms, looking at the SWOT matrix, it should be noted that 12 out of 20 travel apps are in the optimal quadrant and 10 out of 20 have very high scores (all between very good rating and medium MaaS integration). The data show a positive correlation between a high level of MaaS integration (at least Level 2) and user appreciation: with the exception of WHIM Tokyo and AutoNavi, all travel apps with at least MaaS Level 2 received a very good or excellent rating.

This trend confirms what has been found in the literature on the high level of acceptance by users of MaaS platforms (Le Pira *et al.* 2023).

There are limitations to this work that could be addressed by future research. The subject of this study is the relationship between MaaS and tourism: it should be noted that MaaS technology is still in its infancy,

with several projects underway but few concrete cases of application in the world, which does not allow an in-depth analysis of the phenomenon and its consequences over time. Because of this, MaaS research is still in its early stages and therefore the real impact that MaaS can have on other sectors (including tourism) is still little studied.

The analysis in this article is only an exploratory study of the main travel apps: in the future it would be useful to carry out an in-depth analysis of individual products.

This research selected apps available in English: apps in other languages that did not have an English version were not included in this analysis. Furthermore, this study only had access to the information about the apps that was published by the app owners (Google Play Store and App Store).

The results of this research show that all travel apps available in the app stores today do not have relevant "MaaS tourism" features. All the apps considered for this analysis have the characteristics of the category to which they belong and only some services in common with the other typologies.

The contribution of this article to the research, given the limited number of publications on the subject, is to provide an overview of the most downloaded and used travel apps in the world, showing the limitations of each app by including only a few services and excluding others. In order to attract tourists and increase the monetisation of MaaS, one of the key barriers of this technology that is heavily dependent on public funding, this study highlights the urgent need for DMOs, local authorities and PTAs to work synergistically to create innovative applications that can integrate MaaS and tourism features. Future work may include (1) enhancing the MaaS Indicator with UX and functionality-related criteria, and (2) applying the model longitudinally to monitor how MaaS integration evolves over time within travel apps.

In the future, MaaS-Tourism platforms could be radically enhanced by the integration of Artificial Intelligence (AI) for the purpose of providing personalised travel suggestions, real-time analytics to adapt itineraries on the fly based on user behaviour or disruptions, and dynamic bundling algorithms capable of creating customized, context-aware packages combining transport, accommodation, and activities. The implementation of these technologies has the potential to enhance user satisfaction and to facilitate the development of novel monetisation strategies for both public and private stakeholders.

6. Declaration of interest statement

The authors declare no conflict of interest.

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Appendix A – Glossary of Acronyms

AI – Artificial Intelligence
The development of systems that are designed to emulate human intelligence.

AHP – Analytic Hierarchy Process
A structured decision-making method within Multi-Criteria Decision Analysis (MCDA) that uses pairwise comparisons to determine the relative importance of multiple criteria.

AISBL – Association Internationale Sans But Lucratif
A legal designation for non-profit international associations, often used by European organizations such as the MaaS Alliance.

BVG – Berliner Verkehrsbetriebe
The main public transport company of Berlin, Germany, responsible for buses, trams, subways (U-Bahn), and ferries.

DMO – Destination Management Organization
An entity responsible for the strategic marketing and development of tourism within a specific area or destination.

FIA – Fédération Internationale de l'Automobile
A global federation of automobile associations, involved in mobility research and policy advocacy.

GPS – Global Positioning System
A satellite-based navigation system that provides location and time information to devices and applications.

HVV – Hamburger Verkehrsverbund
The integrated public transport authority of the Hamburg metropolitan region, Germany.

IDFM – Île-de-France Mobilités
The regional authority responsible for organizing public transport in the Île-de-France region, including Paris.

MCDA – Multi-Criteria Decision Analysis
A family of techniques used to evaluate options based on multiple, often conflicting, criteria.

MaaF – Mobility as a Feature
An emerging model where mobility is embedded as one of several services in a broader "super-app", rather than being the app's core function.

MaaS – Mobility as a Service
A digital mobility concept that integrates various modes of transport into a single service platform for trip planning, booking, and payment.

MSP – Mobility Service Provider
Any company or platform that offers one or more modes of transport, such as bike-sharing, car-sharing, or ride-hailing services.

OTA – Online Travel Agency
A digital platform that enables users to search for and book travel-related services such as flights, hotels, and car rentals.

PTA – Public Transport Authority
A government or municipal agency responsible for managing public transportation systems.

SNCF – Société Nationale des Chemins de fer Français
The national state-owned railway company of France.

SWOT – Strengths, Weaknesses, Opportunities, Threats
A strategic analysis framework used to evaluate internal and external factors affecting an organization, product, or service.

TFL – Transport for London
The integrated transport authority managing public transport services in Greater London.

TOPSIS – Technique for Order of Preference by Similarity to Ideal Solution
An MCDA technique that ranks alternatives based on their geometric distance from an ideal solution.

UITP – Union Internationale des Transports Publics (International Association of Public Transport)
A global network for public transport authorities and operators, promoting sustainable mobility solutions.

UX – User Experience
Refers to the overall experience and satisfaction of a user when interacting with a system or application.