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Towards the hyper-personalisation of travel itineraries – AI-supported virtual interlining

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Abstract

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The concept of virtual interlining and its effect on travel are introduced, discussed critically and conceptualised. Parallel to this, generative artificial intelligence (GenAI) is discussed within the context of virtual interlining, including early examples of early adoptions of this technology by online travel agencies (OTAs). Implications for practice, policy-making and scholarly research are outlined. It is posited that the full potential offered by virtual interlining platforms will require amendments to the existing legal framework affecting passenger rights so that it adopts a more holistic approach to multi-connection itineraries incorporating air and rail travel.

Keywords

Virtual interlining, artificial intelligence, online travel agencies, AI platforms

Introduction

Global travel destinations tend to offer direct flights to major airport hubs and capital cities around the world. However, regional airports can often have varying levels of connectivity, which often require travellers to include one or more connect flights in their itinerary. This process is often referred to as interlining (IATA, 2024). Parallel to this, airports play an important role in the competitiveness of the destination ecosystem, especially in the context of tourism cities (Lasisi et al., 2025, González-Rodríguez et al., 2023). This is now increasingly supported by disruptive technologies, including generative artificial intelligence (GenAI), digital twins (DT), the metaverse, and machine learning (ML), among others, with the aim of improving the visitor experience.

In these increasingly technologically complex settings, online travel agencies (OTAs) and consumers are developing a growing role in a new form of interlining – Virtual Interlining (VI). VI has emerged as a result of a growing need among travellers to book two or more separate tickets as part of their travel itineraries – a process commonly referred to as self-connection reservations (Suau-Sanchez et al., 2016; Cheung et al., 2022). Today, although VI remains far from achieving its full potential with few airports able to operate to its full requirements (Cheung et al., 2022), the support of GenAI technologies in this context is beginning to offer new opportunities for airports, airline operators and OTAs to reduce costs for all stakeholders and increase the effectiveness of vertical marketing strategies in tourism (Meire & Derudder, 2021; Wendel et al., 2024).

When two or more airlines decide to share flight services on a specific route, this is commonly referred to as a codeshare flight. However, this is a relatively recent development, and it applies to a limited though growing number of itineraries. In cases where airlines operate without any codeshare agreements in place, OTAs have traditionally capitalised on a market opportunity to offer more personalised packages. However, the advent of GenAI is increasingly leading to an enhancement of VI platforms to include other itinerary segments, including trains, shuttle buses, hotels, and rental cars, among other services, using integrated itineraries that are more CO2 efficient (Vinod, 2022, 2024; Meire & Derudder, 2022; Taneja, 2024; Mansfield et al., 2025). For instance, in 2020, Qatar Airways signed a codeshare deal with German rail operator Deutsche Bahn to make flight tickets valid on rail journeys to eight German cities, with a target to reduce CO2 emissions by 50% by 2030 and achieving zero emissions by 2050, in line with the European Green Deal. Inevitably, there remain challenges to the efficiency of these schemes, including the higher potential for missed travel connections (Karadag, 2024) and lost baggage. Today, 40% of baggage handling incidents are linked directly to interlined travel itineraries (SITA, 2023).

In spite of the growing importance of VI in travel and tourism, this concept appears to have attracted a rather limited amount of interest from scholars (Meire & Derudder, 2022), especially in the context of OTAs and GenAI (Vinod, 2022). However, encapsulating VI as a mere digital tool to improve the efficiency and connectivity of airlines is rather simplistic in view of the opportunities that GenAI technologies now offer in this context (Taneja, 2024). Against this backdrop, this article extends earlier research on VI in the context of travel and attempts to enhance existing understanding of the potential of VI options supported by GenAI, with OTAs and consumers as the main beneficiaries in terms of the personalisation of travel and visitor experiences.

From standard Virtual Interlining to GenAI-supported platforms

The Chicago Convention – signed in 1944 – and the deregulation of the US domestic market in the 1970s allowed commercial airlines to diversify their business portfolios and reach bilateral air service agreements (ASAs) to expand their services across the globe, with airlines such as British Airways working in partnership with Iberia or All Nippon Airways working jointly with Air China. This collaborative approach has been enhanced further in the last 15 years through the advent of VI (e.g., Kiwi.com in 2012).

Although further research into VI platforms is still required, earlier studies have argued that VI can offer more efficient itinerary solutions both in terms of logistics and cost (Meire and Derudder, 2021). Moreover, the increasing use of technologies such as Global Distribution Systems (GDS), Passenger Service Systems (PSS) and Central Reservation Systems (CRS) is helping to optimise booking processes in interlining both from a business-to-business perspective (e.g., Amadeus and Webjet) as well as in a business-to-customer context (Altexsoft, 2021). Integration of systems is also a major area of activity in practice and one that remains under-researched from a scholarly perspective. For instance, in 2024 the Tripninja SmartFlight API was integrated into Webjet's OTA business's operating procedures, resulting in average savings of 30% for customers and better fares than GDS-based solutions on 67% of itineraries (Tripninja, 2024).

Today, VI platforms supported by GenAI are beginning to offer increasing levels of personalisation in itinerary design combining distinct routes from more than 200 ground transportation providers and more than 500 carriers (see OAG, 2021; 2024). This offers global tourism cities an opportunity to enhance their global competitiveness (Kuok et al., 2023; Florido-Benitez, 2024).

Similarly, the advent of VI offers new opportunities for linking regional airports with international ones as well as global tourism cities and nearby tourist attractions to much wider markets. In turn, this delivers additional benefits in terms of the sustainability of tourism and travel, by lowering CO_2 emissions with potential for the sector to reduce its impact on climate change (Burbidge et al., 2023).

Figure 1 attempts to conceptualise the VI process showing how GenAI can support it in the context of business-to-business (B2B) and business-to-consumer (B2C) interactions. This conceptualisation builds on customer personalisation options at different levels through the use of existing technologies related to big data analytics, GenAI algorithms and Global Positioning Systems (GPS) (Dwivedi et al., 2024). GenAI can facilitate the creation of value in VI by taking personalisation to a different level, supporting OTAs in anticipating travellers' needs and preferences, and communicating with other systems and decision-makers to improve existing tourism service supply chains. This integrated approach has been advocated by a number of studies (see Merket and Hakim, 2022), which show that promoting online ticket distribution through tailored products can deliver a competitive advantage to airlines and OTAs, especially when it is supported by images and videos.

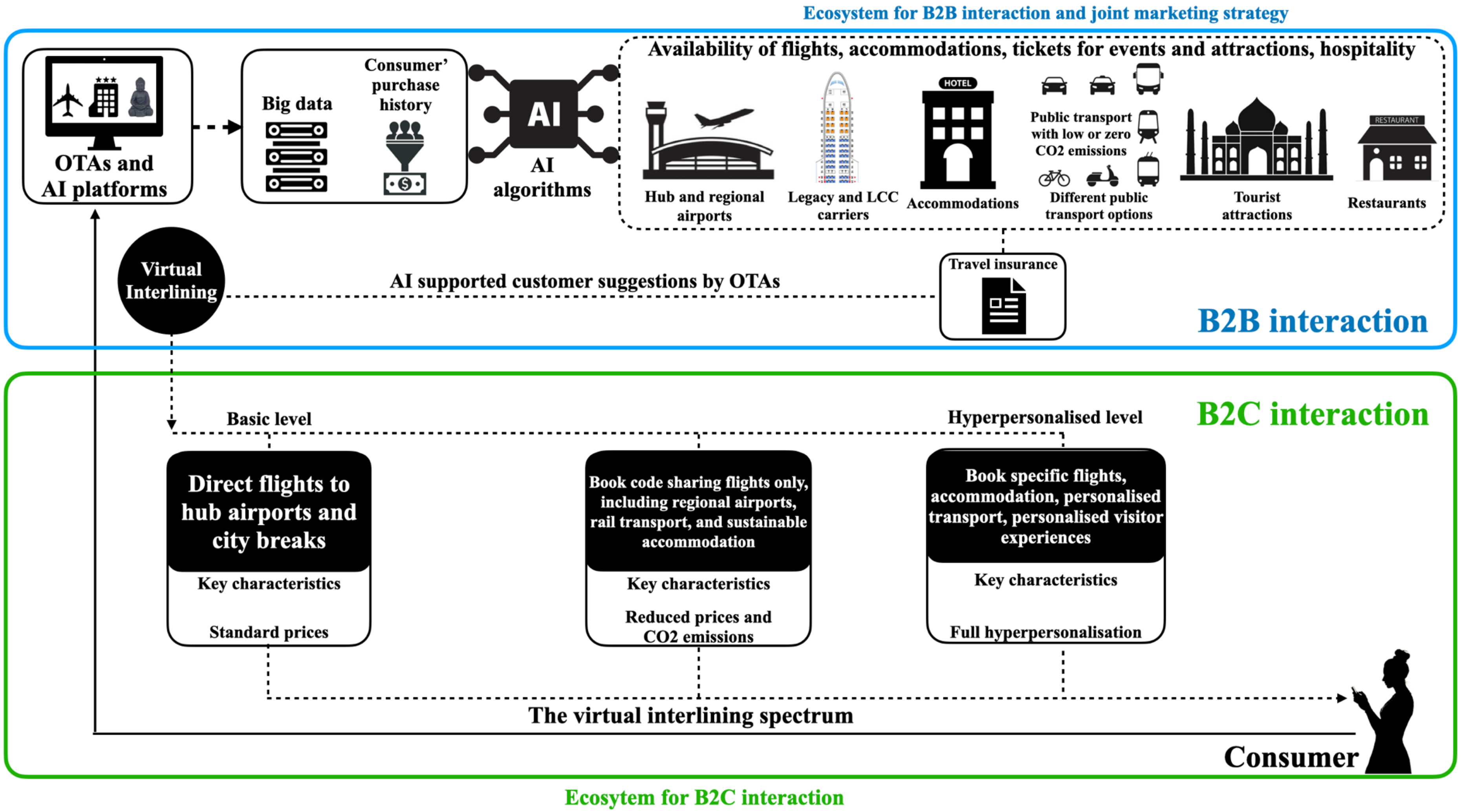

Figure 1. The virtual interlining spectrum in the context of B2B and B2C. (Source: developed by the authors)

Conversely, adopting a customer experience perspective, Figure 2 outlines the main challenges that OTAs, AI platforms, airports, and airlines need to address in the adoption of VI in order to improve existing travel experiences. For instance, when a passenger misses a connecting flight on a single ticket, they are entitled to rebooking free of charge. They may also receive additional services and, in some cases, a full refund with financial compensation. However, this is not currently applied in the context of bookings through VI. At present, the existing legal framework in the European Union does not oblige airlines and travel agencies to treat a VI customer as a passenger in transit in the event of a missed connection. In fact, EU law EC261 only applies to flights connected through a single ticket. Similarly, in line with this law, a VI customer with a missed connection would not be eligible for financial compensation.

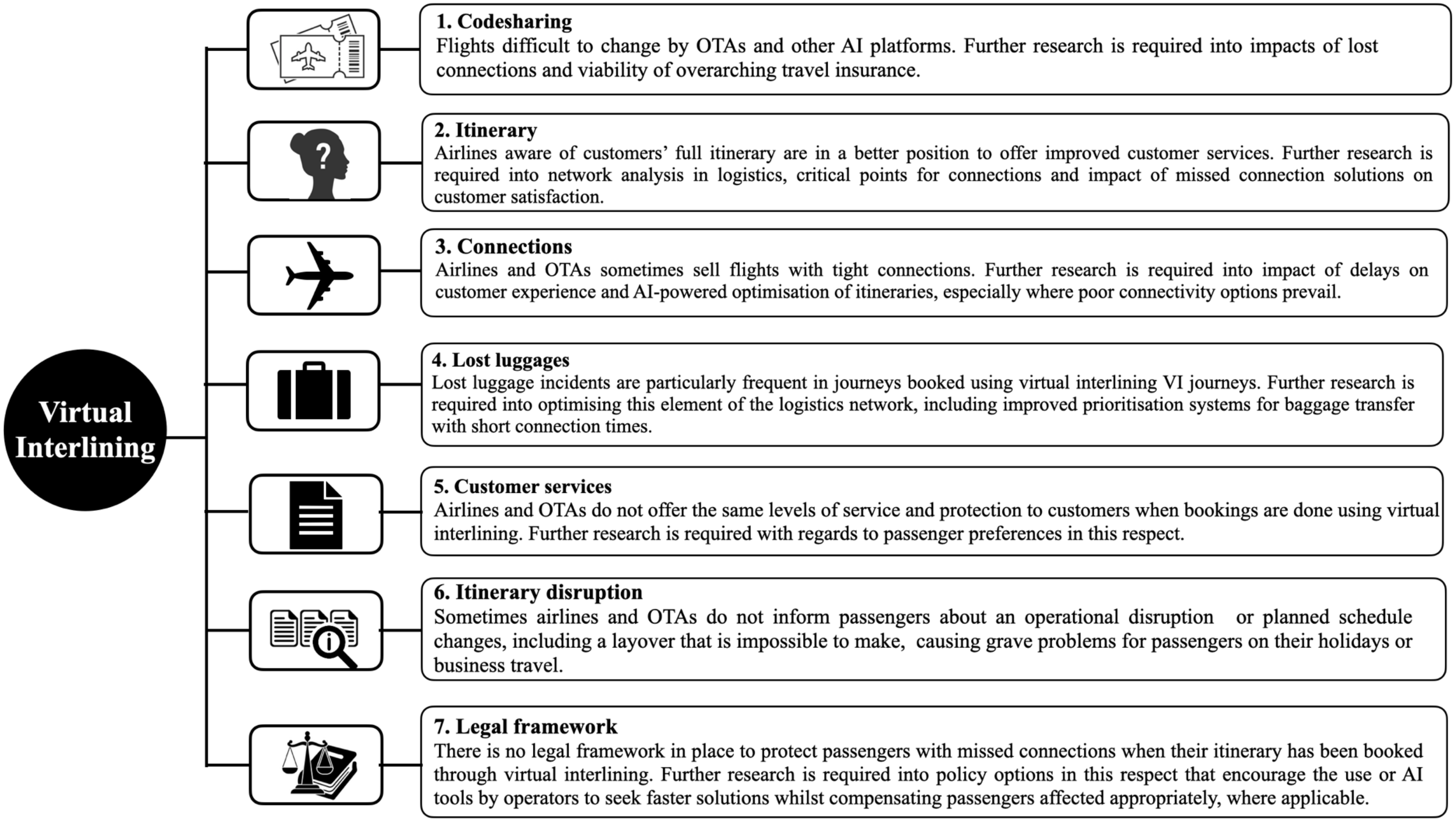

Figure 2. Challenges for AI-supported virtual interlining and avenues for further research. (Source: developed by the authors).

Conclusions and future considerations for practice and policy

Virtual interlining, especially when supported by GenAI technologies, has the potential to become a game changer for the travel and tourism sector. Its potential to offer hyper-personalised travel itineraries and visitor experiences remains in an embryonic testing phase at present, led primarily by OTAs. These include, among others, Kiwi.com, Expedia, Skyscanner.com, Google Flights, Vacay, and Wonderplan. Scholarly research in this respect, although in its early days, is beginning to show that GenAI technologies are set to enhance the competitiveness of OTAs and airlines especially in terms of offering travel itineraries and visitor experiences tailored to the preferences of individual travellers and their companions (Geske et al., 2024), with environmental impact efficiencies to be gained from the use of more sustainable travel options. Similarly, where connections are missed by passengers as part of a VI-based travel itinerary, GenAI research has argued that existing algorithms would be successful in assisting OTAs and passengers in finding affordable alternative travel options to reach their destination (Yetimoğlu & Aktürk, 2021).

Crucially, in order for GenAI-supported VI to be viable, key players in the tourism system (Morrison et al., 2018) and its associated ecosystem, including airports, airlines, OTAs and destination management organisations, need to enter data sharing agreements with a common purpose – destination competitiveness. Above all, however, for customers to embrace VI platforms, changes will be required to the legal framework affecting passenger rights during travel. Existing legal frameworks only protect passengers when their flights or travel have been booked under a single ticket or through a code-sharing mechanism in the case of airlines. Delays or cancellations resulting in itinerary disruption and missed connections when the itinerary has been booked through a VI platform are not covered by the law.

Future research agenda

There are a number of spheres were an insufficient level of understanding exists of mechanisms and interactions between VI parameters. For instance, if personalised itinerary bookings were to become the norm, how would visitor satisfaction improve compared to current options offered by OTAs? Similarly, there is a need to quantify the reduction in CO2 emissions per passenger as a result of using interlinked travel options.

Moreover, to what extent would a customer behaviour shift in this direction influence decision-making and local policies in global urban destinations? Parallel to this, we need to attain a better understanding of the resilience of networks and systems associated with virtual interlining, especially as their level of complexity grows over time. The term resilience applies here to cybersecurity challenges as much as it does to the ability of GenAI to deal with unforeseen circumstances and still deliver alternative itinerary options that are sustainable, feasible and affordable for customers.

Similarly, the use of GenAI-supported VI platforms would open a great deal of opportunities for research into hyper-personalised destination marketing based on bid data analytics, including the concept of aerotainment (Florido-Benitez, 2024). Parallel to this, the implications of this on the image of tourism destinations is yet to be researched. For instance, would smart tourism cities start adopting place marketing strategies related to the specific characteristics that make them smart? (Coca-Stefaniak, 2019).

Today, a number of US and European airlines offer combined air-rail ticketing (see Table 1), with some even transferring passengers' luggage from the plane to the train.

Table 1. European airlines offering air-rail tickets to enhance passengers' experiences and reduce CO_2 emissions.

Airlines that sell air-rail tickets in Europe	Train operators	European destinations
Delta Airlines	Thalys	Antwerp, Bern, Rotterdam, York, and Zurich.
United Airlines	Deutsche Bahn, Eurostar, Great Western Railway, SJ Swedish Railway, SNCB and NS International Rail, Swiss Federal Railways, and Trenitalia.	The UK, the Netherlands, Italy, Germany, Belgium, Sweden, and Switzerland.
Air France	Société nationale des chemins de fer français (SNCF) and Eurostar.	France, Belgium, Switzerland, and the Netherlands.
Austrian Airlines	Lufthansa Express Rail	Vienna, Linz, Salzburg, Graz, and Innsbruck.
Iberia	Renfe	A Coruña, Albacete, Alicante, Córdoba, Gijón, Granada, León, Málaga, Murcia, Ourense, Oviedo, Palencia, Pamplona, Salamanca, Santiago de Compostela, Seville, Valencia, Valladolid, Vigo, and Zaragoza.
ITA Airways	AccesRail	Italy, Spain, Switzerland, the UK, the Netherlands, and Belgium.
Condor	Deutsche Bahn AG railway	Germany and Belgium.
Swiss	Swiss' Air Rail	Switzerland, Munich, Bregenz, and Austria.
Lufthansa	Deutsche Bahn AG railway and Lufthansa Express Rail	Germany

Source: developed by the authors.

Lufthansa offers a 50% discount for children between the ages of 6 and 11 years old (children under the age of 6 travel free of charge). This discount is not limited to air fares, but applies to combined air-rail tickets in Germany to stimulate demand in tourism destinations and sustainable travel choices. Frankfurt (FRA) airport, Europe's second busiest, offers Lufthansa passengers discounted air-rail fares with connections to 28 cities across the country using a simple reservation on a single ticket and with guaranteed connections (see Panel A in Figure 3 below).

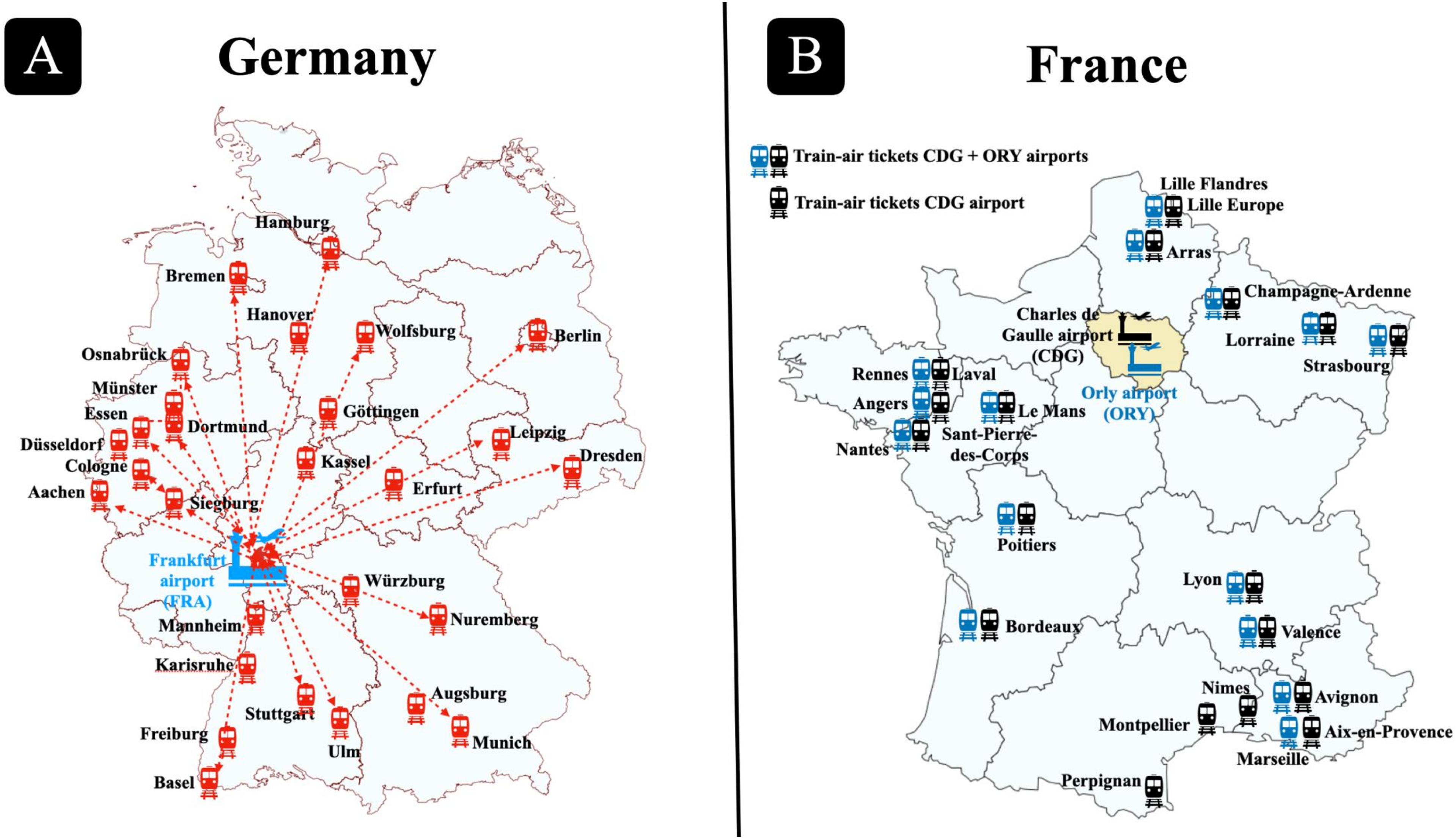

Figure 3. Main destinations for single-ticket air-rail travel in Germany and France. (Source: developed by the authors).

Parallel to this, Air France offers two ways to combine a flight with a rail connection for trips within France (see Panel B in Figure 3). The rail-air tickets are available for any international travellers, including those arriving from or traveling to French overseas territories. In addition to this, Air France also offers a taxi shuttle between the rail station and the airport terminal, given that it is not possible to walk from Paris Orly Airport to Massy TGV train station. In the event of a missed connection, the airline offers free transfers to the next available flight or rail service.

The implications for tourism research of these integrated forms of travel are considerable, especially as it is becoming increasingly apparent that the concept of the tourism system could be interpreted more holistically. It is not just the travel experience that merits further exploration through research but also, crucially, how the ‘slow’ and ‘fast’ tourism paradigms will be intertwined in the future by tourists through their own preferences. This will not only influence how they consume destinations, but it will also apply to the travel associated with getting there and back home.

Similarly, how will these travel options affect seasonality in tourism in the future? Once the trip in itself becomes part of the adventure, with less emphasis on what the destination is able to deliver, this will open up exciting research possibilities related to experiencing travel and destinations during the hitherto named ‘low season’. Furthermore, perhaps the ‘low season’ in destinations affected by increasingly frequent heat waves could become a potentially favoured option by certain consumer market segments (e.g., grey tourism, families, tourists with specific health conditions aggravated by heat, etc.).

Today, the majority of low-cost airlines do not offer interline options. However, it is likely that this could change in the future, especially as a result of changes in customer behaviour and a growing trend towards the personalisation of travel itineraries. If - or perhaps when – that happens, how will it affect low-cost carriers? Will it lead to a consolidation of the travel sector, with airlines potentially merging with rail or cruise liner companies? As regards regional airports, they potentially stand to reap the greatest benefits from VI platforms. Yet, how will larger tourist numbers visiting more rural locations affect overtourism in key global tourism destinations? Will day-trip visitor tourism increase in terms of volume and impact, or will new generations of tourists decide to pursue authenticity by shunning the more visited attractions and opting instead to take advantage of better connectivity to seek more transformational experiences? It is also possible that younger visitors will interact with GenAI platforms differently to other generations. Indeed, as part of this process, mixing digital detox with meaningful interactions may become the norm, without allowing GenAI to dominate over the insights that only local residents can offer.

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