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Perceived Railway Infrastructure Quality and Safety and Sustainable Tourism Intentions in Montenegro: Evidence from a Structural Equation Model of Rail Travellers

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Abstract

Railways are the backbone of low-carbon tourism mobility, yet in peripheral European destinations, the condition and safety record of the network often lag behind visitors' expectations. This study examines how the perceived quality and safety of railway infrastructure shape sustainable tourism development in Montenegro, whose railway network comprises 250 km of open-line track—dominated by the mountainous Vrbnica–Bar section of the Belgrade–Bar line—and is the only corridor linking the saturated Adriatic coast with the under-visited north. Drawing on the transport–tourism nexus, service-quality theory and the expectancy–disconfirmation paradigm, we model infrastructure quality, perceived safety, service reliability and rail-based accessibility as antecedents of satisfaction with the rail experience, which in turn is related to sustainable tourism behavioural intentions directly and, through the perceived contribution of rail, to sustainable destination development. The model was tested with covariance-based structural equation modelling on an intercept survey of 487 rail travellers (summer 2025), complemented by an importance–performance analysis of twelve attributes and by a multigroup comparison of regional and other international visitors for which measurement invariance was established. All ten hypothesised paths were supported: infrastructure quality was the strongest correlate of perceived safety ($\beta = 0.58$; $R^2 = 0.34$); reliability, quality, safety and accessibility explained 58% of the variance in satisfaction; and satisfaction, safety and the perceived sustainability contribution explained 59% of the variance in intentions, with the entirely indirect effect of infrastructure quality on intentions (0.45) estimated within the latent model by bootstrap. In a metric-invariant two-group model, perceived safety weighed more heavily on the intentions of visitors from outside the region and satisfaction on those of regional visitors. Because the design is cross-sectional and based on self-reports, the results describe associations consistent with the hypothesised ordering rather than demonstrated causal effects. Track condition, punctuality and journey time fall in the "concentrate here" quadrant. The findings link the EU-accession agenda on railway safety and interoperability to the destination goal of dispersing tourism flows, and offer prioritisation guidance for the rehabilitation of the Vrbnica–Bar line and the renewal of the passenger fleet.

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1. Introduction

Transport is not merely the means by which tourists reach a destination; it is a constitutive element of the destination product and a pre-condition for the spatial and seasonal distribution of tourism benefits [1–3]. The empirical literature on the transport–tourism nexus consistently shows that transport infrastructure is a significant determinant of international tourism demand, with elasticities comparable to those of income and relative prices [4,5].

At the same time, tourism-related transport accounts for the largest share of the sector's carbon footprint [6–8], which has moved rail—by far the least carbon-intensive motorised mode per passenger-kilometre [9]—to the centre of European sustainable mobility and tourism policy [10–12]. The revised guidelines for the trans-European transport network (TEN-T) explicitly extend the core and extended core networks to the Western Balkans, and the Treaty establishing the Transport Community obliges the region's economies to converge on the EU railway acquis in matters of safety, interoperability and market opening [13,14].

Montenegro offers an unusually sharp case for studying this relationship. It is a small, tourism-dependent economy in which 2.73 million tourist arrivals and 15.4 million overnight stays were recorded in 2025, of which 95.8% were generated by foreign visitors and 92.6% were concentrated in seaside resorts [15]. The extreme spatial and seasonal concentration of demand on a narrow Adriatic strip has long been identified as the principal sustainability challenge of Montenegrin tourism [16–18]. The country's railway network, by contrast, runs perpendicular to the coast: the 167 km Vrbnica–Bar section of the Belgrade–Bar line climbs from sea level at the Port of Bar to 1032 m at Kolašin before reaching the northern towns of Mojkovac and Bijelo Polje and the Serbian border [19,20]. Together with the 56 km Podgorica–Nikšić branch, it is the only transport corridor that links the coast, the capital and the mountainous north—the very regions the national tourism strategy seeks to activate in order to relieve pressure on the littoral [17].

Yet the network is also a textbook example of a legacy infrastructure whose quality and safety have eroded: decades of underinvestment have reduced permitted speeds to about 70 km/h on much of the route, the 2006 Bioče derailment remains a durable anchor of public risk perception, and annual ridership is among the lowest in Europe [19–24]. The sector is nevertheless entering a period of visible change, with the rehabilitation of the Vrbnica–Bar line under way, a new railway safety and interoperability framework in force since 2026 and the first new passenger fleet in decades on order [19,25–29]. Section 3 describes this context in detail.

Despite the salience of these issues, the academic literature on railways and tourism is dominated by studies of high-speed rail in Spain, France, Italy, China and Japan [30–34] and by heritage and scenic railway tourism in mature markets [35–37], while the literature on tourism and public transport at destinations has concentrated on urban and rural bus, tram and metro systems rather than on interregional rail [38,39]. Very little is known about how the perceived quality and safety of conventional, low-speed, mountainous railway infrastructure in a transition economy influence tourists' satisfaction, their willingness to travel by rail again and their assessment of rail as a contributor to sustainable destination development. This is a substantive gap, because the policy case for railway rehabilitation in peripheral destinations rests on the assumption that investment in track, rolling stock and

safety systems will translate into modal shift, spatial dispersal of visitors and extension of the season [40,41]—an assumption that has rarely been tested at the level of tourist behaviour.

This paper addresses the gap by developing and testing a structural model of the relationships between the perceived quality and safety of railway infrastructure and the sustainable tourism intentions of rail travellers in Montenegro. Specifically, the study pursues four objectives: (1) to conceptualise and measure railway infrastructure quality, perceived safety, service reliability and rail-based accessibility as distinct antecedents of the tourist rail experience; (2) to estimate their direct and indirect effects on satisfaction, on the perceived contribution of rail to sustainable destination development and on sustainable tourism behavioural intentions; (3) to test whether these effects differ between visitors from the immediate region and other international visitors; and (4) to translate the results into prioritisation guidance for infrastructure managers and destination management organisations through an importance–performance analysis (IPA) of twelve concrete attributes.

The empirical basis is an intercept survey of 487 rail travellers conducted at Bar, Podgorica, Bijelo Polje and Kolašin stations and on board Bar–Bijelo Polje and Belgrade–Bar trains during the 2025 summer season.

The remainder of the paper is organised as follows. Section 2 reviews the literature on the transport–tourism nexus, sustainable mobility, railway service quality, perceived safety and sustainable behavioural intentions. Section 3 describes the research context: the Montenegrin railway system, its safety record and regulatory reform, and the structure of tourism demand. Section 4 presents the conceptual model and hypotheses, the research design, the instrument, sampling and the analytical procedures. Section 5 reports the measurement and structural model results, the mediation, measurement-invariance and multigroup analyses and the IPA. Section 6 discusses the findings, their managerial and policy implications, limitations and directions for future research, and Section 7 concludes.

2. Literature Review

2.1. The Transport–Tourism Nexus and Infrastructure as a Development Driver

The proposition that transport shapes destination development has a long lineage in tourism geography and transport economics. Prideaux [1] argued that the capacity, cost and quality of the transport system set an upper bound on the growth trajectory of a destination, while Hall [42] drew attention to the distributional and externality issues that arise when tourism transport is planned without regard to residents. Subsequent syntheses have treated transport as inseparable from tourism—as a source of experience in its own right and as a lever for sustainability [2,3,43]. Macro-econometric evidence corroborates the micro-level argument: using gravity models for Mauritius and for a panel of countries, Khadaroo and Seetanah [4,5] showed that transport infrastructure is a robust determinant of tourist arrivals, with land-transport infrastructure mattering most for intra-regional flows. A recent global panel analysis of 132 countries confirms that railway development continues to shape the spatial distribution of international tourists and strengthens the convergence of tourism flows across destinations [44].

This literature connects to the broader debate on infrastructure and economic performance, in which public capital is found to be productive [45] but in which the wider economic benefits of transport investment materialise only under specific conditions of accessibility, agglomeration and complementary policy [46–48]. Accessibility—the ease with which destinations can be reached [49]—is the mechanism that links the two debates, and a series of studies on high-speed rail (HSR) has examined whether improved accessibility translates into tourism growth. Evidence from Spain suggests modest increases in arrivals and stronger effects on day trips and on the distribution rather than the volume of demand [30,31,50,51]; French and Italian studies emphasise the role of destination attrac-

tiveness and of complementary local policies [33,52–54]; and Chinese studies document positive but heterogeneous effects across provinces and market segments [32,34,55,56]; tree-based models have also been used to identify which tourist profiles are most responsive to HSR access [57]. Recent work also shows that rail connectivity can moderate seasonality by lowering the cost of short off-peak trips [58]. Reviews of HSR caution, however, that the conditions under which such investments are justified are demanding [59,60], and the transferability of HSR findings to conventional networks in small economies is limited.

For destinations in which the railway is a conventional, single-track, mixed-traffic line, three other strands are more directly relevant. First, the research on tourists' use of public transport at destinations shows that visitors are more sensitive than residents to information, legibility, integration and perceived reliability, and that public transport performance affects overall destination satisfaction [38,61–64]. Second, studies of scheduled bus and branch-line rail services in rural areas show that well-designed services can meet tourism objectives, particularly for car-free and "slow travel" segments [37,65–68]; slow tourism, which values the journey as part of the experience, has recently been conceptualised as a distinct market in small European countries [69]. Third, the railway can itself be an attraction: scenic and heritage railways, station architecture and rail journeys feature prominently in tourism products from Tibet to Singapore and France [35,36,70,71], and a systematic review of 56 studies on railways and tourism concludes that the environmental-sustainability dimension of rail tourism remains under-researched [72]. Regional evidence from the Western Balkans, although sparse, points in the same direction: improvements in service quality along the Danube corridor have been shown to enlarge cooperation and demand [73,74], the prioritisation and risk assessment of rail projects in Serbia have been approached with multi-criteria tools that weigh tourism and regional-development effects [75,76], and the safety of railway sections in the region has been evaluated with multi-criteria models precisely because the condition of the infrastructure is so heterogeneous [77].

2.2. Railways, Sustainable Mobility and Tourism

The concept of sustainable tourism descends from the Brundtland definition [78] and has been elaborated in tourism studies since the early 1990s [79–83]. Beyond a narrow environmental reading, it embraces the economic viability of the destination, the equitable distribution of benefits across communities and regions, and the temporal spread of activity across the year [84–86]. Critical reviews note that research on sustainable tourism has rarely been matched by measurable outcomes, and that the transport component of the tourist trip is the domain in which the gap between rhetoric and impact is widest [8,87,88]. The Sustainable Development Goals give this agenda formal expression through Targets 8.9, 9.1, 11.2 and 12.b, which link resilient infrastructure, sustainable transport and sustainable tourism [89]. The COVID-19 pandemic exposed the vulnerability of transport-dependent destinations and reinforced the case for a transformation of tourism mobility towards lower-carbon modes [90].

Within the sustainable mobility paradigm, rail occupies a privileged position because of its low emissions per passenger-kilometre, its land-use efficiency and its capacity to structure development around stations [9,12,91,92]. The European Green Deal and the Sustainable and Smart Mobility Strategy set explicit targets for shifting traffic to rail, and the TEN-T regulation defines the technical standards—electrification, line speed, ERTMS, interoperability—that a modern passenger railway should meet [10,11,13,93]. For tourism destinations, the sustainability contribution of rail operates through at least four channels: (i) substitution of car and air travel and thus lower emissions and congestion [7,88]; (ii) spatial dispersal of visitors from saturated hubs to peripheral areas, an antidote to overtourism [94–96]; (iii) extension of the season through affordable, weather-independent

access [58,97,98]; and (iv) support for community wellbeing and resident attitudes, since transport externalities are a frequent source of resident opposition to tourism [42,99,100].

2.3. Infrastructure Quality and Railway Service Quality

Service-quality theory provides the conceptual link between the physical state of the railway and the tourist's evaluation of it. Perceived quality is defined in the SERVQUAL tradition as the gap between expectations and perceptions across a set of quality dimensions [101,102], whereas the performance-only (SERVPERF) view argues that perceptions alone predict satisfaction and behaviour better [103]. In public transport, this framework has been operationalised in a mature body of research on customer-satisfaction surveys [104–107], in service-quality indices for contract monitoring [108], in studies of the attributes that attract car users [109–111], and in normative standards such as EN 13816, which distinguishes quality dimensions such as availability, accessibility, information, time, customer care, comfort, security and environmental impact [112,113]. Applications to railways have measured quality on the Hellenic railways [114], on Indian station platforms [115] and on New Zealand commuter services using zones of tolerance [116], and have repeatedly identified reliability, comfort, cleanliness and information as the most influential attributes. A recent cross-country analysis confirms that satisfaction mediates the effect of service quality on behavioural intentions across heterogeneous public transport systems [117], IPA has been applied to bus service attributes to set priorities under budget constraints [118], and the pandemic has raised the weight that passengers attach to cleanliness, crowding and hygiene [119]. A recurring finding is the "quality paradox": supply-side quality improvements are not always reflected in satisfaction because expectations move as well [120].

Two features of this literature are important for the present model. First, infrastructure quality—the condition of track, structures, stations and rolling stock—is analytically distinct from service-quality dimensions such as punctuality and frequency, even though the former constrains the latter: the permitted speed, ride comfort and the probability of temporary speed restrictions on a line are direct functions of track geometry and asset degradation [121–125]. Second, on lines exposed to mountainous terrain and extreme weather, infrastructure quality is also a resilience issue, since landslides, floods and heat all translate into disruption and, ultimately, into the traveller's experience [126–128]. We therefore model perceived infrastructure quality (IQ) and service reliability (SR) as separate constructs, together with rail-based accessibility (AC), which captures whether the railway makes the desired destinations reachable and integrates with buses, airports and the Port of Bar [38,49].

Satisfaction is conceptualised in the expectancy–disconfirmation tradition as a post-consumption evaluation [129] and is a well-established consequence of perceived quality in tourism settings [130–133]. Applied to the rail journey, satisfaction with the rail experience (SAT) is expected to depend on infrastructure quality, on service reliability and on accessibility; these expectations are formalised as hypotheses H2, H4 and H5 in Section 4.2.

2.4. Railway Safety, Perceived Safety and Tourist Behaviour

Railway safety is governed in the EU by a comprehensive regulatory architecture—the Railway Safety Directive, the Interoperability Directive and the common safety methods and targets administered by the European Union Agency for Railways—which candidate countries are required to transpose [134–136]. Fatal train accidents in Europe have declined markedly over the past four decades, and derailments and collisions are increasingly attributable to interactions between degraded infrastructure, rolling stock and organisational factors rather than to single-point failures [22,137,138]. Systems-theoretic and organisa-

tional accident models emphasise that safety is an emergent property of the socio-technical system as a whole, including maintenance regimes, regulatory oversight and human factors [139–141]. From the tourist's perspective, however, what matters is perceived safety, and risk perception is known to be driven less by statistical frequencies than by dread, catastrophic potential, memorability and lack of control [142]. A single high-profile disaster such as the Bioče derailment can therefore shape perceptions long after objective safety has improved.

The tourism literature has established that perceived risk and safety are decisive for destination choice, satisfaction and revisit intentions [143–151]. Transport safety is one of the salient risk dimensions, and its effect is stronger for unfamiliar, long-haul and first-time visitors than for those who know the destination [146,151]. Research conducted during and after the COVID-19 pandemic has confirmed that perceived risk remains a central predictor of travel behaviour and that it varies systematically with familiarity and market of origin [152,153], and a systematic review of five decades of research shows that personal security at stations and on board—as distinct from technical safety—shapes the willingness to use public transport [154]. We expect perceived safety (PS) on Montenegrin trains to be shaped by the visible condition of infrastructure and rolling stock—the tangible cues from which laypersons infer technical safety—and, in turn, to influence both satisfaction and sustainable behavioural intentions directly, since tourists are unlikely to commit to rail as their future mode of transport if they doubt its safety, regardless of how satisfying a given trip was (hypotheses H1, H3 and H7 in Section 4.2).

2.5. Satisfaction, Perceived Sustainability Contribution and Sustainable Behavioural Intentions

The link from satisfaction to behavioural intentions—revisit, recommendation and willingness to pay—is one of the most replicated relationships in tourism and services marketing [130–133,155,156]. In the present context, the intentions of interest are sustainable tourism behavioural intentions (SBI): the intention to travel by rail again in Montenegro, to choose rail over car for intra-country trips, to recommend rail travel, to visit inland and northern destinations reachable by rail, and to accept a price premium for low-carbon transport. Such intentions are consistent with attitude–behaviour models in which attitudes formed through experience shape intentions [157,158] and with the literature on pro-environmental consumer behaviour in tourism, which has expanded rapidly since 2020 [159,160]. The satisfaction–intention link is formalised as hypothesis H6.

A further mechanism runs through the tourist's assessment of the railway's contribution to sustainable destination development (SDP). Tourists who experience a well-maintained railway are more likely to perceive it as a credible alternative to the car and as a means of opening the interior of the country; and those who are satisfied with their journey are more likely to generalise from their own experience to the destination-level benefits of rail. Destination-image research shows that such cognitive evaluations are formed from direct experience and, in turn, influence behavioural intentions [156,161]; and destination-competitiveness frameworks treat infrastructure as a core resource whose perceived quality feeds into the destination's sustainable competitive position [162–166]. These mechanisms correspond to hypotheses H8–H10.

Visitor origin (regional vs. other international) is also examined as a moderator of the structural paths in a multigroup analysis, because the tourism literature suggests that the weight of safety relative to satisfaction differs between familiar and unfamiliar visitors [146,150,151], and because visitors from Serbia, Bosnia and Herzegovina and neighbouring economies account for a large share of Montenegrin tourism and of cross-border rail traffic [15]. Because origin is at best an imperfect proxy for familiarity, the interpretation

of any difference between the two groups is checked against visit history (first-time vs. repeat visitors) in Section 5.6.

2.6. Tourism and Public Transport at Destinations

The research question of this paper is also embedded in the literature on tourism and public transport at destinations, which has developed into a distinct field over the past two decades [38,39]. Three findings of that literature inform the present model. First, tourists' use of public transport at a destination is shaped by a combination of personal characteristics (age, income, car availability, travel party), trip characteristics (arrival mode, length of stay, trip organisation) and supply characteristics (network coverage, frequency, information and ticketing), and tourists are consistently more sensitive than residents to the legibility, integration and reliability of the system [38,61,167,168]; users and non-users differ systematically in their perceptions, so that improving the experience of users does not automatically convert non-users [61,169]. Second, public transport performance feeds into the evaluation of the destination as a whole—Thompson and Schofield [62] showed that the ease of use and the safety of public transport predict overall destination satisfaction—and the quality of the transport experience determines which areas of a destination are visited and how far tourists disperse from their accommodation [167,170,171]. Third, public transport provision for tourism faces specific supply-side constraints: seasonal peaks that overload systems designed for residents [64], the difficulty of serving dispersed rural attractions [63,65,66], the tension between car access and the conservation role of protected landscapes [172], and the need to plan tourism and mobility together rather than sequentially [173]. Recent work extends this agenda to the environmental dimension, showing that visitors' modal choices at destinations are linked to their mobility habits at home and to the type of destination, with coastal destinations associated with less sustainable choices [174], and that smart-card data can be used to profile tourists' public transport use at scale [170].

The Montenegrin railway is a public transport system in exactly this sense: it is used by tourists alongside residents, it competes with coaches and the private car on the coast–north axis, its attractiveness depends on frequency, information, ticketing and connections as much as on the track, and its intended role is to disperse visitors from the coast to the interior. The model developed in Section 4 therefore borrows from this literature the distinction between accessibility (whether the railway makes destinations reachable and integrates with other modes), reliability (frequency, punctuality, journey time and connections) and the infrastructure that underpins both, and it adopts the destination-level outcome variables—satisfaction, revisit and recommendation intentions and the perceived contribution to destination development—that the tourism–public transport literature has shown to be sensitive to transport performance. Conversely, the study contributes to that literature a case in which the public transport mode is a conventional interregional railway rather than the urban buses, trams and metros that dominate the field, and in which safety perceptions, which that literature has rarely examined [154], play a central role.

3. Research Context: Railways and Tourism in Montenegro

Montenegro's railway system comprises 250 km of standard-gauge, single-track open line, of which 225 km are electrified at 25 kV 50 Hz [20,175]. The backbone is the Vrbnica–Bar section (167 km) of the 476 km Belgrade–Bar line, built in phases between 1952 and 1976, which links the Port of Bar—the country's principal seaport—with Podgorica and, via the Morača canyon, Kolašin, Mojkovac and Bijelo Polje to the Serbian border [19]. The line is described by the infrastructure manager as unique in Europe in climbing roughly 1000 m between Podgorica and Kolašin over little more than 50 km, with gradients of

up to 25‰ and minimum curve radii of 300 m; the Vrbnica–Bar section alone includes 106 tunnels—among them the 6.2 km Sozina tunnel between Bar and the Skadar Lake basin—and 96 bridges, including the Mala Rijeka viaduct [19,20]. A 56 km electrified branch connects Podgorica with Nikšić across the Bjelopavlići plain, and a 24 km non-electrified line runs from Podgorica through Tuzi to the Albanian border, currently used for freight only [20]. Figure 1 shows a schematic layout of the network—with the four survey stations, the two airports and the main coastal, lake and mountain tourist areas marked—together with an indicative longitudinal profile of the main line.

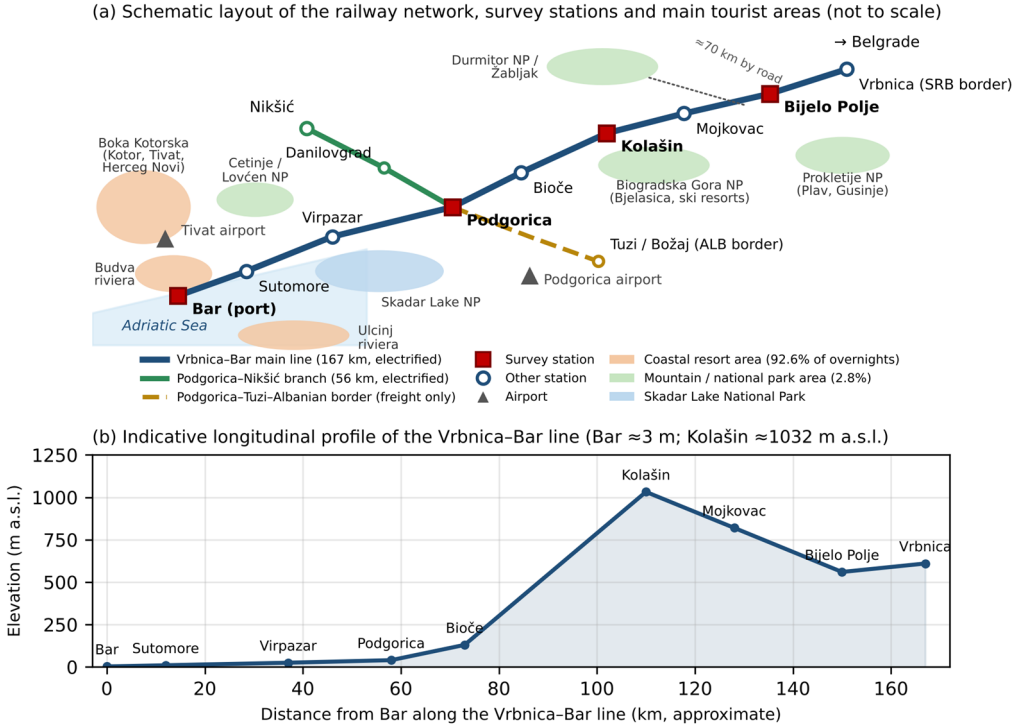


Figure 1. (**a**) Schematic layout of the Montenegrin railway network with the survey stations, airports and the main tourist areas (not to scale; the dashed line is the non-electrified Podgorica–Tuzi line to the Albanian border, used for freight only; the dotted line indicates the road connection from Mojkovac to Durmitor National Park; shaded areas mark the coastal resort areas, the mountain and national park areas and Skadar Lake National Park); (**b**) indicative longitudinal profile of the Vrbnica–Bar line, from the Port of Bar (≈3 m a.s.l.) to Kolašin (≈1032 m a.s.l.) and the Serbian border at Vrbnica. Source: authors, based on [15,19,20].

Institutionally, the former Railways of Montenegro were unbundled in 2008 into four joint-stock companies—Železnička infrastruktura Crne Gore (ŽICG, infrastructure manager), Železnički prevoz Crne Gore (ŽPCG, passenger operator), Montecargo (freight) and a rolling-stock maintenance company—in line with the first EU railway packages [20,176]. Passenger services are limited: in the second quarter of 2025 rail carried 225 thousand passengers, 7% fewer than a year earlier, against 1.58 million by intercity road transport and 0.89 million passengers handled at the two airports [24]. Eurostat lists Montenegro among the candidate countries recording fewer than one million rail passengers and fewer than 70 million passenger-kilometres in 2024 [23]. Nonetheless, the Belgrade–Bar line is Montenegro's only international passenger rail connection and the sole rail link between the coast and the north, and it is served in summer by day and night trains that are heavily used by visitors from Serbia and by international "rail-tourists" attracted by the scenic route. Passenger information is provided primarily in Montenegrin: station announcements and printed timetables are in Montenegrin, the operator's website and online ticketing are

available in Montenegrin and English, and announcements on the international trains are made in Montenegrin and English; information in Russian, German or the other languages of the main source markets is not provided systematically.

The network's safety and quality profile has been shaped by the 2006 Bioče derailment, in which a four-coach train from Bijelo Polje to Bar left the track above the Morača river after a brake failure, killing at least 44 and injuring about 200 people [21]. The accident triggered a multi-year programme of superstructure renewal, signalling upgrades and tunnel and bridge rehabilitation on the Vrbnica–Bar line financed by the EBRD, the EIB and EU IPA/WBIF grants, with the explicit objectives of raising safety, restoring design speeds and meeting interoperability requirements [19,41]. According to the infrastructure manager, around EUR 70 million of EBRD, EIB, IPA and WBIF financing has been absorbed on the line over the past decade and roughly 40% of the superstructure has been renewed; nevertheless, permitted speeds remain at about 70 km/h on much of a line that was engineered in the 1950s–1970s as one of the most ambitious railway projects in Europe, and its maintenance is among the most complex and expensive on the continent [19,20]. The Vrbnica–Bar line is designated as Route 4 of the South-East Europe core network and lies on the indicative extension of the TEN-T network to the Western Balkans, and its continued rehabilitation is listed as a long-term national priority in the Reform and Growth Facility framework [13,41]. Successive European Commission progress reports had long noted that the railway regulatory body and the national safety authority lacked full operational independence and adequate staffing, and had called for a new law on railway safety and interoperability aligned with Directives (EU) 2016/798 and 2016/797 [134,135,176,177]. The 2025 Commission report concluded that Montenegro was between a moderate and a good level of preparation in transport policy, welcomed the new Law on Railways and called for a law on railway safety and interoperability and for an operationally independent and adequately staffed regulator and safety authority [176]. Both requests were met within months: the Law on Railway Safety and Interoperability was adopted by Parliament on 27 December 2025 and, together with the Law on Railways, has applied since the beginning of 2026, while the Railway Agency was established on 7 January 2026 and became operational in June 2026 [25–27]. The survey reported below was thus conducted in the final months of the previous regulatory regime, which makes it a useful baseline against which the effects of the new safety and interoperability framework can later be assessed. On the operator side, the fleet-renewal contract signed in May 2026—a EUR 30 million, EBRD-financed order for three four-car electric multiple units interoperable with the Serbian fleet, expressly motivated by the goal of making rail "more attractive for both residents and tourists"—will add the first new passenger rolling stock in decades within three years [28,29].

The tourism side of the equation is well documented. Tourism is the largest export sector of the Montenegrin economy; the 2025 figures of 2.73 million arrivals and 15.4 million overnight stays were generated primarily by visitors from Serbia (23.4% of foreign overnights), the Russian Federation (16.4%) and Bosnia and Herzegovina (8.1%), and 92.6% of overnights were spent in seaside resorts, compared with 2.8% in mountain resorts and 2.7% in the capital [15]. As Figure 1 shows, the railway serves the coast directly only at Bar: the Budva riviera, Boka Kotorska and the Ulcinj riviera, where most overnight stays are concentrated, depend on road connections from Bar or Podgorica stations and on Tivat airport, whereas the mountain destinations of the north—Kolašin with Biogradska Gora National Park and the Bjelasica ski resorts, and, some 70 km by road from Mojkovac, Durmitor National Park—are reached directly from stations on the line.

Seasonality is among the most pronounced in the Mediterranean [16]. Both the Tourism Development Strategy 2022–2025 and the National Strategy for Sustainable Development identify the dispersal of demand to the north and the extension of the season as strategic

goals, and both name transport accessibility as a limiting factor [17,18], while the Transport Development Strategy 2019–2035 assigns the railway a role in sustainable mobility and in linking the coast with the mountainous hinterland [40]. Whether tourists perceive the railway as a credible vehicle for these goals is the empirical question that this study addresses.

4. Research Methodology

4.1. Research Design

The study adopts a quantitative, cross-sectional design with a two-stage analytical strategy. In the first stage, the hypothesised relationships in Figure 2 were tested with covariance-based structural equation modelling (CB-SEM), following the two-step approach of Anderson and Gerbing [178]: a confirmatory measurement model was validated before the structural model was estimated [179,180]. Mediation was assessed with bootstrap confidence intervals [181], and the moderating role of visitor origin was examined through a multigroup comparison preceded by tests of measurement invariance [182–184]. In the second stage, an importance–performance analysis [185,186] of twelve concrete infrastructure and service attributes was carried out on the same sample to translate the structural findings into actionable priorities. The population of interest was defined as adult tourists—non-residents of Montenegro, or residents travelling away from their usual environment with at least one overnight stay—who had completed at least one rail journey within Montenegro during their current trip. Because the design is cross-sectional, the structural model tests whether the pattern of associations in the data is consistent with the hypothesised ordering of the constructs; it cannot establish temporal precedence, and the hypotheses are therefore formulated and interpreted as directional associations rather than as demonstrated causal effects.

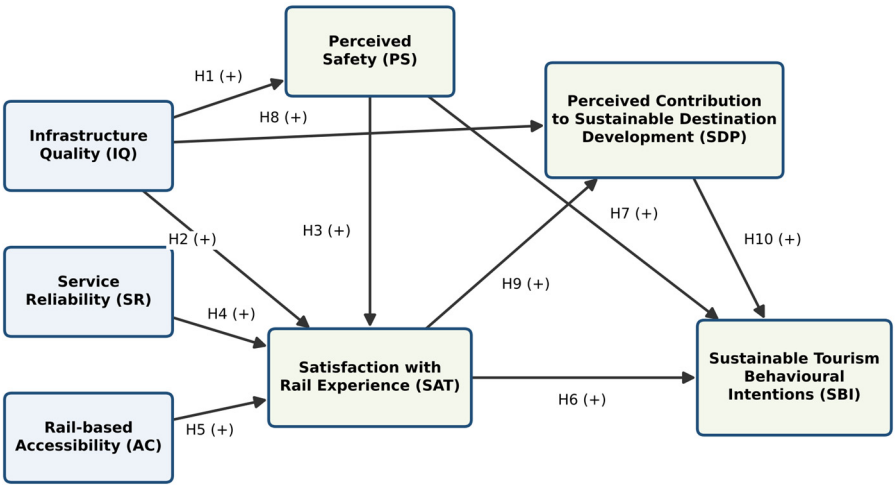


Figure 2. Conceptual model of the study with the hypothesised paths H1–H10. Arrows indicate the hypothesised positive relationships; infrastructure quality, service reliability and rail-based accessibility are exogenous constructs (blue), and perceived safety, satisfaction, the perceived sustainability contribution and behavioural intentions are endogenous constructs (green).

4.2. Conceptual Model and Hypotheses

Figure 2 integrates the constructs derived from the literature into a single conceptual model. Infrastructure quality (IQ), service reliability (SR) and rail-based accessibility (AC) are exogenous constructs, allowed to covary. IQ is hypothesised to influence perceived safety (PS), satisfaction with the rail experience (SAT) and the perceived contribution of

rail to sustainable destination development (SDP); PS, SR and AC influence SAT; PS also influences sustainable tourism behavioural intentions (SBI) directly; SAT influences SDP and SBI; and SDP influences SBI. SAT is thus a mediator of the effects of IQ, PS, SR and AC on SBI, and SDP a mediator of the effect of SAT on SBI. Visitor origin is examined as a moderator. The ten hypotheses are numbered in the order in which they appear in the model, from the exogenous constructs to the outcome construct; their theoretical grounding is given in Sections 2.3–2.5.

H1. *Perceived railway infrastructure quality has a positive effect on perceived safety.*

H2. *Perceived railway infrastructure quality has a positive effect on satisfaction with the rail experience.*

H3. *Perceived safety has a positive effect on satisfaction with the rail experience.*

H4. *Perceived service reliability has a positive effect on satisfaction with the rail experience.*

H5. *Perceived rail-based accessibility has a positive effect on satisfaction with the rail experience.*

H6. *Satisfaction with the rail experience has a positive effect on sustainable tourism behavioural intentions.*

H7. *Perceived safety has a positive effect on sustainable tourism behavioural intentions.*

H8. *Perceived railway infrastructure quality has a positive effect on the perceived contribution of rail to sustainable destination development.*

H9. *Satisfaction with the rail experience has a positive effect on the perceived contribution of rail to sustainable destination development.*

H10. *The perceived contribution of rail to sustainable destination development has a positive effect on sustainable tourism behavioural intentions.*

4.3. Research Instrument

The questionnaire was developed in three steps. First, an item pool of 36 candidate items was assembled from validated scales in the public transport quality literature [102,106,107,112,114], the tourist risk and safety literature [145,147,148], the satisfaction and behavioural-intention literature [129,131,132,155] and the sustainable tourism literature [84,159], and adapted to the railway and Montenegrin context. Second, content validity was assessed by a panel of six experts—two academics in transport engineering, two in tourism management, one manager from the infrastructure manager (ŽICG) and one from the passenger operator (ŽPCG)—using a two-round modified Delphi procedure with structured scoring sheets [187]. In the first round, each expert independently rated the relevance and the clarity of every item on a four-point scale (1 = not relevant/unclear, 4 = highly relevant/very clear) and proposed rewording where necessary; the item-level content validity index (I-CVI, the proportion of experts rating an item 3 or 4) and the scale-level index (S-CVI/Ave) were computed following Polit and Beck [188]. Items with an I-CVI below 0.78 were reworded or removed, and the revised list was returned to the panel in a second round together with the anonymised first-round ratings; after this round all retained items reached an I-CVI of at least 0.83 and the S-CVI/Ave was 0.94, while six items were dropped as redundant or inappropriate to the Montenegrin context. Third, the

instrument was pre-tested with 32 rail travellers at Podgorica station in May 2025, which led to the simplification of three items and the removal of one redundant accessibility item.

The final instrument measured seven latent constructs with 29 reflective items, all rated on seven-point Likert scales (7 = strongly agree): perceived infrastructure quality (IQ, five items), perceived safety (PS, four items), service reliability (SR, four items), rail-based accessibility (AC, three items), satisfaction with the rail experience (SAT, four items), perceived contribution of rail to sustainable destination development (SDP, four items) and sustainable tourism behavioural intentions (SBI, five items). The full wording is given in Appendix A. The questionnaire was administered in three language versions—Montenegrin (readable also by speakers of Serbian, Bosnian and Croatian), English and Russian—selected to cover the main source markets [15]; the English and Russian versions were produced by translation and back-translation by bilingual academics, discrepancies were resolved by the research team, and respondents chose the version they preferred. In a separate part of the instrument, respondents were asked to rate the importance of the twelve attributes of rail travel in Montenegro (1 = not at all important, 7 = extremely important) and, subsequently, the performance of the railway on the same attributes (1 = very poor, 7 = excellent), following standard IPA practice [185,186]. The attributes—track condition and ride smoothness, punctuality, technical safety of rolling stock, personal security at stations and on board, journey time, train frequency, cleanliness and comfort of coaches, station facilities, passenger information and digital ticketing, connections with buses, airports and the Port of Bar, scenic value of the route, and ticket price/value for money—were selected to cover the quality dimensions of EN 13816 [112] and the specific characteristics of the Montenegrin network. A final block recorded gender, age, education, country of residence, purpose of trip, route travelled, first or repeat visit, length of stay and survey location.

The seven constructs were specified as reflective and unidimensional, and because several of them combine facets that could in principle be separated, the reasoning deserves to be made explicit. Infrastructure quality is conceived, in the servicescape and EN 13816 traditions [112,113], as the passenger's evaluation of the tangible state of the railway's assets—track, stations, rolling stock, coach interiors and information systems—which share a common cause in the level of investment and maintenance; the items therefore reflect one underlying evaluation of the physical system, whereas the service outputs of that system (punctuality, frequency, journey time, connections) belong to the reliability construct. Perceived safety combines technical safety and personal security because, from the traveller's perspective, both are facets of the same judgement—whether the railway is a safe way to travel—and because the tourism risk literature treats transport safety as a single risk dimension [145,147]. Sustainable tourism behavioural intentions are specified as a single disposition to use, recommend and favour the railway in future, of which revisit, recommendation, modal preference, inland visitation and willingness to pay a premium are observable manifestations, following the treatment of behavioural intention as a reflective construct in the tourism literature [130,155]. Because these decisions are contestable, the unidimensionality of each construct and the distinctness of the constructs were tested against alternative measurement models (Section 5.3; Appendix A, Table A3).

4.4. Data Collection

Data were collected between June and September 2025 through an intercept survey at the four principal passenger stations on the Vrbnica–Bar line—Bar, Podgorica, Kolašin and Bijelo Polje—and on board Bar–Bijelo Polje regional trains and the Belgrade–Bar international day and night trains within Montenegrin territory. Ten trained enumerators, students of the two faculties of the Adriatic University involved in the study, worked on a rotating schedule that covered weekdays and weekends and morning, afternoon and evening departures.

A systematic sampling procedure was applied whereby every third arriving or waiting passenger who met the eligibility criteria was invited to participate; on board, enumerators started from a randomly selected coach and approached every third occupied seat block; only one member of a travelling party was interviewed. Of 541 questionnaires distributed, 512 were returned (94.6%). Twenty-five were excluded because more than 10% of the items were missing, because of straight-lining across all scale items, or because the respondent proved to be a commuting resident, leaving 487 usable responses (90.0% of those distributed). The sample size exceeds the conventional minimum of ten observations per estimated indicator for CB-SEM [179,189] and provides power above 0.80 to reject a hypothesis of poor fit (RMSEA ≥ 0.08) at 364 degrees of freedom [190].

Systematic intercept sampling of this kind does not yield a probability sample of all rail tourists, and several potential sources of selection bias were considered [191]. First, the fixed selection interval removes enumerator discretion in choosing respondents, and the rotation of enumerators across stations, days and times of day limits the over-representation of particular services; nevertheless, passengers with longer waiting times at stations had a higher chance of being approached, which is why on-board interviews covering both regional and international trains were added. Second, non-response (5.4%) and the exclusion of incomplete questionnaires were low and did not differ noticeably by station or language version. Third, because the survey was conducted in summer, at four stations and on the main line only, the sample cannot represent off-season travellers or users of the Podgorica–Nikšić branch, who are under-represented (8.2%). Fourth, the sample is restricted to rail users: tourists who travelled by road or air are not covered, so the results describe the perceptions of those who have experienced the railway rather than the modal-choice potential of all visitors. A comparison with official statistics suggests that the sample is broadly consistent with the structure of demand—the shares of visitors from Serbia and Bosnia and Herzegovina, of repeat visitors and of stays of four to seven nights are close to those reported by MONSTAT for the 2025 summer season [15]—although visitors from the Russian Federation are under-represented, consistent with their lower propensity to travel by rail. These limitations are taken up in Section 6.3.

4.5. Data Analysis

Common method variance was assessed in three ways, following Podsakoff et al. [192,193]: with Harman's single-factor test, by comparing the measurement model with a single-factor confirmatory model, and with an unmeasured latent method construct (ULMC), i.e., a method factor with equal loadings on all 29 items and orthogonal to the substantive factors added to the measurement model [194]. Reliability and validity were evaluated with Cronbach's alpha, composite reliability, average variance extracted, the Fornell–Larcker criterion and heterotrait–monotrait (HTMT) ratios [195–199], and the unidimensional specification of the constructs was tested against six alternative measurement models. Measurement and structural models were estimated by maximum likelihood with the semopy package (version 2.3.11) for Python 3.13 [200]; the complete model syntax and estimation settings are given in Appendix B, and model fit was judged against the chi-square test, CFI, TLI, RMSEA, GFI and the standardised root mean square residual [179,180]. Structural paths are reported both as unstandardised coefficients (B, with the first indicator of each construct fixed to 1 for scaling), to which the standard errors and z-tests refer, and as fully standardised coefficients (β); the explained variance of each endogenous construct is computed within the latent model as one minus its standardised disturbance variance. Specific indirect, total indirect and total effects—including the serial pathways—were computed from the standardised latent path coefficients, and their uncertainty was assessed with 5000 bootstrap resamples of the complete latent model and percentile confidence inter-

vals [181]. Because omitting a direct path by specification does not by itself demonstrate full mediation, the hypothesised model was compared with an augmented model in which direct paths from infrastructure quality, service reliability and accessibility to intentions were freed, and mediation was classified following Zhao et al. [201]. For the multigroup analysis, domestic respondents ($n = 76$) were excluded because the group was too small for the stable estimation of a 29-indicator model, and the robustness of the pooled estimates to their exclusion was checked by re-estimating the full model on the 411 non-domestic respondents. Measurement invariance between regional visitors (residents of the successor states of the former Yugoslavia and of Albania; $n = 231$) and other international visitors ($n = 180$) was tested in the sequence configural, metric (equal factor loadings) and scalar (equal loadings and item intercepts) invariance [182–184], using the $\Delta CFI \leq 0.010$ and $\Delta RMSEA \leq 0.015$ criteria in addition to the chi-square difference test [183]. Group differences in the structural paths were then tested in a two-group structural model with factor loadings constrained to equality and all other parameters free, by comparing, for each path, a model in which its unstandardised coefficient is constrained to be equal across groups with the unconstrained model ($\Delta\chi^2$ with one degree of freedom) [202]; unstandardised coefficients were compared because differences between standardised coefficients can reflect differences in construct variances between groups. The same procedure was applied to first-time versus repeat visitors as a check on the interpretation of origin. Differences in construct means across routes and across origin groups were tested with one-way ANOVA. For the IPA, the quadrant classification was based on the grand means of importance and performance [185]; because this classification is sensitive to the placement of the cross-hairs [186,203], its stability was checked against the scale midpoint, the medians of the attribute means and the gap-based (diagonal) approach.

5. Research Results

5.1. Sample Profile

Table 1 presents the profile of the 487 respondents. Women slightly outnumbered men, and the sample was young: 46.2% of respondents were aged 18–34 and a further 24.4% were aged 35–44. Three-quarters held a university degree. Regional visitors from neighbouring economies formed the largest group (47.4%), followed by other international visitors (37.0%) and domestic tourists (15.6%). Leisure was the dominant purpose of travel (69.4%). The largest share of respondents (42.9%) had travelled on the international Belgrade–Bar service, 28.5% on the Bar–Podgorica section, 20.3% on the mountainous Podgorica–Bijelo Polje section and 8.2% on the Podgorica–Nikšić branch; 55.9% were repeat visitors to Montenegro, and the modal length of stay was four to seven nights, consistent with official statistics on occupancy in the summer season [15].

Table 1. Sample descriptive statistics ($n = 487$).

Characteristic	Category	*n*	%
Gender	Female	261	53.6
	Male	220	45.2
	Other/undisclosed	6	1.2
Age	18–24	90	18.5
	25–34	135	27.7
	35–44	119	24.4
	45–54	67	13.8
	55–64	49	10.1
	65+	27	5.5

Table 1. *Cont.*

Characteristic	Category	*n*	%
Education	Secondary or lower	125	25.7
	Bachelor	216	44.4
	Master/PhD	146	30.0
Visitor origin	Domestic (Montenegro)	76	15.6
	Regional (SRB, BIH, MKD, ALB, XK)	231	47.4
	Other international	180	37.0
Purpose of trip	Leisure/holiday	338	69.4
	Visiting friends and relatives	87	17.9
	Business	41	8.4
	Other	21	4.3
Route travelled	International Belgrade–Bar	209	42.9
	Bar–Podgorica (coastal/central)	139	28.5
	Podgorica–Bijelo Polje (mountain)	99	20.3
	Podgorica–Nikšić	40	8.2
Visit history	First visit to Montenegro	215	44.1
	Repeat visit	272	55.9
Length of stay (nights)	1–3	98	20.1
	4–7	214	43.9
	8–14	120	24.6
	15+	55	11.3
Survey location	Podgorica station	137	28.1
	Bar station	118	24.2
	Bijelo Polje station	92	18.9
	Kolašin station	48	9.9
	On board	92	18.9

5.2. Descriptive Statistics and Common Method Variance

Construct means (Table 2) reveal a clear pattern. Respondents rated the perceived contribution of rail to sustainable destination development highly (SDP, M = 5.19) and expressed fairly strong sustainable behavioural intentions (SBI, M = 4.88) and a moderate-to-high sense of safety (PS, M = 4.84), but evaluated infrastructure quality (IQ, M = 3.94) and, especially, service reliability (SR, M = 3.72) below the scale midpoint. Satisfaction with the rail experience was moderate (SAT, M = 4.38), as was accessibility (AC, M = 4.34). Item-level skewness ranged from −0.39 to 0.17 and kurtosis from −0.48 to 0.01, well within the |2| and |7| thresholds for maximum-likelihood estimation [179].

Table 2. Measurement model: items, descriptive statistics, standardised loadings, reliability and convergent validity.

Construct/Item	Mean	SD	Loading	α	CR	AVE
Infrastructure quality (IQ)	3.94	1.17		0.872	0.872	0.578
IQ1 Tracks provide a smooth and comfortable ride	3.93	1.17	0.806			
IQ2 Stations and platforms are in good physical condition	3.97	1.15	0.768			
IQ3 Trains are in good technical condition	3.93	1.25	0.775			
IQ4 Coaches are clean and comfortable	3.94	1.15	0.756			
IQ5 Passenger information systems work well	3.91	1.14	0.691			

Table 2. *Cont.*

Construct/Item	Mean	SD	Loading	ɑ	CR	AVE
Perceived safety (PS)	4.84	1.19		0.878	0.879	0.645
PS1 I felt safe on board the train	4.85	1.16	0.834			
PS2 I trust the technical safety of trains and tracks in Montenegro	4.89	1.18	0.809			
PS3 I felt personally secure at stations and on board	4.85	1.19	0.805			
PS4 Safety and emergency information was adequate	4.77	1.23	0.763			
Service reliability (SR)	3.72	1.20		0.879	0.879	0.645
SR1 Trains departed and arrived on time	3.72	1.21	0.847			
SR2 Train frequency was adequate for my needs	3.70	1.20	0.811			
SR3 Journey time was acceptable	3.70	1.17	0.786			
SR4 Connections with other trains and buses were reliable	3.76	1.20	0.766			
Rail-based accessibility (AC)	4.34	1.16		0.826	0.827	0.615
AC1 The railway made the places I wanted to visit easy to reach	4.35	1.17	0.827			
AC2 The railway is a good way to travel between the coast, the capital and the north	4.31	1.15	0.782			
AC3 The railway is well integrated with buses, airports and the port	4.37	1.18	0.741			
Satisfaction with the rail experience (SAT)	4.38	1.18		0.878	0.879	0.646
SAT1 Overall, I am satisfied with my rail travel in Montenegro	4.41	1.18	0.841			
SAT2 The rail journey met my expectations	4.43	1.18	0.818			
SAT3 Travelling by train in Montenegro was a pleasant experience	4.38	1.19	0.801			
SAT4 Compared with other modes, rail was a good choice	4.32	1.16	0.751			
Perceived contribution to sustainable destination development (SDP)	5.19	1.17		0.869	0.869	0.625
SDP1 Rail travel reduces road congestion and pollution at the coast	5.20	1.22	0.813			
SDP2 The railway helps tourism development in the north of Montenegro	5.24	1.14	0.804			
SDP3 The railway helps spread tourism across the year	5.21	1.13	0.771			
SDP4 The railway helps preserve Montenegro's landscapes and environment	5.11	1.18	0.773			
Sustainable tourism behavioural intentions (SBI)	4.88	1.20		0.890	0.890	0.618
SBI1 I intend to travel by train again in Montenegro	4.90	1.19	0.798			
SBI2 I would recommend rail travel in Montenegro to others	4.91	1.18	0.830			
SBI3 I would choose rail over car for trips within Montenegro	4.91	1.22	0.792			
SBI4 I intend to visit inland or northern destinations reachable by rail	4.82	1.21	0.776			
SBI5 I would pay more for low-carbon transport	4.84	1.19	0.733			

Note: Rows in bold are construct-level rows: the construct mean and SD are the averages of the item scores, and ɑ, CR and AVE are reported at construct level; the remaining rows are the items with their standardised loadings. ɑ = Cronbach's alpha; CR = composite reliability; AVE = average variance extracted.

One-way ANOVA detected no significant differences in construct means across the four routes (IQ: $F = 1.17$, $p = 0.320$; PS: $F = 0.67$, $p = 0.572$; SR: $F = 2.13$, $p = 0.095$; SAT: $F = 1.63$, $p = 0.180$; SBI: $F = 0.71$, $p = 0.548$), although reliability was rated lowest on the Podgorica–Nikšić branch ($M = 3.39$). Nor did construct means differ significantly across the three origin groups (domestic, regional and other international; F between 0.38 and 2.10, all $p > 0.12$), which indicates that the domestic respondents excluded from the multigroup analysis do not form a distinct population in terms of their evaluations. Three tests addressed common method variance. In Harman's single-factor test the first unrotated factor accounted for 36.1% of the variance in the 29 items, below the 50% threshold; a single-factor confirmatory model fitted the data very poorly ($\chi^2(377) = 3695.10$; CFI = 0.583; RMSEA = 0.135; SRMR = 0.114; Appendix A, Table A3); and adding an unmeasured latent method construct to the seven-factor model did not improve fit ($\Delta\chi^2(1) = 1.06$, $p = 0.303$), the method factor accounted on average for 11.7% of item variance (mean standardised method loading 0.34), and the substantive loadings changed by 0.08 on average and by

0.10 at most, all remaining significant. These results indicate that a single method factor cannot account for the covariances among the items; they cannot exclude common method variance entirely, a limitation noted in Section 6.3 [192–194].

5.3. Measurement Model

The confirmatory factor analysis of the seven-factor measurement model showed excellent fit: $\chi^2(356) = 391.10$, $p = 0.097$; CFI = 0.996; TLI = 0.995; RMSEA = 0.014 (90% CI 0.000–0.022); SRMR = 0.028; GFI = 0.953.

All standardised loadings exceeded 0.69 and were significant at $p < 0.001$ (Table 2). Cronbach's alpha ranged from 0.826 (AC) to 0.890 (SBI), composite reliability from 0.827 to 0.890 and AVE from 0.578 (IQ) to 0.646 (SAT), exceeding the recommended thresholds of 0.70, 0.70 and 0.50, respectively [195–197,199]. Discriminant validity was supported: the square root of the AVE of every construct (0.760–0.803) exceeded its correlations with all other constructs (maximum 0.694), and all HTMT ratios were below the conservative 0.85 threshold, the highest being 0.696 for SAT–SBI [196,198]; the full matrix is given in Appendix A, Table A2. The unidimensional specification of the constructs was then examined against alternative measurement models (Appendix A, Table A3). Splitting perceived safety into technical safety (PS1–PS2) and personal security (PS3–PS4), infrastructure quality into physical assets (IQ1–IQ3) and amenities and information (IQ4–IQ5), or behavioural intentions into reuse, recommendation and modal preference (SBI1–SBI3) and inland visitation and willingness to pay (SBI4–SBI5) did not improve fit significantly ($\Delta\chi^2(7) = 9.13$, 5.79 and 9.36; $p = 0.24$, 0.56 and 0.23) and produced correlations between the split factors of 0.99–1.04, i.e., factors that are empirically indistinguishable; the single-factor specification of each construct was therefore retained. Conversely, merging service reliability with accessibility worsened fit markedly ($\Delta\chi^2(6) = 459.21$, $p < 0.001$), and a three-factor model that collapses all evaluative constructs into one fitted poorly (CFI = 0.726; RMSEA = 0.110), confirming that the constructs are distinct rather than facets of a general favourable evaluation.

5.4. Structural Model and Hypothesis Testing

The structural model fitted the data very well: $\chi^2(364) = 394.44$, $p = 0.131$; CFI = 0.996; TLI = 0.996; RMSEA = 0.013 (90% CI 0.000–0.022); SRMR = 0.029; GFI = 0.953 (Table 3). The difference in chi-square between the measurement and the structural model ($\Delta\chi^2 = 3.34$, $\Delta df = 8$) was not significant, indicating that the hypothesised structure reproduces the latent covariances without loss of fit.

Table 3. Goodness-of-fit indices of the measurement and structural models.

Index	Threshold	Measurement Model (CFA)	Structural Model (SEM)
χ^2 (df)		391.10 (356)	394.44 (364)
χ^2/df	<3	1.10	1.08
p-value	>0.05	0.097	0.131
CFI	≥0.95	0.996	0.996
TLI	≥0.95	0.995	0.996
RMSEA	≤0.06	0.014	0.013
SRMR	≤0.08	0.028	0.029
GFI	≥0.90	0.953	0.953
AIC/BIC		156.4/487.3	140.4/437.7

Note: Thresholds after Hu and Bentler [180] and Kline [179].

All ten hypothesised paths were supported (Table 4, Figure 3). Table 4 reports the unstandardised coefficients, to which the standard errors and z-tests refer, alongside the fully standardised coefficients, and the explained variances are those of the latent model. Infrastructure quality was by far the strongest correlate of perceived safety (H1: β = 0.579, $p < 0.001$), accounting for 34% of its variance—a result consistent with the reliance of lay travellers on tangible cues when judging the technical safety of a railway. Satisfaction with the rail experience was jointly predicted by service reliability (H4: β = 0.295), infrastructure quality (H2: β = 0.282), perceived safety (H3: β = 0.281) and, more weakly, accessibility (H5: β = 0.150, $p = 0.002$), with an R^2 of 0.58. Infrastructure quality (H8: β = 0.284) and satisfaction (H9: β = 0.316) explained 30% of the variance in the perceived contribution of rail to sustainable destination development. Finally, sustainable tourism behavioural intentions were predicted primarily by satisfaction (H6: β = 0.414), followed by perceived safety (H7: β = 0.282) and the perceived sustainability contribution (H10: β = 0.240), with an R^2 of 0.59. All standardised paths exceed the threshold for a medium effect except AC → SAT, which is small [190].

Table 4. Unstandardised (B) and standardised (β) path coefficients and hypothesis tests ($n = 487$).

Hypothesis	Path	B	SE	z	*p*	β	Result
H1	IQ → PS	0.595	0.052	11.39	<0.001	0.579	Supported
H2	IQ → SAT	0.297	0.061	4.88	<0.001	0.282	Supported
H3	PS → SAT	0.289	0.051	5.68	<0.001	0.281	Supported
H4	SR → SAT	0.284	0.044	6.41	<0.001	0.295	Supported
H5	AC → SAT	0.153	0.050	3.06	0.002	0.150	Supported
H6	SAT → SBI	0.397	0.052	7.62	<0.001	0.414	Supported
H7	PS → SBI	0.278	0.047	5.86	<0.001	0.282	Supported
H8	IQ → SDP	0.299	0.069	4.35	<0.001	0.284	Supported
H9	SAT → SDP	0.315	0.065	4.86	<0.001	0.316	Supported
H10	SDP → SBI	0.231	0.044	5.27	<0.001	0.240	Supported

Note: B = unstandardised maximum-likelihood estimate (first indicator of each construct fixed to 1); SE and z refer to B; β = fully standardised estimate. R^2 (latent model, 1—standardised disturbance variance): PS = 0.34; SAT = 0.58; SDP = 0.30; SBI = 0.59. Standardised exogenous covariances: IQ–SR = 0.431; IQ–AC = 0.499; SR–AC = 0.447 (all $p < 0.001$).

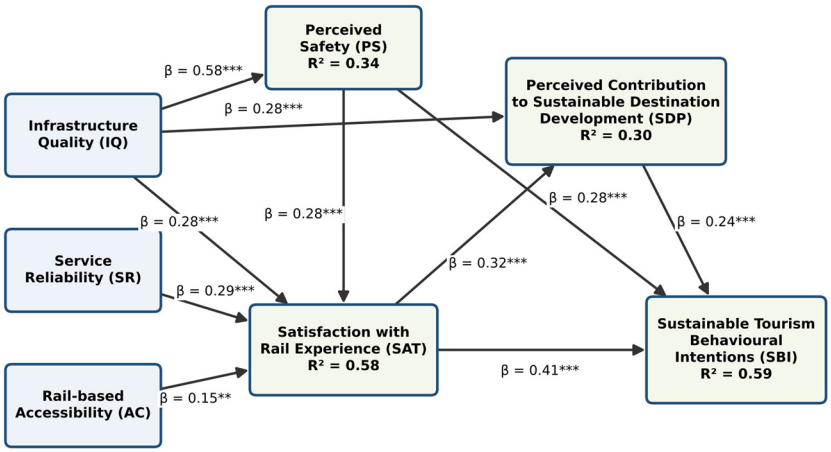


Figure 3. Results of the structural model. Arrows show the hypothesised paths with their fully standardised maximum-likelihood coefficients (β; *** $p < 0.001$, ** $p < 0.01$); exogenous constructs are shaded blue and endogenous constructs green, with their explained variance (R^2) from the latent model ($n = 487$).

As a robustness check related to the multigroup analysis reported below, the pooled model was re-estimated without the 76 domestic respondents ($n = 411$). The fit was unchanged ($\chi^2(364) = 394.74$; CFI = 0.995; TLI = 0.995; RMSEA = 0.014), all ten paths remained significant at $p < 0.001$, and all standardised coefficients lay within ±0.035 of the full-sample estimates, the largest differences being SDP → SBI (0.206 vs. 0.240) and AC → SAT (0.182 vs. 0.150). The exclusion of the domestic group from the multigroup analysis therefore does not affect the pooled conclusions.

To test whether the absence of direct paths from infrastructure quality, reliability and accessibility to intentions is warranted rather than merely assumed, the model was re-estimated with these three direct paths freed. None of them was significant (IQ → SBI: B = 0.040, SE = 0.061, $p = 0.51$; SR → SBI: B = −0.016, SE = 0.045, $p = 0.72$; AC → SBI: B = −0.057, SE = 0.048, $p = 0.23$), the improvement in fit was negligible ($\Delta\chi^2(3) = 1.85$, $p = 0.60$), and the remaining coefficients changed by less than 0.03. The more parsimonious hypothesised model was therefore retained, and the effects of these three constructs on intentions are classified as indirect-only mediation in the typology of Zhao et al. [201].

5.5. Mediation Analysis

Table 5 reports the specific indirect, total indirect and total effects computed within the latent model, with bootstrap standard errors and percentile confidence intervals from 5000 resamples of the complete SEM. All fourteen specific indirect effects were significant. Infrastructure quality was related to satisfaction indirectly through perceived safety (0.163; total effect on satisfaction 0.444), and to intentions through five pathways: via perceived safety (0.164), via satisfaction (0.117), via perceived safety and satisfaction in series (0.067), via the perceived sustainability contribution (0.068) and via the longer serial routes through satisfaction and the sustainability contribution (0.021 and 0.012). Its total effect on intentions (0.450; 95% CI 0.381–0.515) is entirely indirect and of the same magnitude as the total effect of perceived safety (0.420; 95% CI 0.325–0.511), of which roughly two-thirds is direct and one-third runs through satisfaction and the sustainability contribution (0.138). Service reliability and accessibility reach intentions only through satisfaction (total effects 0.144 and 0.073), and satisfaction, besides its direct effect, has a further indirect effect through the perceived sustainability contribution (0.076; total effect 0.490). Together with the augmented-model test in Section 5.4, these results support indirect-only mediation for infrastructure quality, reliability and accessibility and complementary (partial) mediation for perceived safety and satisfaction [201].

Table 5. Specific indirect, total indirect and total effects in the latent model (standardised estimates; bootstrap standard errors and percentile 95% confidence intervals from 5000 resamples).

Type	Effect	Estimate	Boot SE	95% CI Lower	95% CI Upper
Specific indirect	IQ → PS → SAT	0.163	0.034	0.098	0.233
	IQ → SAT → SBI	0.117	0.029	0.061	0.176
	IQ → PS → SBI	0.164	0.032	0.102	0.230
	IQ → PS → SAT → SBI	0.067	0.016	0.038	0.102
	IQ → SDP → SBI	0.068	0.021	0.032	0.113
	IQ → SAT → SDP → SBI	0.021	0.007	0.009	0.037
	IQ → PS → SAT → SDP → SBI	0.012	0.004	0.006	0.021
	PS → SAT → SBI	0.116	0.027	0.068	0.174
	PS → SAT → SDP → SBI	0.021	0.007	0.010	0.037
	SR → SAT → SBI	0.122	0.024	0.078	0.171
	SR → SAT → SDP → SBI	0.022	0.007	0.011	0.037
	AC → SAT → SBI	0.062	0.021	0.022	0.106
	AC → SAT → SDP → SBI	0.011	0.005	0.003	0.023
	SAT → SDP → SBI	0.076	0.020	0.040	0.117

Table 5. *Cont.*

Type	Effect	Estimate	Boot SE	95% CI Lower	95% CI Upper
Total indirect/total	IQ → SAT (indirect)	0.163	0.034	0.098	0.233
	IQ → SAT (total)	0.444	0.047	0.350	0.533
	IQ → SDP (indirect)	0.141	0.030	0.083	0.202
	IQ → SDP (total)	0.425	0.046	0.332	0.510
	IQ → SBI (total = indirect)	0.450	0.034	0.381	0.515
	PS → SBI (indirect)	0.138	0.030	0.082	0.200
	PS → SBI (total)	0.420	0.048	0.325	0.511
	SR → SBI (total = indirect)	0.144	0.026	0.096	0.196
	AC → SBI (total = indirect)	0.073	0.025	0.026	0.124
	SAT → SBI (indirect)	0.076	0.020	0.040	0.117
	SAT → SBI (total)	0.490	0.052	0.386	0.588

Note: All effects are products and sums of the standardised latent path coefficients in Table 4; each bootstrap resample re-estimates the complete measurement and structural model. Total effects equal direct plus indirect effects; constructs without a direct path to the outcome have total effects equal to their indirect effects.

5.6. Measurement Invariance and Multigroup Analysis by Visitor Origin

Because a comparison of structural coefficients is meaningful only if the constructs are measured equivalently in both groups, measurement invariance was tested before the multigroup comparison (Table 6). The configural model, in which the same seven-factor structure was specified in both groups with all parameters free, fitted well ($\chi^2(712) = 732.39$, $p = 0.290$; CFI = 0.997; RMSEA = 0.012; SRMR = 0.042), confirming that the factor structure holds for regional and other international visitors alike. Constraining the factor loadings to equality (metric invariance) produced a statistically significant chi-square difference ($\Delta\chi^2(22) = 35.80$, $p = 0.032$), but the change in the practical fit indices was negligible (ΔCFI = −0.002; ΔRMSEA = 0.003), well within the ΔCFI ≤ 0.010 and ΔRMSEA ≤ 0.015 criteria recommended for samples of this size [182,183]; given the known sensitivity of the chi-square difference test to minor and substantively trivial deviations [184], metric invariance was accepted. Adding equality constraints on the item intercepts (scalar invariance) did not worsen the fit ($\Delta\chi^2(22) = 19.36$, $p = 0.623$; ΔCFI = 0.000; ΔRMSEA = −0.001). Full metric and scalar invariance therefore hold, so that differences in structural paths between the two groups can be interpreted as substantive rather than as measurement artefacts.

Table 6. Measurement invariance of the seven-factor measurement model across regional ($n = 231$) and other international ($n = 180$) visitors.

Model	χ^2 (df)	p	CFI	TLI	RMSEA	SRMR	$\Delta\chi^2$ (Δdf)	p	ΔCFI	ΔRMSEA
Configural	732.39 (712)	0.290	0.997	0.997	0.012	0.042	–	–	–	–
Metric	768.19 (734)	0.185	0.995	0.994	0.015	0.043	35.80 (22)	0.032	−0.002	0.003
Scalar	787.55 (756)	0.207	0.995	0.995	0.014	0.043	19.36 (22)	0.623	0.000	−0.001

Note: Maximum-likelihood estimation with mean structure; metric = equal factor loadings; scalar = equal loadings and item intercepts (latent means free in the second group). Δ values are relative to the preceding model. Invariance is accepted when ΔCFI ≤ 0.010 and ΔRMSEA ≤ 0.015 [183].

With metric and scalar invariance established, the structural paths were compared in a two-group model in which the factor loadings were constrained to equality and all other parameters were free to differ between groups ($\chi^2(750) = 780.54$, $p = 0.213$; CFI = 0.995; RMSEA = 0.014). Table 7 reports the unstandardised coefficients of the two groups, on which the equality tests are based, together with the standardised coefficients for interpretation. An omnibus test rejected the equality of all ten paths ($\Delta\chi^2(10) = 19.24$, $p = 0.037$), and three paths differed individually. The effect of satisfaction on sustainable behavioural intentions

was almost twice as strong among regional visitors (B = 0.525; β = 0.532) as among other international visitors (B = 0.269; β = 0.282; $\Delta\chi^2(1) = 5.73$, $p = 0.017$), whereas the direct effect of perceived safety was far stronger among other international visitors (B = 0.482; β = 0.458) than among regional visitors (B = 0.183; β = 0.196; $\Delta\chi^2(1) = 9.52$, $p = 0.002$), and the effect of infrastructure quality on satisfaction was larger among international visitors (B = 0.471 vs. 0.187; $\Delta\chi^2(1) = 4.46$, $p = 0.035$). The remaining seven paths did not differ (all $p > 0.18$). The overall picture is that visitors from the region form their intentions on the basis of how satisfying the journey was, whereas visitors from farther afield condition their future rail use above all on whether they perceived the system to be safe and read the condition of the infrastructure more directly into their satisfaction.

Table 7. Multigroup comparison of structural paths between regional ($n = 231$) and other international ($n = 180$) visitors: unstandardised coefficients (standardised in parentheses) from the metric-invariant two-group model and chi-square difference tests of path equality.

Path	Regional B (β)	Other International B (β)	$\Delta\chi^2(1)$	p
IQ → PS	0.533 (0.505)	0.637 (0.646)	1.10	0.294
IQ → SAT	0.187 (0.187)	0.471 (0.432)	4.46	0.035
PS → SAT	0.319 (0.337)	0.168 (0.152)	1.74	0.187
SR → SAT	0.270 (0.284)	0.253 (0.265)	0.03	0.862
AC → SAT	0.189 (0.195)	0.169 (0.161)	0.03	0.862
IQ → SDP	0.269 (0.268)	0.330 (0.318)	0.17	0.680
SAT → SDP	0.303 (0.301)	0.343 (0.361)	0.08	0.777
SAT → SBI	0.525 (0.532)	0.269 (0.282)	5.73	0.017
PS → SBI	0.183 (0.196)	0.482 (0.458)	9.52	0.002
SDP → SBI	0.161 (0.164)	0.260 (0.260)	1.04	0.308

Note: $\Delta\chi^2(1)$ compares the model in which the path is constrained to be equal across groups with the unconstrained model; factor loadings are equal across groups in both. Omnibus test of the equality of all ten paths: $\Delta\chi^2(10) = 19.24$, $p = 0.037$.

Whether this contrast reflects familiarity with the railway, as the tourism literature would suggest, or other characteristics of the two markets was examined with the information available in the survey. Visitor origin was not associated with visit history (55.8% of regional and 58.9% of other international visitors were repeat visitors to Montenegro; $\chi^2(2) = 2.26$, $p = 0.32$), and re-estimating the two-group model for first-time ($n = 215$) versus repeat visitors ($n = 272$) revealed no significant difference in any path (omnibus $\Delta\chi^2(10) = 10.19$, $p = 0.42$; SAT → SBI: β = 0.465 vs. 0.371, $p = 0.29$; PS → SBI: β = 0.264 vs. 0.298, $p = 1.00$). The regional–international contrast therefore cannot be attributed to familiarity with the destination as measured here; it is more plausibly a market-of-origin effect that bundles cultural and linguistic proximity, the use of the Belgrade–Bar line as everyday transport rather than as a tourist experience, and market-specific expectations of railway safety, and it is interpreted in these terms in Section 6.

5.7. Importance–Performance Analysis

The IPA (Table 8, Figure 4) sharpens the structural results at the attribute level. Respondents attached the highest importance to technical safety of rolling stock (6.45), punctuality (6.25), track condition and ride smoothness (6.23) and personal security (6.19). Performance was rated highest for scenic value (6.07), value for money (5.37), personal security (4.94) and technical safety (4.48), and lowest for station facilities (3.18), train frequency (3.29), passenger information and digital ticketing (3.39), journey time (3.42), intermodal connections (3.50) and punctuality (3.53). With the exception of scenic value, where performance exceeded importance, all gaps were negative and statistically significant, and the

largest gaps—between 2.4 and 2.7 scale points—concerned punctuality, track condition, journey time, train frequency and station facilities.

Table 8. Importance–performance analysis of twelve attributes of rail travel in Montenegro (n = 487).

Code	Attribute	Importance	Performance	Gap (P − I)	Paired t	Quadrant
A1	Track condition/ride smoothness	6.23	3.72	−2.51	40.78 ***	I
A2	Punctuality of trains	6.25	3.53	−2.72	42.32 ***	I
A3	Technical safety of rolling stock	6.45	4.48	−1.97	31.85 ***	II
A4	Personal security at stations and on board	6.19	4.94	−1.25	20.71 ***	II
A5	Journey time	5.89	3.42	−2.47	38.29 ***	I
A6	Train frequency	5.70	3.29	−2.41	35.83 ***	III
A7	Cleanliness and comfort of coaches	5.78	3.87	−1.91	29.98 ***	III
A8	Station facilities (waiting rooms, toilets, accessibility)	5.58	3.18	−2.40	37.32 ***	III
A9	Passenger information and digital ticketing	5.52	3.39	−2.13	32.98 ***	III
A10	Connections with buses, airports and the Port of Bar	5.83	3.50	−2.33	36.20 ***	III (boundary of I)
A11	Scenic value of the route	5.08	6.07	+0.99	−16.76 ***	IV
A12	Ticket price/value for money	5.62	5.37	−0.25	3.93 ***	IV
	Grand mean	5.84	4.06			

Note: *** $p < 0.001$ (paired-samples t-test, importance vs. performance). Scales 1–7.

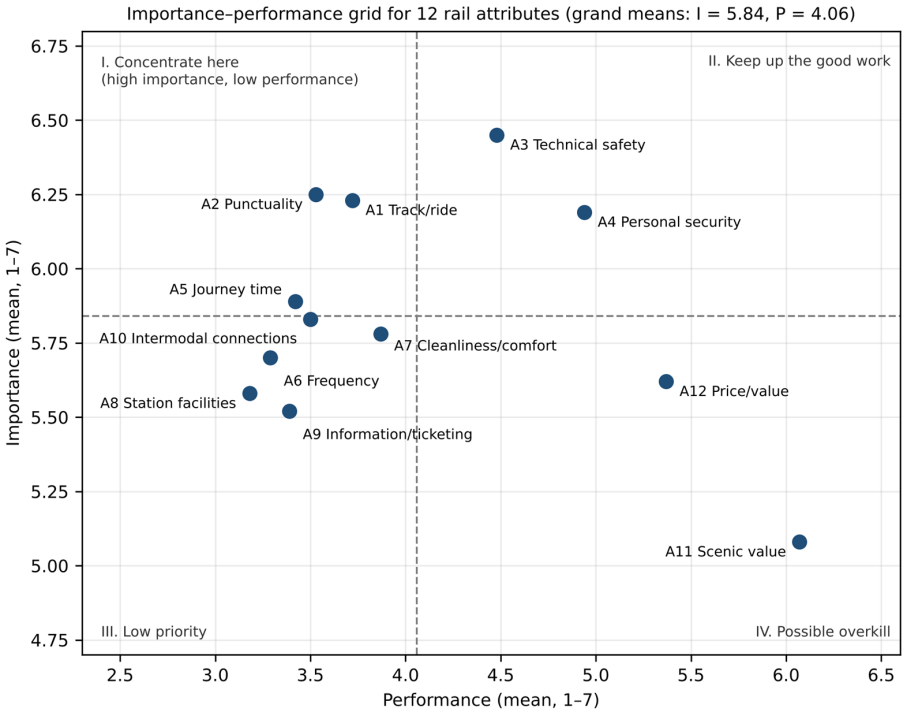


Figure 4. Importance–performance grid for twelve attributes of rail travel in Montenegro (cross-hairs at grand means). Dots represent the twelve attributes, labelled with the codes of Table 8; the dashed lines are the cross-hairs at the grand means of importance (5.84) and performance (4.06), which define the four quadrants.

Using the grand means (importance 5.84, performance 4.06) as cross-hairs, three attributes fall in Quadrant I ("concentrate here"): track condition and ride smoothness, punctuality of trains and journey time; intermodal connections (importance 5.83, performance 3.50) lie on the boundary of this quadrant. Their importance is only 0.01 scale points below the grand mean of 5.84, whereas their performance is the fifth lowest of the twelve attributes and their gap (−2.33) the sixth largest; the quadrant assignment of this attribute is therefore an artefact of the cross-hair placement rather than a substantive finding [186,203]. With the cross-hairs at the scale midpoint (4.0/4.0) or at the medians of the attribute means (5.81/3.63), connections fall unambiguously in Quadrant I, and under the gap-based (diagonal) approach they rank sixth among the twelve priorities. For policy purposes we therefore treat intermodal connections as a Quadrant I priority—a reading that is consistent with the structural results, in which connections form part of the reliability construct that is the strongest driver of satisfaction, and with the evidence that integration is among the attributes to which visitors, as opposed to residents, are most sensitive [38,62]. Technical safety of rolling stock and personal security fall in Quadrant II ("keep up the good work"), which indicates that the post-2006 safety investments are recognised by travellers, although the gaps of 2.0 and 1.3 points show that expectations are still not fully met. Train frequency, cleanliness and comfort, station facilities and information and ticketing fall in Quadrant III ("low priority")—but only because their importance ratings are marginally below the grand mean; their performance scores are among the lowest in the set, and several of them (frequency, journey time, connections) are direct correlates of the reliability construct that was the strongest driver of satisfaction. Scenic value and value for money fall in Quadrant IV ("possible overkill"), a label that should not be read literally: the scenic value of the route is an inherent asset rather than an investment, and the low ticket price reflects public-service compensation.

6. Discussion

6.1. Principal Findings

This research assessed whether, and through which mechanisms, the perceived quality and safety of railway infrastructure are related to the sustainable behavioural intentions of rail travellers in Montenegro and to their perception of the railway's contribution to destination development. Four principal findings emerge.

First, infrastructure quality is the root of the hypothesised chain. It is the dominant antecedent of perceived safety, a direct antecedent of satisfaction and of the perceived sustainability contribution of rail, and—although it has no direct link to intentions—its total effect on sustainable behavioural intentions (0.45), estimated within the latent model, is of the same order as that of perceived safety (0.42). This extends the transport–tourism nexus literature [1,5], which has typically treated infrastructure as an aggregate stock in econometric models, by showing at the individual level how the physical condition of track, stations and rolling stock is associated, through perceived safety and satisfaction, with destination-relevant intentions. It also corroborates the engineering literature's observation that the state of the permanent way determines ride quality, permitted speed and disruption risk [121–123], and adds that these outcomes are legible to lay passengers, who read them as cues for safety.

Second, perceived safety matters both as a component of satisfaction and, independently, as a condition for future rail use. The direct effect of safety on intentions, over and above satisfaction, is consistent with the risk-perception literature in tourism [145,147,150] and with Slovic's insight that dread and catastrophic potential shape lay risk judgements [142]. In a network whose worst accident is still within living memory [21], the finding that safety is rated moderately high (M = 4.84) and that technical safety and per-

sonal security fall in the "keep up the good work" quadrant is encouraging, and suggests that the rehabilitation programme of the past two decades [19] has been noticed by users.

Third, reliability—punctuality, frequency, journey time and connections—is the single strongest driver of satisfaction and the attribute cluster with the largest importance–performance gaps. This replicates the consensus of the public transport quality literature [104,106,109,114] and the "quality paradox" that improvements in supply are judged against rising expectations [120]; it also confirms, for an interregional railway, the finding of the tourism–public transport literature that frequency, information and integration are the attributes to which visitors are most sensitive [38,62,167]. On a single-track mountain line with permitted speeds of about 70 km/h, journey times of roughly three hours between Bar and Bijelo Polje and a handful of daily services, reliability is bounded by infrastructure and fleet; the structural and the IPA results together therefore point to the same conclusion, namely that track renewal and rolling-stock replacement are not only safety measures but also the main levers of satisfaction.

Fourth, tourists themselves perceive the railway as an instrument of sustainable destination development—this construct received the highest mean rating of all—and that perception feeds into their intentions to use rail again, to visit the north and to accept a price premium for low-carbon transport. The mediation results show that this perception is not free-floating: it is associated with good infrastructure and with satisfying journeys. The multigroup analysis adds nuance by revealing that regional visitors, who account for the largest share of both overnight stays and cross-border rail traffic [15], respond primarily to satisfaction, while other international visitors respond primarily to safety; because metric and scalar invariance were established and the comparison rests on unstandardised coefficients, this contrast reflects a genuine difference in the weight of the two predictors rather than a measurement artefact or a difference in construct variances. The tourism literature would attribute such a contrast to familiarity, since unfamiliar and first-time visitors are known to weigh risk more heavily [146,151]; in this sample, however, origin was unrelated to visit history and first-time and repeat visitors did not differ in any path (Section 5.6), so the contrast is better understood as a market-of-origin effect: visitors from Serbia and the neighbouring economies use the Belgrade–Bar line as ordinary transport and judge it by the journey, whereas visitors from more distant markets approach an unfamiliar railway system through the lens of safety. Either way, the result has direct implications for how the railway should be communicated to different markets.

6.2. Managerial and Policy Implications

For the infrastructure manager and the passenger operator, the IPA provides an immediate prioritisation: track condition, punctuality and journey time are the attributes on which investment will yield the largest gains in satisfaction and, through it, in intentions. This aligns with the sequencing of the Vrbnica–Bar rehabilitation—superstructure renewal to restore design speeds, followed by signalling and telecommunications—and with the fleet-renewal contract of May 2026, which will deliver new electric multiple units designed for reliable cross-border operation with the Serbian fleet [19,28,29]. The results also warn against treating the "low priority" quadrant literally: station facilities, information and digital ticketing and intermodal connections—the last of which belongs in the priority quadrant under any reasonable cross-hair rule (Section 5.7)—have very low performance scores, are inexpensive to improve relative to civil works, and are precisely the attributes to which tourists, as opposed to residents, are most sensitive [38,62,167,168]. Integrated ticketing with coastal buses and with the airports at Podgorica and Tivat, real-time passenger information in English and in the languages of the main source markets—at present provided systematically only in Montenegrin and, on the international trains, in English

(Section 3)—and step-free access at Bar, Podgorica and Bijelo Polje stations are therefore low-cost complements to the capital programme. Regulation (EU) 2021/782 on rail passengers' rights, whose transposition the European Commission has requested [176,204], would in addition give visitors enforceable guarantees on information, assistance and compensation for delays—an institutional contribution to perceived reliability.

For destination management, the finding that safety dominates the intentions of non-regional international visitors implies that the safety improvements achieved since 2006 must be communicated, not merely delivered. Independent safety certification under the newly established Railway Agency, whose competences as national safety authority under the 2025 Law on Railway Safety and Interoperability mirror those required by the EU acquis [26,134,136], and visible cues such as modern rolling stock, well-lit stations and multilingual safety information are likely to be more persuasive to these markets than tariff incentives. For regional visitors, the emphasis should be on the quality of the journey itself—comfort, catering, punctuality—since satisfaction is what converts them into repeat rail users. The strong endorsement of the railway's sustainability role suggests, moreover, that the line can be marketed as a product in its own right, in the manner of scenic and heritage railways elsewhere [35,36,70], with the Morača canyon, the Mala Rijeka viaduct and the ascent to Kolašin as attractions that combine the "slow travel" appeal [68] with access to the national parks of the north. Such positioning would serve the strategic objectives of demand dispersal and season extension set out in the national tourism and sustainable-development strategies [17,18] and would draw on the same logic that has been applied to alternative destination products elsewhere in the region [73,205].

For national policy, the results support the case for maintaining railway rehabilitation among the long-term priorities of national reforms and investment strategies [41] and for turning the formal alignment with the Railway Safety and Interoperability Directives achieved through the laws of 2025 and the Railway Agency of 2026 into an operational reality—staffing, safety certification of operators and infrastructure, and accident investigation capacity—since the 2025 Commission report had identified precisely these as the outstanding closing benchmarks in transport policy [26,27,134,135,176]. Beyond compliance, the potential sustainability dividend is clear in principle, although this study measures intentions rather than realised behaviour: every tourist who shifts from car to rail on the coast–north axis would reduce emissions and congestion on the Adriatic road and on the Bar–Boljare motorway corridor, and the geographic and seasonal redistribution of visitors that the railway could enable is the most direct available response to the concentration of 92.6% of overnight stays on the coast [15,94,95]. Whether stated intentions translate into modal shift and dispersal is an empirical question that only monitoring can answer. Monitoring of rail-tourist volumes, satisfaction and safety perceptions could be institutionalised through the sustainable transport indicator frameworks recommended in the literature [92] and through the harmonised passenger statistics of the UIC and Eurostat [23,206], in line with OECD guidance on evidence-based tourism policy [207].

6.3. Limitations

The cross-sectional design permits a test of whether the data are consistent with a theoretically grounded ordering of the constructs, but it cannot establish temporal precedence or causal mediation: satisfaction may colour the evaluation of quality and safety as much as the reverse, equivalent models can reproduce the same covariances, and unobserved respondent characteristics or shared response tendencies may influence several constructs at once; the hypotheses should therefore be read as directional associations and the mediation results as decompositions of those associations rather than as demonstrated causal processes. The design also does not permit the observation of change over time;

a panel or repeated cross-section spanning the completion of the current rehabilitation phase and the entry into service of the new fleet would allow the "quality paradox" [120] to be tested directly. The survey covered the summer season only, and rail travellers only; non-users—tourists who chose car or bus, or who did not visit the north at all—may hold systematically different perceptions of railway safety and quality, and their inclusion would be necessary to estimate the modal-shift potential of investment. The constructs are perceptual; linking them to objective measures of track quality, delay minutes and safety indicators, in the manner of the subjective–objective methodology of Eboli and Mazzulla [106], would strengthen the managerial inferences. The multigroup analysis compared two broad groups; although configural, metric and scalar invariance were established, residual (strict) invariance and the invariance of the structural covariances were not tested [182,184], and finer segmentation by market and by prior rail experience is warranted. Visitor origin, moreover, bundles several characteristics—familiarity, cultural and linguistic proximity, trip purpose and expectations—and the survey measured only visit history, not prior experience of the Montenegrin railway, so that the market-of-origin interpretation offered in Section 6.1 should be tested with direct measures of familiarity. Domestic tourists ($n = 76$) were too few to be included in the multigroup analysis as a separate group, so the moderating role of origin was tested only for the regional–international contrast; although the pooled estimates proved robust to the exclusion of this group (Section 5.4) and its construct means did not differ from those of the other groups (Section 5.2), the structural weights of safety and satisfaction among domestic tourists—who are the most familiar with the network—remain untested and may differ from both of the patterns identified here. The systematic intercept procedure, while limiting enumerator discretion, favoured passengers with longer dwell times at stations, covered only the summer season, the main line and rail users, and relied on three language versions, so that visitors who do not read Montenegrin, English or Russian were less likely to participate (Section 4.4); the sample is therefore best read as representative of summer rail travellers on the Vrbnica–Bar line rather than of all visitors to Montenegro. Finally, although the single-factor and unmeasured-method-construct tests give no indication that common method variance drives the results, all data are self-reported and no statistical remedy can rule it out completely; moreover, the outcome variables are stated intentions, not observed modal choice, visitor dispersal, emissions or destination outcomes, and the well-documented gap between intention and behaviour applies. Replication with alternative estimators such as PLS-SEM [189], with objective behavioural data and, ideally, with a longitudinal design would be valuable. Because the data were collected shortly before the new Law on Railway Safety and Interoperability and the Railway Agency took effect, a repeat survey after the new safety regime has been operating for two or three seasons would allow a before–after assessment of whether institutional change is reflected in tourists' safety perceptions.

6.4. Future Research

Future research could extend the model to residents of the northern municipalities, whose support is critical to sustainable tourism [99,100]; compare the perceptions of rail users with those of non-users travelling by car or coach, following the users-versus-non-users designs of the tourism–public transport literature [61,169], in order to estimate the modal-shift potential of investment; include domestic tourists as a third group once a sufficient sample is available; test experimentally whether multilingual information and integrated ticketing change the evaluations of international visitors; and apply comparable designs to other Western Balkan railways where accession-driven modernisation and tourism dispersal objectives coincide [75,208].

7. Conclusions

Railway infrastructure is often discussed in Montenegro as a matter of freight logistics for the Port of Bar or of EU-accession compliance. This study shows that it is also a matter of tourism sustainability. Using a structural model estimated on a cross-sectional survey of 487 rail travellers, it shows that the perceived quality of track, stations and rolling stock is associated—through perceived safety and satisfaction, in a pattern consistent with the hypothesised chain—with the intentions of tourists to travel by rail again, to visit the inland and northern regions and to support low-carbon transport, and with their perception of the railway as a driver of sustainable destination development. Reliability is the strongest immediate correlate of satisfaction; safety is independently associated with intended future use—particularly among visitors from outside the region—and tourists strongly endorse the sustainability role of rail. Importance–performance analysis identifies track condition, punctuality and journey time as the priorities for investment, while pointing to inexpensive gains in information, ticketing, station facilities and intermodal integration. The practical message for the infrastructure manager, the operator, the national tourism organisation and the Government is that the rehabilitation of the Vrbnica–Bar line and the renewal of the passenger fleet should be planned, financed and communicated as a tourism-development programme, not only as a transport project; and that closing the benchmarks on railway safety and interoperability in the EU accession process would deliver a benefit measurable in the behaviour of the very visitors on whom the Montenegrin economy depends.

Three contributions follow from these findings. Theoretically, the study separates infrastructure quality from service reliability and from accessibility and shows that each has a distinct route to intentions: infrastructure quality works through perceived safety and satisfaction, reliability through satisfaction alone, and accessibility only weakly and indirectly. It also shows that perceived safety and the perceived sustainability contribution of rail are partially independent predictors of sustainable behavioural intentions rather than mere facets of satisfaction, and that the balance between them shifts with market of origin—a moderating effect that the measurement-invariance tests and the comparison of unstandardised coefficients allow us to interpret as substantive, although not as an effect of familiarity. In doing so, the paper moves the rail–tourism debate from the high-speed corridors of large economies, where most of the evidence has been produced, to the conventional, single-track mountain railway of a small transition economy—a setting that is far more common across the Western Balkans, Eastern Europe and other peripheral regions than the high-speed cases that dominate the literature—and it brings the perspective of the tourism–public transport literature, hitherto focused on urban and rural bus, tram and metro systems, to an interregional railway.

Empirically, the study provides the first quantitative evidence on how rail travellers in Montenegro perceive the quality, safety and sustainability role of the railway, collected in the last season before the new Law on Railway Safety and Interoperability and the Railway Agency took effect. The dataset therefore establishes a baseline against which the effects of the new institutional framework, of the rehabilitation of the Vrbnica–Bar line and of the new fleet can be measured. Methodologically, the combination of a structural model with an importance–performance analysis, together with the checks on cross-hair sensitivity, construct dimensionality, measurement invariance, direct-path tests of mediation and the robustness of the pooled estimates to the composition of the sample, offers a transferable template for destinations that wish to evaluate transport investment from the user's perspective rather than from engineering or accounting indicators alone.

In practical terms, the results order the agenda. The physical rehabilitation of the Vrbnica–Bar line—track renewal, structures and signalling—remains the first priority, because it is at once a safety measure, the main lever of satisfaction and the precondition for

shorter journey times. The second priority is reliability in the narrow sense—punctuality, frequency and connections—which the new fleet will improve only if timetable planning and intermodal coordination improve with it. The third is communication: for visitors from outside the region, who condition their future use of rail on perceived safety, the achievements of the past two decades and the new institutional safeguards must be made visible through modern rolling stock, well-maintained stations and multilingual information, which at present is provided systematically only in Montenegrin and English. The fourth is inexpensive but neglected: passenger information, digital ticketing, station facilities and connections with buses and airports score lowest of all twelve attributes and can be improved within a single season. Taken together, these priorities turn a transport project into a tourism-development programme that addresses the central sustainability problem of Montenegrin tourism—the concentration of more than nine out of ten overnight stays on a narrow coastal strip in a few summer months.

Finally, the findings carry a message beyond Montenegro. Across the Western Balkans and the wider European periphery, legacy railways are being rehabilitated with EU and international finance primarily to meet freight, connectivity and accession benchmarks. This study shows that the same investments are reflected in how visitors evaluate a destination and in their stated willingness to reward a safe and reliable railway with repeat use, with visits to less-developed regions and with a premium for low-carbon travel. Measuring those perceptions before, during and after rehabilitation—as this paper has begun to do—would allow governments and funders to count the tourism dividend of railway investment alongside its transport benefits.

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Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

AC	Rail-based accessibility
AIC/BIC	Akaike/Bayesian information criterion
ANOVA	Analysis of variance
AVE	Average variance extracted
CB-SEM	Covariance-based structural equation modelling
CFA	Confirmatory factor analysis
CFI	Comparative fit index

CI	Confidence interval
CR	Composite reliability
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
ERTMS	European Rail Traffic Management System
GFI	Goodness-of-fit index
HSR	High-speed rail
IPA	Importance–performance analysis; also Instrument for Pre-Accession Assistance (EU funding)
IQ	Perceived railway infrastructure quality
PLS-SEM	Partial least squares structural equation modelling
PS	Perceived safety
RMSEA	Root mean square error of approximation
SAT	Satisfaction with the rail experience
SBI	Sustainable tourism behavioural intentions
SDP	Perceived contribution of rail to sustainable destination development
SEM	Structural equation modelling
SR	Service reliability
SRMR	Standardised root mean square residual
TEN-T	Trans-European Transport Network
TLI	Tucker–Lewis index
WBIF	Western Balkans Investment Framework
ŽICG	Željeznička infrastruktura Crne Gore (infrastructure manager)
ŽPCG	Železnički prevoz Crne Gore (passenger operator)

Appendix A. Measurement Items

Table A1. Constructs, items and sources.

Construct	Code	Item (7-Point Likert Scale)	Adapted From
Infrastructure quality	IQ1	The tracks provide a smooth and comfortable ride.	[112,114]
	IQ2	Stations and platforms are in good physical condition.	[113,115]
	IQ3	Trains (coaches and locomotives) are in good technical condition.	[106]
	IQ4	Coaches are clean and comfortable.	[102,105]
	IQ5	Passenger information systems (displays, announcements) work well.	[110,112]
Perceived safety	PS1	I felt safe on board the train.	[145,148]
	PS2	I trust the technical safety of trains and tracks in Montenegro.	[142,147]
	PS3	I felt personally secure at stations and on board.	[113,148]
	PS4	Safety and emergency information on board was adequate.	[112]
Service reliability	SR1	Trains departed and arrived on time.	[106,107]
	SR2	The frequency of trains was adequate for my needs.	[108,109]
	SR3	The journey time was acceptable.	[109,116]
	SR4	Connections with other trains and buses were reliable.	[38,113]
Rail-based accessibility	AC1	The railway made the places I wanted to visit easy to reach.	[49,62]
	AC2	The railway is a good way to travel between the coast, the capital and the north.	[61]
	AC3	The railway is well integrated with buses, airports and the Port of Bar.	[63,112]
Satisfaction with the rail experience	SAT1	Overall, I am satisfied with my rail travel in Montenegro.	[129,132]
	SAT2	The rail journey met my expectations.	[129,131]
	SAT3	Travelling by train in Montenegro was a pleasant experience.	[133]
	SAT4	Compared with other modes, rail was a good choice.	[103]
Perceived contribution to sustainable destination development	SDP1	Rail travel reduces road congestion and pollution at the coast.	[84,88]
	SDP2	The railway helps tourism development in the north of Montenegro.	[5,17]
	SDP3	The railway helps spread tourism across the year.	[58,97]
	SDP4	The railway helps preserve Montenegro's landscapes and environment.	[68,159]
Sustainable tourism behavioural intentions	SBI1	I intend to travel by train again in Montenegro.	[132,155]
	SBI2	I would recommend rail travel in Montenegro to others.	[130,155]
	SBI3	I would choose rail over car for trips within Montenegro.	[109,157]
	SBI4	I intend to visit inland or northern destinations reachable by rail.	[156,158]
	SBI5	I would be willing to pay more for low-carbon transport.	[155,159]

Table A2. Discriminant validity: square root of the AVE (diagonal, bold), latent correlations from the CFA (below the diagonal) and HTMT ratios (above the diagonal, italics).

Construct	IQ	PS	SR	AC	SAT	SDP	SBI
IQ	**0.760**	*0.583*	*0.430*	*0.501*	*0.643*	*0.491*	*0.559*
PS	0.583	**0.803**	*0.219*	*0.253*	*0.550*	*0.328*	*0.590*
SR	0.431	0.227	**0.803**	*0.453*	*0.547*	*0.291*	*0.336*
AC	0.499	0.258	0.447	**0.784**	*0.500*	*0.329*	*0.319*
SAT	0.648	0.552	0.550	0.498	**0.803**	*0.506*	*0.696*
SDP	0.489	0.327	0.286	0.326	0.500	**0.790**	*0.544*
SBI	0.559	0.589	0.345	0.320	0.694	0.540	**0.786**

Note: Fornell–Larcker criterion satisfied for every pair (diagonal element larger than any correlation in its row and column); all HTMT ratios below 0.85 [196,198].

Table A3. Alternative measurement models (maximum likelihood, $n = 487$).

Model	χ^2 (df)	CFI	RMSEA	SRMR	$\Delta\chi^2$ (Δdf) vs. M0	Split-Factor r
M0 Seven factors (hypothesised)	391.10 (356)	0.996	0.014	0.028	–	–
M1 One general factor	3695.10 (377)	0.583	0.135	0.114	3304.00 (21); $p < 0.001$	–
M2 Eight factors: PS split into technical safety (PS1–PS2) and personal security (PS3–PS4)	381.98 (349)	0.996	0.014	0.027	9.13 (7); $p = 0.24$	1.04
M3 Eight factors: IQ split into physical assets (IQ1–IQ3) and amenities/information (IQ4–IQ5)	385.31 (349)	0.995	0.015	0.028	5.79 (7); $p = 0.56$	0.99
M4 Eight factors: SBI split into reuse/recommendation/modal preference (SBI1–SBI3) and dispersal/willingness to pay (SBI4–SBI5)	381.75 (349)	0.996	0.014	0.027	9.36 (7); $p = 0.23$	1.02
M5 Three factors: all evaluative items (IQ, PS, SR, AC, SAT) on one factor, SDP, SBI	2553.88 (374)	0.726	0.110	0.095	2162.78 (18); $p < 0.001$	–
M6 Six factors: SR and AC merged	850.31 (362)	0.939	0.053	0.062	459.21 (6); $p < 0.001$	–

Note: Models M2–M4 add parameters relative to M0 (negative Δdf), so the test asks whether splitting a construct improves fit; a split-factor correlation close to or above 1 indicates that the two facets are empirically indistinguishable. Models M1, M5 and M6 remove parameters, so the test asks whether merging constructs worsens fit.

Appendix B. Model Syntax and Estimation Settings

Models were estimated with semopy 2.3.11 [200] in Python 3.13 by maximum likelihood (objective MLW, default optimiser), with the first indicator of each construct fixed to 1. The measurement model (CFA) consists of the seven measurement equations below with all factor covariances free; the structural model replaces the free covariances among the endogenous constructs with the regression equations listed. Bootstrap resamples (5000, with replacement, $n = 487$) re-estimated the complete structural model; the ULMC, the measurement-invariance models and the two-group structural model with equality constraints were estimated with the same maximum-likelihood fit function implemented in NumPy/SciPy and verified to reproduce the semopy solution for the pooled sample.

```
IQ =~ IQ1 + IQ2 + IQ3 + IQ4 + IQ5
PS =~ PS1 + PS2 + PS3 + PS4
SR =~ SR1 + SR2 + SR3 + SR4
```

AC =~ AC1 + AC2 + AC3
SAT =~ SAT1 + SAT2 + SAT3 + SAT4
SDP =~ SDP1 + SDP2 + SDP3 + SDP4
SBI =~ SBI1 + SBI2 + SBI3 + SBI4 + SBI5
PS ~ IQ
SAT ~ IQ + PS + SR + AC
SDP ~ IQ + SAT
SBI ~ SAT + PS + SDP
IQ ~~ SR
IQ ~~ AC
SR ~~ AC
Augmented model (Section 5.4): SBI ~ SAT + PS + SDP + IQ + SR + AC
ULMC (Section 5.2): CMV =~ a*IQ1 + a*IQ2 + ... + a*SBI5; CMV ~~ 0*IQ, 0*PS, 0*SR, 0*AC, 0*SAT, 0*SDP, 0*SBI

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