



Technology-Enabled On-Demand Transportation Platforms: A Review of Digital Services and Applications

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Abstract—

Digital platforms have changed the way on-demand transportation is requested, matched, routed, paid for, and monitored. This review examines the digital services and applications that support ride-hailing, dynamic ride-sharing, microtransit, first- and last-mile transport, and Mobility as a Service. A narrative review was carried out using peer-reviewed studies and established transport research reports covering platform architecture, real-time matching, routing, travel behaviour, shared mobility, and multimodal integration. The literature shows that the value of an on-demand platform does not come from a single application feature; it emerges from the interaction of location services, trip booking, dynamic matching, dispatch, digital payment, communication, and feedback mechanisms. Research on dynamic ride-sharing has concentrated strongly on optimization and real-time assignment, while studies of ride-hailing have highlighted both user convenience and wider system effects such as empty vehicle travel and changes in mode choice. Research on Mobility as a Service further shows that integration across operators introduces operational, financial, and governance challenges. The review therefore identifies a need for transportation platforms to treat digital services as an integrated system rather than isolated functions. The paper concludes by outlining practical research directions involving interoperability, privacy-aware data management, transparent pricing, accessible interfaces, and more balanced evaluation of user, operator, and public-system outcomes.

Keywords— On-demand transportation; ride-hailing; dynamic ride-sharing; mobility platforms; digital services; Mobility as a Service

I. INTRODUCTION

On-demand transportation platforms connect a transport request with an available mobility service through a digital interface. A user can enter a location, select a destination, request a service, receive an estimated arrival time, and complete payment without arranging the trip through a traditional dispatch channel. The underlying platform combines several technical

services, including location capture, communication, matching, routing, transaction processing, and service monitoring. This combination has made digital platforms an important part of contemporary shared and flexible transport systems [1], [2].

The literature uses related but not identical terms for these services. Ride-hailing generally refers to



app-mediated requests for a vehicle and driver, while dynamic ride-sharing attempts to combine compatible trips so that a vehicle can serve more than one traveler. Shared mobility is broader and can include carsharing, ridesharing, on-demand services, microtransit, and other forms of short-term access. Mobility as a Service extends the idea further by bringing different transport modes and services together through a common digital interface [1], [5], [6].

The rapid growth of these platforms has also created a research problem. A transportation application may appear simple to the user, but its operation depends on continuous coordination between users, drivers, vehicles, maps, payment systems, databases, and service operators. Research has therefore examined separate aspects such as matching algorithms, trip-vehicle assignment, travel behaviour, and multimodal integration. However, the digital service layer that links these functions is often discussed indirectly rather than as a complete platform architecture [2], [7], [8].

This review focuses on that digital service layer. It does not propose a new transportation algorithm or report an original field experiment. Instead, it brings together findings from studies of on-demand and shared transportation to explain how platform services work, where they are applied, what benefits are reported, and which technical and operational problems remain. The objectives are to: (1) identify the major digital services used by on-demand transportation platforms; (2) compare their roles across different transportation applications; (3) synthesize reported benefits and system-level effects; and (4) identify research gaps relevant to the design of reliable and user-oriented platforms.

II. LITERATURE REVIEW

A. Dynamic Ride-Sharing and Matching

Agatz et al. reviewed optimization methods for dynamic ride-sharing and described the central problem as bringing travelers with compatible itineraries and schedules together at short notice [2]. Their review makes clear that matching is not simply a database search. A platform must consider time, location, route compatibility, vehicle capacity, and service constraints while producing decisions quickly enough for real-time use. Furuhashi et al. later organized the ridesharing literature into a broader taxonomy and highlighted continuing challenges involving matching, pricing, trust, and system design [9].

Alonso-Mora et al. studied high-capacity ride-sharing through dynamic trip-vehicle assignment and showed how real-time demand and vehicle locations can be incorporated into route and assignment decisions [7]. Their work illustrates the close relationship between a user-facing application and an optimization layer: the application collects requests, while the underlying service decides which requests can be grouped and which vehicle should serve them. The result is a platform in which digital interaction and operational optimization are tightly connected.

B. Ride-Hailing and User-Facing Services

Rayle et al. examined app-based ridesourcing in San Francisco and compared it with taxis and public transit [3]. The study reported shorter and more reliable waiting times than taxis in its surveyed setting and found that ridesourcing trips replaced a mixture of taxi, transit, and driving trips. This is important for platform design because convenience at the interface level does not by itself determine the wider transport outcome. A service may be easy to request while still changing travel behaviour in ways that vary by location and user group.

Tirachini reviewed international evidence on ride-hailing, travel behaviour, and sustainability and found that effects on vehicle travel, congestion, and other externalities depend on factors such as modal substitution, trip generation, and whether rides are shared [4]. The literature therefore does not support treating digital convenience as an automatic sustainability benefit. Instead, the design of matching, pricing, vehicle utilization, and integration with public transport can influence the final system effect.

C. Shared Mobility and Multimodal Integration

Shaheen, Cohen, and Zohdy described shared mobility as a group of services that can provide short-term access to transportation, including ridesharing, on-demand services, shuttles, and microtransit [1]. Their work also emphasizes the role of public agencies and the need to understand governance and implementation conditions. This broad view is useful because a digital platform may support several service types even when the underlying operating models are different.

Jittrapirom et al. examined Mobility as a Service and noted that the concept has been defined in different ways across the literature, creating a need for clearer assessment of its characteristics and implementations [5]. Utriainen and Pöllänen reviewed published MaaS research and grouped studies around transport modes, pilots and trials,



and expected effects [6]. Together, these studies show that multimodal platforms require more than a common interface; they also require coordination between service providers, payment arrangements, information exchange, and institutional actors.

D. Recent Modelling and Operational Gaps

Daou and Leurent reviewed 31 contributions on modelling Mobility as a Service and observed that demand-side usage models dominate much of the literature, while supply-side operational, profitability, and financial-flow considerations receive less attention [8]. This observation is relevant to platform engineering because real services must operate under capacity limits, revenue constraints, service-level expectations, and interactions among multiple providers. A complete digital platform therefore needs both user-facing functionality and operational controls. Nair et al. focused on deadheading in ride-hailing, referring to vehicle travel between passenger trips when no passenger is being carried [10]. Their modelling work demonstrates why a platform should evaluate empty travel rather than measuring performance only through completed passenger trips. For digital services, this means that dispatch, pickup prediction, vehicle positioning, and demand information can affect system performance beyond the immediate booking experience.

III. METHODOLOGY

This paper uses a narrative literature review approach. The purpose is to synthesize established research on digital services and applications in on-demand transportation rather than to estimate a pooled statistical effect. Peer-reviewed journal articles and recognized transport research reports were selected because they provide documented descriptions of platform operations, optimization approaches, user behaviour, shared mobility, and Mobility as a Service.

The literature search was guided by combinations of terms such as “on-demand transportation,” “ride-hailing,” “dynamic ride-sharing,” “shared mobility,” “Mobility as a Service,” “transportation platform,” “matching,” “dispatch,” and “digital services.” Priority was given to studies that explained either the digital mechanisms of the service or their operational and behavioural implications. Studies were then grouped into themes: platform architecture, location and booking, dynamic matching, routing and dispatch, payment and communication, multimodal integration, system effects, and research gaps.

The synthesis was performed by comparing the purpose of each digital function, the transport application in which it appears, and the issue identified by the literature. No primary survey, interview, or experimental dataset was created for this review. Consequently, the “results” reported in the next section are review findings derived from the selected literature, not newly measured performance values. This distinction is important for interpreting the conclusions of the paper.

IV. DIGITAL SERVICES AND PLATFORM ARCHITECTURE

A. User Interface and Account Services

The user interface is the visible entry point to an on-demand transportation platform. Typical functions include registration, profile management, pickup and destination entry, service selection, booking confirmation, trip status, payment history, and feedback. For drivers or service providers, the interface may additionally include availability controls, trip acceptance, navigation, earnings, and status updates. The literature on app-based ridesourcing shows how smartphone interfaces can connect passenger requests with nearby supply in real time [3].

B. Location, Mapping, and Trip Information

Location services provide the spatial information required by almost every other platform function. A system may use device positioning, geocoding, map data, estimated travel time, and route information to interpret a request and communicate pickup instructions. In ride-hailing, location information can also be shared with the user to show vehicle position and estimated arrival time [3]. The accuracy and timeliness of this layer directly affect matching, dispatch, and user trust.

C. Booking and Dynamic Matching

Booking converts a user request into an operational task. Dynamic matching then determines which driver, vehicle, or shared trip can serve the request. Matching may consider proximity, time windows, capacity, route overlap, service constraints, and existing commitments. Agatz et al. and Alonso-Mora et al. demonstrate why matching becomes a computational problem when requests arrive continuously and vehicle assignments must be updated in real time [2], [7].

D. Routing and Dispatch

After matching, the platform must guide the vehicle toward the pickup and destination while responding to changes such as traffic, cancellations, new requests, or route deviations. Dispatch services can therefore be treated as a



control layer between the booking system and the physical transport operation. Research on dynamic ride-sharing emphasizes that routing and assignment decisions are interdependent rather than separate tasks [2], [7].

E. Digital Payment and Receipts

Digital payment connects the trip record with the financial transaction. Depending on the service model, the platform may support a fixed fare, distance- or time-based pricing, shared fare allocation, subscription, or pay-as-you-go model. MaaS literature also highlights the importance of integrating payment across multiple transport providers [5], [8]. From a system perspective, payment records should be linked to booking identifiers and protected through appropriate authentication and transaction controls.

F. Notifications, Feedback, and Support

Notifications keep users informed about request acceptance, driver arrival, trip progress, payment status, and cancellations. Feedback and rating mechanisms provide a channel for service evaluation and can contribute to trust between users and providers. Rayle et al. describe how app-based services can expose real-time vehicle information and collect mutual ratings after a trip [3]. These functions also create operational data that can be used to identify recurring service problems.

G. Administration and Analytics

The administrative layer is less visible to users but is essential for platform operation. It can manage accounts, vehicles, service areas, pricing rules, complaints, transactions, and system reports. Analytics can examine request volume, waiting time, trip completion, cancellation, vehicle utilization, and empty travel. Nair et al. show why deadheading should be considered in evaluating ride-hailing operations rather than focusing only on passenger-carrying trips [10].

V. APPLICATIONS OF TECHNOLOGY-ENABLED ON-DEMAND TRANSPORTATION

A. Ride-Hailing

Ride-hailing platforms are designed around immediate or near-immediate requests for individual vehicle service. Their digital workflow commonly includes location capture, nearby driver discovery, fare estimation, acceptance, navigation, live status, payment, and rating. The strength of this model lies in reducing the effort required to arrange a trip, although its wider effects depend on how users substitute it for taxis, transit, walking, cycling, or private driving [3], [4].

B. Dynamic Ride-Sharing

Dynamic ride-sharing adds the problem of combining compatible passenger requests. The platform must decide whether trips can share a vehicle without violating acceptable waiting, detour, capacity, or service constraints. This application places greater emphasis on optimization than a simple point-to-point booking service and has motivated extensive research on matching and trip-vehicle assignment [2], [7], [9].

C. Microtransit and Flexible Services

Microtransit uses flexible routing or demand-responsive operation to serve passengers who may not be well served by fixed routes. Shared mobility research places microtransit alongside other alternatives such as shuttles and paratransit [1]. A digital platform can collect requests, group passengers, define pickup points, communicate estimated arrival times, and coordinate vehicles. The key design challenge is to maintain sufficient flexibility without making service quality unpredictable.

D. First- and Last-Mile Services

On-demand services can connect users to larger transport networks at the beginning or end of a journey. This role is especially relevant when fixed-route public transport does not reach a user's origin or destination conveniently. Shared mobility literature identifies the potential for on-demand and shared services to complement conventional transit [1]. Effective integration requires synchronized information, clear transfer instructions, and service coordination rather than treating the feeder trip as an isolated booking.

E. Mobility as a Service

MaaS represents a broader digital model in which several transport options can be discovered, planned, booked, and potentially paid for through a common interface [5], [6]. The platform becomes an integration layer between users and multiple transport providers. This creates opportunities for a more connected travel experience, but also introduces challenges involving data standards, commercial agreements, revenue allocation, service quality, and public-sector coordination [8].

F. Institutional and Specialized Transport

The same digital principles can support transport for campuses, workplaces, hospitals, events, and other defined user communities. Such services may use restricted eligibility, scheduled or on-demand trips, designated pickup points, and administrator-controlled service rules. Compared with open ride-hailing, these systems can operate



within a smaller geographic and organizational boundary, which may simplify coordination while still requiring reliable booking, routing, communication, and reporting.

VI. RESULTS AND DISCUSSION

The literature synthesis indicates that technology-enabled on-demand transportation is best understood as a layered service ecosystem. The user sees a single application, but the underlying operation depends on several connected services. Table I summarizes the main digital functions identified in the reviewed literature and the transport problem each function addresses.

Digital service	Primary role	Typical application	Key issue identified in literature
Location and mapping	Capture and interpret trip geography	Ride-hailing, ride-sharing, MaaS	Accuracy and timely location information affect matching and pickup.
Booking and request handling	Convert demand into a service request	All on-demand services	Requests must be processed quickly and reliably.
Dynamic matching	Assign users to vehicles or compatible trips	Ride-sharing, ride-hailing	Time, route, capacity and service constraints create trade-offs.
Routing and dispatch	Guide and update vehicle movements	Ride-hailing, microtransit	Operational decisions must respond to changing demand and traffic.
Payment and fare services	Record and settle trip costs	Ride-hailing, MaaS	Integration and transparent financial flows become harder with multiple providers.
Communication and feedback	Inform users and collect service responses	All platform types	Trust depends on clear status information and responsive support.
Analytics and administration	Monitor service performance and resources	Operators, public agencies	Passenger trips alone may not capture empty travel or system effects.

Table I: Digital services and their roles in on-demand transportation platforms

A. Convenience and Service Visibility

Across the literature, digital interfaces reduce the effort required to discover and request transport.

Real-time status, estimated arrival information, and automated payment can make the service easier to understand from the user perspective [3]. The review suggests that convenience is closely tied to information quality: a platform that provides a booking button but weak location, timing, or cancellation information does not offer the same service value as an integrated platform.

B. Operational Coordination and Vehicle Utilization

Dynamic matching and assignment can improve the coordination of supply and demand when requests are compatible. The optimization literature shows that matching quality depends on more than distance alone; time schedules, route overlap, capacity, waiting time, and detour constraints may all need to be considered [2], [7]. At the same time, Nair et al. show that empty travel remains an important part of ride-hailing operations [10]. Thus, a platform should evaluate vehicle utilization at the system level rather than assuming that every completed booking represents efficient operation.

C. Sustainability and Wider Transport Effects

Shared mobility and ride-sharing are often associated with potential reductions in vehicle use, congestion, or environmental burden, but the literature presents a more conditional picture [1], [4], [9]. If an on-demand trip replaces a public transport journey or creates additional vehicle travel, the overall effect may differ from the effect of a shared trip that replaces multiple private-car journeys. Therefore, sustainability should be evaluated using measurable system outcomes rather than inferred from the presence of a digital platform alone.

D. Multimodal Integration

MaaS studies indicate that integrating multiple transport modes is technically and institutionally more demanding than providing a single-mode application [5], [6], [8]. The challenge includes consistent information, service availability, booking rules, payment, and responsibilities among providers. The digital platform can act as a common interface, but successful integration also depends on agreements and data exchange outside the application itself.

VII. CHALLENGES AND LIMITATIONS

A. Data Quality and Reliability

Location errors, stale vehicle status, incomplete service information, and communication delays can affect the complete booking chain. Because matching and routing depend on current information, a small error at the input stage can



produce a poor assignment or an inconvenient pickup. Platforms therefore require mechanisms for validating, updating, and recovering from inconsistent data.

B. Privacy and Cybersecurity

Transportation platforms handle sensitive information such as locations, travel histories, identity details, and payment records. Even when the user interface is simple, the backend may retain a detailed record of mobility behaviour. Privacy-aware data retention, authentication, access control, encryption, and responsible data sharing are therefore important design requirements. These concerns become more significant when several operators exchange information through a common platform.

C. Matching Trade-Offs

A matching system rarely optimizes every objective at the same time. A very close vehicle may have limited capacity, while a vehicle with spare capacity may require a longer pickup. Shared rides can increase utilization but may increase waiting or detour time. The optimization literature demonstrates these trade-offs directly [2], [7], [9]. Platform design should therefore make service constraints explicit and choose objectives appropriate to the application.

D. Pricing Transparency and Financial Integration

Digital pricing can simplify payment, but it can also make costs difficult to understand when prices vary with time, distance, demand, subscriptions, or multiple transport providers. MaaS research highlights the additional complexity of financial flows when different service providers participate in the same platform [8]. Transparent fare rules and clear transaction records are consequently important for user trust and operator accountability.

E. Digital Accessibility and Inclusion

A platform that assumes continuous smartphone access, stable connectivity, high digital literacy, or familiarity with digital payments may not serve every potential user equally. The shared mobility literature also places attention on accessibility and the role of public agencies [1]. Alternative access channels, clear interfaces, language support, and human assistance can help reduce exclusion without removing the benefits of digital coordination.

F. Integration and Governance

A platform connecting multiple operators must manage differences in data formats, service rules, liability, pricing, and performance standards.

MaaS research repeatedly points toward coordination among transport providers and public authorities as a major issue [5], [6], [8]. This means that interoperability is not only a software problem; it is also an organizational and governance problem.

VIII. RESEARCH GAPS

First, more research is needed on complete platform architectures that connect user interaction with operational decision-making. Many studies focus deeply on one component, such as matching or travel behaviour, while fewer examine how booking, routing, payment, notifications, analytics, and administration operate as one service system [2], [8].

Second, the literature can be strengthened by evaluating both passenger-serving and non-passenger vehicle travel. The deadheading study by Nair et al. illustrates why empty movement should be included in operational analysis [10]. Future platform evaluations could report passenger service, waiting time, vehicle utilization, empty travel, cancellations, and cost together rather than relying on a single indicator.

Third, multimodal platforms need stronger attention to supply-side and financial integration. Daou and Leurent identify a relative lack of operational and profitability considerations in MaaS modelling [8]. Research that connects user choice with provider capacity, pricing, revenue allocation, and public objectives could provide a more realistic picture of platform performance.

Fourth, privacy and inclusion deserve to be treated as core platform requirements rather than secondary concerns. A transportation platform collects mobility information continuously, while some users may have limited access to smartphones, data connectivity, or digital payment methods. Research should therefore examine privacy-preserving analytics and accessible service models alongside optimization performance.

IX. FUTURE SCOPE

Future work can move toward interoperable transportation platforms that use common data structures and service interfaces to connect multiple providers. Such platforms could combine trip planning, booking, payment, and service monitoring while preserving the autonomy of individual operators. Another direction is adaptive matching that balances travel time, waiting time, vehicle capacity, user preferences, and operational cost instead of optimizing a single objective.



Further studies can also evaluate platform performance using real operational data while protecting user privacy. Measures such as request-to-acceptance time, pickup reliability, cancellation rate, passenger detour, vehicle utilization, empty travel, and transaction completion can provide a more complete picture of service quality. Research on accessible interfaces and non-smartphone alternatives can broaden the usefulness of these systems.

Finally, the integration of on-demand services with public transport and other mobility modes deserves continued attention. MaaS research indicates that multimodal integration involves operational and financial relationships as well as technology [5], [6], [8]. Future platforms should therefore be designed with interoperability and governance in mind from the beginning rather than adding them after the software is completed.

X. CONCLUSION

Technology-enabled on-demand transportation platforms are not single-purpose booking applications; they are integrated digital systems that coordinate demand, vehicles, routes, payments, communication, and operational information. The reviewed literature shows that dynamic matching and trip-vehicle assignment are central to shared services, while ride-hailing research highlights the importance of real-time information and user interaction. MaaS research extends the problem to multimodal coordination and reveals additional challenges involving supply, finance, interoperability, and governance [2], [5], [7], [8].

The review also shows why platform success should not be judged only by the number of completed bookings or the convenience of the application. Vehicle utilization, empty travel, waiting time, modal substitution, accessibility, privacy, and financial transparency can all influence the wider value of the service [4], [6], [10]. A balanced platform design therefore needs to connect user-oriented digital services with operational and public-system considerations. These findings provide a foundation for future transportation systems that are more connected, transparent, and responsive while remaining realistic about the technical and organizational limits of on-demand mobility.

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