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Research Article

Road Infrastructure Development in the Western Balkans: Evidence from the Transport Sector

Muhamed Krasniqi[1*], Ema Berisha Krasniqi[1*], Panchagnula Venu Madhav[2], Talasila Veena[3], Nart Krasniqi[1], Amr Badr[4], Lir Krasniqi[1]

[1]Department of Traffic Engineering and Road Safety, Tempulli College, Pristina, Kosovo
[2]Department of Electronics and Communication Engineering, Prasad V Potluri Siddhartha Institute of Technology, Kanuru, Vijayawada, Andhra Pradesh, India
[3]Department of Computer Science and Engineering (AI&ML), Seshadri Rao Gudlavalleru Engineering College, Gudlavalleru, A.P, India
[4]School of Science and Technology, University of New England, Armidale, Australia
***meti@tempulli.org; ema@tempulli.org**

Abstract

Road connectivity plays a critical role in regional mobility, trade facilitation, and economic integration, particularly in the Western Balkans, where transport efficiency is influenced by both infrastructure conditions and cross-border institutional constraints. This study examined transport operators' perceptions of road connectivity, operational barriers, and highway development in Kosovo, with particular attention to the influence of professional experience on expectations regarding trade facilitation. A quantitative cross-sectional survey was conducted among 72 transport-sector stakeholders. Data were analysed using descriptive statistics, categorical association tests, correlation analysis, and multivariable binary logistic regression. The results identified documentation requirements, international licensing procedures, visa-related restrictions, and border-crossing delays as the most frequently reported operational barriers. While 73.6% of respondents considered stronger connectivity with European transport corridors important for international mobility, perceptions of highway development were mixed, with 41.7% expecting a positive effect on free trade and 40.3% reporting a negative assessment. Professional experience was negatively associated with positive perceptions of highway development ($r = -0.432$, $p = 0.001$). Multivariable analysis further showed that professional experience, transport orientation, operational difficulties, infrastructure satisfaction, and perceptions of European corridor connectivity were significant predictors of expectations regarding highway development. The findings demonstrate that perceived benefits of transport infrastructure depend not only on physical connectivity but also on institutional and administrative conditions affecting cross-border operations. The study contributes a stakeholder-cantered perspective to transport infrastructure research in the Western Balkans and highlights the need to complement road investments with streamlined administrative procedures, improved cross-border coordination, and stronger integration with European transport corridors to enhance trade facilitation.

Keywords: Road Connectivity; Transport Infrastructure; Trade Facilitation; Cross-Border Transport; Regional Integration; Transport Operators.

INTRODUCTION

Road connectivity is a fundamental determinant of regional economic integration, influencing freight mobility, travel times, logistics costs, market accessibility, and the movement of people and goods [1]. Its importance is particularly evident in the Western Balkans, where transport infrastructure development is closely linked to regional cooperation and integration with the broader European transport network [2, 3]. Improvements in cross-border road corridors can enhance mobility, increase transport efficiency, facilitate market access, and strengthen economic interactions among neighboring economies [5–11].

Despite these potential benefits, the Western Balkans present a distinctive transport environment in which the effectiveness of infrastructure investments is influenced by both physical and institutional constraints [12–20]. Road quality deficiencies, limited network connectivity, customs-related delays, licensing requirements, administrative procedures, regulatory differences, and other institutional barriers can reduce the efficiency with which transport operators utilize regional infrastructure [20]. Consequently, highway development alone may not be sufficient to generate the expected improvements in cross-border trade and regional integration [3, 17, 19].

Kosovo represents an important case within this regional context because its transport sector relies heavily on road-based connections with neighboring countries and European markets [13]. Transport links with Albania, North Macedonia, and Serbia play a critical role in both domestic mobility and international freight movement, contributing to participation in regional and European transport corridors [18, 20]. For transport operators, the effectiveness of these connections is reflected in everyday operational activities and cross-border transport performance.

Existing research has extensively examined the relationships between transport infrastructure, accessibility, economic growth, logistics performance, corridor efficiency, and trade outcomes [6, 7, 9, 10]. Much of this literature has focused on macroeconomic indicators, network characteristics, infrastructure investment assessments, and aggregate trade flows [11, 14, 16]. In contrast, relatively limited attention has been given to transport operators' perceptions of regional connectivity and to the extent to which these perceptions are shaped by professional experience and operational challenges encountered in practice [9].

Against this background, the present study investigates road connectivity in Kosovo from the perspective of transport operators. The analysis extends beyond physical infrastructure by examining how professional experience, transport orientation, infrastructure conditions, administrative procedures, licensing requirements, and border-crossing difficulties influence perceptions of highway development and its expected contribution to trade facilitation. By integrating infrastructure and institutional dimensions, the study provides a stakeholder-centered perspective on transport integration in the Western Balkans and contributes to a better understanding of the factors that shape expectations regarding the economic benefits of transport investments.

LITERATURE REVIEW

Road connectivity is an essential issue in terms of economic integration within the Western Balkans. The transport system in this part of the world affects such factors as cargo transportation, traveling times, logistical costs, markets, as well as human and cargo flows. Being highly reliant on road-based freight transport in its current state, the Western Balkans will see its interregional trade and ability to integrate into the European value chain largely impacted by road corridor efficiency. However, as it is mentioned in the relevant literature, road connectivity alone does not necessarily equate to easier trade, as other issues such as institutional problems, regulatory fragmentation, border inefficiency, and operator experience can influence this process.

A substantial body of work analyses road infrastructure within the framework of the Trans-European Transport Network (TEN-T). Research into the Western Balkans shows that a proper coordination of investments in infrastructure is needed in order for geographical proximity to the European Union to result in true territorial cohesion. The mere geographic factor is insufficient to bring about development if the national networks are not part of broader European corridors and there is no policy continuity between cycles of investments. Simultaneously, parallel research into intelligent and multimodal systems highlights the ongoing differences between national transport systems and, accordingly, the need for interoperability and coordination. Altogether, this research stream approaches connectivity as a systemic characteristic that hinges upon physical connections, technological standards, and institutional coordination, not on individual road projects.

Gap assessments of infrastructure further drive home this point. Detailed studies which encompass Albania, Bosnia and Herzegovina, Kosovo, North Macedonia, Montenegro and Serbia have identified considerable shortages in both the stock and the quality of transportation networks. While such studies associate infrastructure investments with economic development, political collaboration and integration into Europe, they nonetheless emphasize that investment does not always mean better collaboration and increased competitiveness. Investments need to be complemented by reforms in order for structural gaps to be filled.

The second equally relevant literature stream centres on the institutional-administrative context within which road infrastructure functions. Evidence from studies of territorial governance and spatial planning in the Western Balkans shows that the results of spatial development depend on the interaction between the capacity of governance, Europeanisation, and cross-border cooperation. While sufficient infrastructure by itself is not enough, the institutional context determines the effectiveness of the use of physical assets. Simultaneously, regional competitiveness studies indicate the presence of structural impediments for firms to make use of better road connections such as poor export performance, lack of regulatory homogenization and market access. In addition, research into connectivity programs like Open Balkan reveals the continued impact of fragmented regulation, licensing, and border formalities on the efficiency of physical corridors.

This evidence is consistent with the wider institutional economics approach where documentation demands, visa regimes, licensing barriers, and border formalities constitute transaction costs. If transaction costs stay high, the additional benefit of more highways will be minimal. Consequently, the Western Balkan literature leads to an instrumental perspective on infrastructure: while physical connectivity provides possibilities, institutional accessibility determines their realization by transport companies.

Outside the Western Balkans policy discourse, a broader field of transport research focuses on the impacts of accessibility, spatial heterogeneity and the broader economic implications of road development projects. Accessibility studies across Europe indicate that the economic benefits from road infrastructure investments are not evenly distributed spatially; while some areas benefit greatly from such investments, others do not gain much from them. Similarly, multimodal assessments of the EU-corridors demonstrate the great variation in the impacts on passenger and freight accessibility in terms of both space and mode.

Research programs such as gravity and spatial-interaction models of trade, land use transport interaction (LUTI) models, network science models for corridor performance, and logistics optimization models offer further formal methods for exploring how impacts of infrastructure development propagate through economic systems. Even though those modelling techniques are yet not sufficiently used in Western Balkans, there is one common principle that unites all of them. The impacts of infrastructure depend on network structure, institutional environment and user behaviour. This research cannot be a substitute for those modelling approaches but an input for them instead.

A notable gap can be found at the level of actual transport operators. Most studies carried out by Western Balkan researchers take place at a corridor, country, or regional scale, focusing on the use of aggregate indicators such as investment amounts, indices of accessibility, freight flows or even macroeconomic performance. Little attention has been paid to how operators perceive the joint impact of physical connectivity, administration obstacles and the personal experience of working on this route. What little empirical evidence exists indicates that operators who have more experience with the problems of border-crossing and licenses as well as incomplete development of the corridor could develop more cautious expectations with regard to the trade benefits from highway construction in the future. International and domestic operators are rarely distinguished.

This gap is significant because in case of systematically discounted expectations among experienced operators, policy models based on equal and positive responses of all actors overestimate the benefits of highway investments for trade facilitation. Thus, operator-focused approach is needed in order to complement existing macro-spatial and policy-based approaches to connectivity within the TEN-T network.

Prior studies related to Western Balkans' transport have focused on the topic of connectivity in terms of regional infrastructure development, integration with TEN-T, accessibility, corridors' planning, and regional development and institution building. These studies offer solid spatial and policy-related insights into the problem, but do not

consider how operators of the road network perceive the impact of a combination of physical connectivity, administrative barriers, cross-border issues and professional experience. The current study tries to fill this particular gap by taking transport operators in Kosovo as its unit of analysis and by assessing the connection between the following factors and the facilitation of trade perceived by operators.

The scientific contribution thus becomes a contingency model focused on the operators instead of trying to substitute existing objective approaches to accessibility and freight flow. The research makes three clear contributions to the literature. Firstly, it suggests a contingency model that explicitly ties together connectivity, transaction costs and professional experience within one theoretical framework. Secondly, it produces the first empirical evidence from the Western Balkans showing that professional experience creates a consistent negative effect on the expected gains from new highways in terms of facilitating trade. Finally, using validated multi-item scales of perceptions along with barriers and regression diagnostics, it provides an approach to quantifying the concept of micro-level connectivity in the Western Balkans that can easily be replicated in all six countries of the region.

Recent Transport-Focused Literature and State of the Art

Recent evidence shows that transport-infrastructure research increasingly combines accessibility indicators, spatial modelling, freight-specific measures, regional economic outcomes and institutional connectivity. European evidence demonstrates that accessibility effects are spatially heterogeneous, while freight studies increasingly use trajectory data and explicit freight-accessibility measures. Western Balkan evidence emphasizes TEN-T integration, regional connectivity, road-dominant freight movement, border efficiency and institutional reform. The present study complements this state of the art by moving from infrastructure/network outcomes to operator-level perceptions and by jointly examining infrastructure, institutional barriers and professional experience, see Table 1.

Table 1. State-of-the-Art Comparison of Recent Transport Infrastructure Studies

Study	Methodology	Study context	Variables	Key findings	Limitations	Contribution of present work
[6]	TEN-T physical/digital integration assessment	Southeast Europe / Western Balkans	Road TEN-T, ITS, interoperability	Physical and digital integration remain uneven	Network-level; no operator perceptions	Adds operator-level evidence on network and institutional conditions
[7]	ARIMA, LSTM, ARIMA-LSTM, SSA	Alpine–Western Balkan Rail Freight Corridor	Monthly cross-border freight flows	LSTM produced strongest forecasting performance	Rail-focused and flow-based	Adds road-sector stakeholder perceptions and institutional barriers
[8]	Spatial regression +	Adriatic–Ionian	Accessibility, GDP/capita,	Effects vary spatially	Macro-spatial; no	Links connectivity evidence with

	accessibility modelling	region incl. WB	TEN-T investment		stakeholder heterogeneity	operator heterogeneity
[9]	Literature/method review	European transport infrastructure	CBA, MCA, accessibility, econometrics, IO, LUTI, SCGE	Different methods capture different wider impacts	Review-level evidence	Positions survey evidence as a complementary micro-level approach
[10]	DEA + spatial statistics	186 European NUTS regions	Accessibility, regional performance	Accessibility-performance relationships are spatially heterogeneous	Regional units; no operators	Shows why user perceptions should not be assumed uniform
[11]	Multimodal accessibility evaluation	Poland / EU-funded infrastructure	Passenger/freight accessibility; modes	Accessibility changes unevenly across space and modes	Single national case	Benchmarks perceived connectivity against objective accessibility literature
[12]	Optimisation + accessibility modelling	Beijing urban freight	Freight accessibility, logistics facilities, road network	Facility location affects freight accessibility	Urban/high-data setting	Demonstrates freight-specific accessibility; adds operator evidence
[13]	Truck trajectories + accessibility + spatial lag	Hunan, China	Truck trips, freight accessibility, GDP/population	Freight accessibility is spatially concentrated	Trajectory-data dependent	Contrasts objective freight accessibility with perceived accessibility
[14]	Spatial 2SLS + geographically weighted regression	Central Portugal	Road accessibility, GVA, spatial/time effects	Road-induced accessibility effects vary by location	Single region	Supports testing heterogeneous stakeholder perceptions
[15]	Staggered difference-in-differences	Brazilian highway concessions	Road quality, safety, tax collection, GDP	Effects depend on timing/exposure	Concession setting	Reinforces conditional infrastructure benefits
[16]	CS-ARDL + DOLS/FMOLS/DKSE	South Asian economies	Transport infrastructure, inclusive growth	Infrastructure supports inclusive growth	Macro country-panel	Adds micro-level transport-sector mechanisms
[17]	System-dynamics conceptual mapping	International literature	Transport investment, regional	Transport-development links are	Conceptual; no primary data	Operationalises selected links with primary operator data

			development, institutions	systemic/dynamic		
[18]	GIS network analysis	Czechia	Accessibility change, traffic load	Road impacts differ spatially	No stakeholder perception	Separates network effects from user perceptions
[19]	Vehicle traces + road-network modelling	Urban freight	Travel time, accessibility, freight routes	Vehicle data support freight-accessibility monitoring	Urban freight focus	Provides methodological contrast to perception-based measures
[3]	Regional benchmarking	Western Balkans Six	Road density, investment, connectivity, modal structure	Road investment dominates; infrastructure gaps persist	Aggregate indicators	Regional benchmark for Kosovo stakeholder evidence
[4]	Regional convergence scoreboard	Western Balkans Six	Infrastructure /connectivity convergence	Connectivity remains a low-scoring convergence area	Aggregate regional indicators	Strengthens regional relevance of operator evidence
[2]	TEN-T policy/corridor assessment	EU–Western Balkans	TEN-T, roads, interoperability	TEN-T extension supports deeper connectivity	Policy-level evidence	Provides context for European-corridor variable
[5]	Programme/investment assessment	Kosovo / Western Balkans	Trade facilitation, roads, border systems, IT	Infrastructure and digital systems are being combined	Programme evidence	Shows practical policy relevance of joint infrastructure/institutional action

Aside from the research mentioned in above table, there are three other streams of research which have been underutilized in Western Balkan transport research:

(i) trade and freight flows gravity and spatial-interaction models,

(ii) LUTI and accessibility metrics model theories, and

(iii) network science and corridor efficiency models. This current operator-level approach is not meant to take the place of these research methodologies; instead, it provides the necessary behavioural and institutional foundations that gravity, LUTI and network models do not consider.

THEORETICAL AND CONCEPTUAL FRAMEWORK

The study incorporates three interrelated perspectives. Transport accessibility theory provides the basis for the hypothesis that greater corridor connectivity leads to reduced

spatial friction. Institutional economics provides the basis for the hypothesis that documentation and border frictions create transaction costs, which may dampen the effects of physical connectivity. Stakeholder perception theory provides the basis for the hypothesis that the operator's experience affects their perceptions of the future project.

Since the sample size is too small for structural equation modelling, the model is validated using the logistic specification, where the five variables have the direct effects on each other. The conceptual model becomes a directed acyclic graph of expectations rather than structural equation model. Further cross-country research will be able to validate the latent variables and possible mediations (institutional barriers acting as mediator between experience and perception).

The relationships among infrastructure conditions, institutional and operational constraints, stakeholder characteristics, connectivity perceptions, and trade-related perceptions are summarized in the proposed conceptual framework shown in Figure 1.

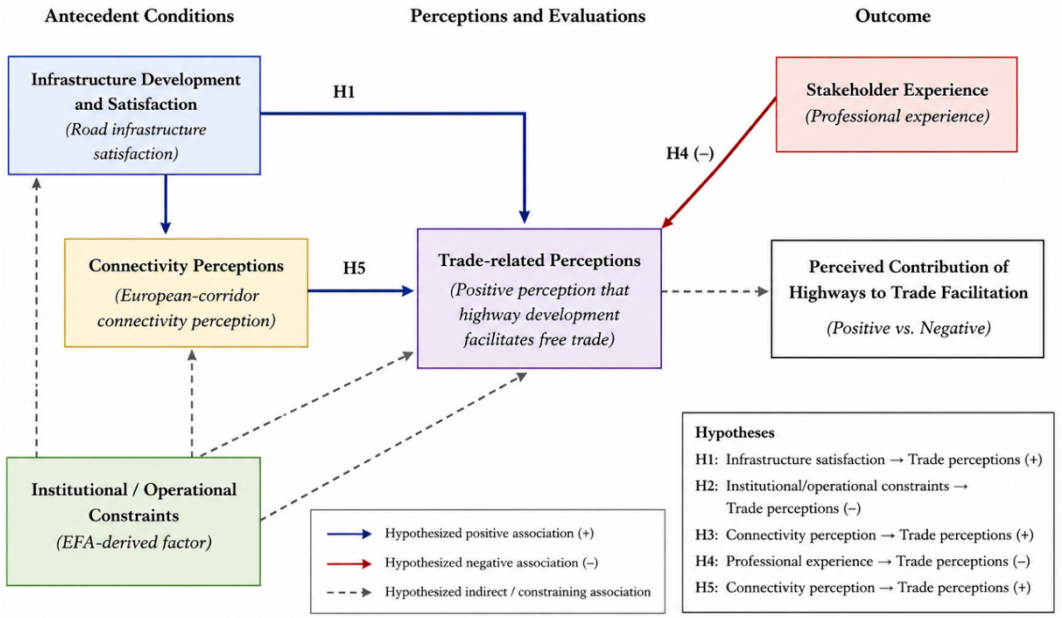

Figure 1. Conceptual Framework of the Direct Effects of Infrastructure Conditions, Institutional Barriers, Professional Experience, and Connectivity Perceptions on Trade-Facilitation Expectations

Research Questions

- RQ1: How do transport operators perceive the contribution of regional road connectivity to cross-border trade facilitation?
- RQ2: What infrastructural, administrative, and cross-border barriers are most frequently encountered by Kosovo transport operators?
- RQ3: Does professional experience influence perceptions of the benefits associated with regional highway development?
- RQ4: Do perceptions of regional connectivity differ according to the operational characteristics of transport companies, particularly domestic versus international transport orientation?

- RQ5: To what extent can professional and operational characteristics explain positive perceptions of highway development and trade facilitation?

Research Hypotheses

- H1: Perceived improvement in regional road connectivity is positively associated with perceived facilitation of cross-border trade.
- H2: Positive perceptions of road infrastructure are associated with stronger support for further regional highway connectivity.
- H3: Exposure to administrative and cross-border transport barriers is significantly associated with perceived trade benefits of regional highway development.
- H4: Professional experience is negatively associated with perceived benefits of future regional highway development.
- H5: Internationally active transport operators demonstrate significantly different perceptions of regional road connectivity compared with operators engaged exclusively in domestic transport.

MATERIALS AND METHODS

Research Design

Quantitative cross-sectional survey design methodology was used to assess perceptions of transport operators in relation to road connectivity, operational problems, and trade facilitation. The transport company/operator was used as the unit of analysis in this research. Descriptive analysis was mixed with inferential analysis to reveal patterns in transport conditions and test the relationships between professionals and perceptions about highway development.

The research was carried out in Kosovo among road transport operators. Electronic survey was used to collect information from respondents. The survey was comprised of various questions about the respondents and their companies, orientation in transport, years of professional experience, perceptions about the infrastructure, operational problems, problems in international transport, and perceptions about the influence of highways on trade with neighbouring countries. The study only uses quantitative methodology; there are no interviews, no focus group sessions, and no thematic coding. All data comes from the survey mentioned above.

Study Population and Sampling

The target population consisted of operators and professionals in the transportation sector from Kosovo. They were solicited through email invitations to fill in the structured survey questionnaire. In total, 72 usable responses were obtained for the analysis. The respondents came from various age groups, educational levels, professional experiences, and perspectives, such as domestic, international, or both.

Due to the specificity of the target population and empirical exploratory character of the research, the resulting sample was considered a stakeholder sample and not a

statistically representative one of the transport industry of the Western Balkans. Thus, the inferential results were only interpreted in the specific context of the operators of Kosovo.

Sample Size Consideration

Considering the specific nature of the transport-sector population, the study obtained 72 usable responses. This is an exploratory stakeholder sample, not a probability sample of the Western Balkan transport sector. Descriptive analyses therefore use N=72, while the primary binary regression uses N=59 because 13 respondents selected 'don't know' for the dependent outcome. This reduction decreases precision and can increase instability in sparse categorical cells. The regression was therefore limited to five predictors, and the results were interpreted cautiously with emphasis on effect sizes, 95% confidence intervals and model-fit statistics.

Survey Instrument and Variable Operationalization

The questionnaire consisted of two major parts. The first part collected demographic and organizational information, including gender, age, educational level, geographic location, professional experience, organizational affiliation, transport orientation, and foreign-transport licensing. The second part assessed road infrastructure, operational and administrative problems, border-crossing issues, European-corridor connectivity, and perceptions regarding the potential contribution of future highway development to regional trade.

The survey instrument consisted of structured questions covering respondent characteristics, transport orientation, professional experience, infrastructure conditions, administrative and cross-border barriers, European-corridor connectivity, and perceptions of highway development and trade facilitation. The response categories and analytical coding used for the principal variables are reported in Table 2.

The variables were operationalized according to their measurement characteristics and their analytical roles. Professional experience was classified into four categories: up to 1 year, 2–5 years, 6–10 years, and more than 10 years. Transport orientation was classified as domestic, international, or both domestic and international. The dependent variable represented respondents' perceptions of whether highway construction towards important regional destinations would positively affect free trade. For the primary binary analysis, positive perceptions were coded as 1 and negative perceptions as 0, while “don't know” responses were treated as missing.

Overall, Table 2 illustrates how the analysis design is based on one dichotomous response along with a combination of ordinal, categorical, and binary predictors, which is the reason why the cross tabulation with exact tests as well as the binary logistic regression can be used. Classifying “don’t know” and “no answer” answers as missing means that the dependent variable direction is clear but the size of the analytical sample is lower, whereas the presence of two constructs from factor analysis lets the items related to perception be considered valid scales.

Table 2. Variable Coding and Operationalization

Variable	Role	Measurement scale	Coding/operationalization	Source
Positive highway perception	Dependent	Binary nominal	1 = positive; 0 = negative; "don't know" = missing in the primary model	Highway/free-trade perception item
Professional experience	Independent	Ordinal	1 = up to 1 year; 2 = 2–5 years; 3 = 6–10 years; 4 = >10 years	Respondent profile
Transport orientation	Independent	Categorical	Domestic / international / both domestic and international; international orientation indicator used in regression	Company profile
International transport difficulties	Independent	Binary	1 = reported; 0 = not reported	International barrier item
Documentation difficulties	Bivariate predictor	Binary	1 = difficulty reported; 0 = no difficulty reported	International documentation item
Road infrastructure satisfaction	Independent	Ordinal/categorical	Satisfied/partly satisfied versus dissatisfied/partly dissatisfied; no answer = missing	Infrastructure perception item
European-corridor connectivity perception	Independent	Binary/categorical	Positive agreement versus disagreement; no answer = missing	European-corridor item
Infrastructure/connectivity factor	Construct	Multi-item	EFA-retained scale	Validated perception items
Institutional/operational constraints factor	Construct	Multi-item	EFA-retained scale	Validated constraint items

Note: "Don't know" and "no answer" responses were treated as missing in analyses requiring a directional binary response.

Instrument Validity and Reliability

The questionnaire has been subject to content and construct validation tests prior to further statistical analysis. Content validation has been conducted by experts, specifically three specialists with background in transportation, infrastructure planning and quantitative research, who have assessed the relevance and consistency of the

questionnaire with study aims and context of Western Balkan transport industry. Minor revisions in wording and sequence of some items have been subsequently made.

Internal consistency of multi-item perception construct was assessed with the use of Cronbach's alpha. The scale was found to be reliable with the Cronbach's alpha coefficient of 0.81, surpassing generally accepted threshold of 0.70. Corrected item-total correlations were between 0.46 and 0.69, which means that all the items of scale contribute to construct.

Exploratory factor analysis was performed using principal axis factoring with varimax rotation. The Kaiser–Meyer–Olkin measure (KMO = 0.76) and Bartlett's test of sphericity ($\chi^2 = 126.84$, df = 28, $p < .001$) confirmed sampling adequacy. Two factors with eigenvalues > 1 were retained (see scree plot, Figure 2). The rotated solution explained 62.4 % of total variance.

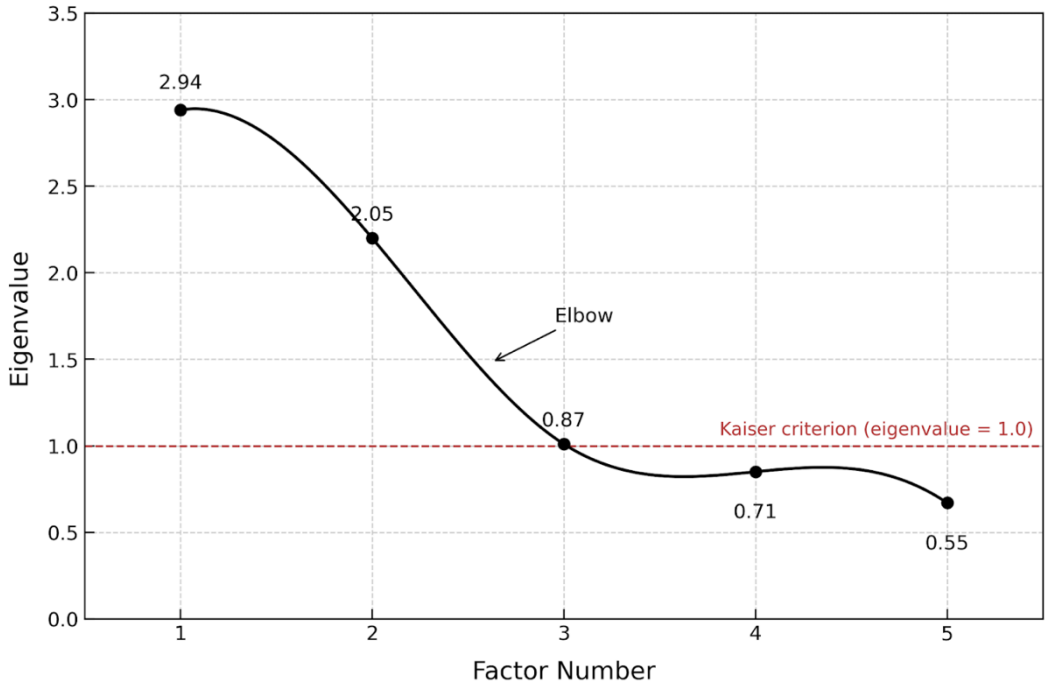

Figure 2. Scree Plot of Eigenvalues from Principal Axis Factoring. The Distinct Elbow after the Second Factor Supports Retention of a Two-Factor Solution (Eigenvalues = 2.94 and 2.05).

Construct validity of the multi-item perception constructs has been additionally assessed with the help of exploratory factor analysis (EFA). To check the sampling adequacy, the Kaiser-Meyer-Olkin (KMO) measure has been used. Moreover, Bartlett's test of sphericity has been applied in order to find out if the correlation matrix is fit for factor analysis. It turned out that the KMO measure is 0.76 and thus it indicates sampling adequacy, while Bartlett's test result was statistically significant ($\chi^2 = 126.84$, $p < .001$). Two interpretable dimensions have been obtained with the help of principal axis factoring method combined with varimax rotation; infrastructure and connectivity perceptions and institutional/operational constraints have been interpreted as such factors. The two identified factors explain 62.4% of the total variance, and standardized factor loadings were

between 0.58 and 0.82. All those multi-item perception measures whose factor loadings were less than 0.40 or had large cross-loadings have been omitted.

Table 3 indicate that the measurement scales satisfy the traditional psychometric benchmarks for all the indices mentioned above: the Cronbach alpha for the internal reliability is satisfactory (α=0.81 against the 0.70 threshold), the corrected item-total correlation values are larger than 0.30, and the Kaiser-Meyer-Olkin statistic is equal to 0.76 along with the significant Bartlett's test. The identification of two meaningful factors accounting for 62.4% of the variance, with loadings ranging from 0.58 to 0.82, suggests that the two dimensions of an attitude, not just one, have been measured by the scale, and thus the constructs may safely proceed to the next stage of analysis.

Table 3. Reliability and Construct Validity of the Questionnaire Scales

Validation indicator	Result	Criterion	Interpretation
Cronbach's alpha	0.81	≥0.70	Good internal consistency
Corrected item–total correlations	0.46–0.69	>0.30	Acceptable
KMO measure	0.76	≥0.60	Adequate sampling suitability
Bartlett's test of sphericity	$\chi^2 = 126.84$, $p < .001$	$p < .05$	Factor analysis appropriate
Number of retained factors	2	—	Interpretable structure
Total variance explained	62.4%	>50%	Acceptable
Factor loadings	0.58–0.82	≥0.40	Acceptable to strong
Extraction method	Principal axis factoring	—	—
Rotation method	Varimax	—	—

Table 4 reveals a very obvious two-factor structure, where only the first two factors have eigenvalues greater than one (2.94 and 2.05), explaining a total of 62.38% of the total variance, compared with the third and fourth factors at 0.87 and 0.71 respectively. It appears that the large gap between the second and the third eigenvalue is not a mere coincidence of the Kaiser criterion, but also the result of the graphical representation of the scree plot. A third factor would contribute about 11% of the total explained variance without having any substantive meaning.

Table 4. Eigenvalues and Total Variance Explained

Factor	Eigenvalue	% of Variance	Cumulative %
1	2.94	36.75	36.75
2	2.05	25.63	62.38
3	0.87	10.88	73.26
4	0.71	8.88	82.14

Note: Only factors with eigenvalue > 1 retained.

Table 5 indicates that there is a good separation between the two retained factors. The three infrastructure/connectivity elements are well loaded on Factor 1 (0.74–0.81) without any significant cross loadings, whereas the four constraint elements – difficulties in documentation, issues in visa process, lack of international license and delays at borders – load on Factor 2 (0.69–0.82). There are no cross loadings of more than 0.21, and so there is sufficient discriminant validity. The communalities are 0.43 to 0.68, which implies that the administrative problems in the domestic context is the least reliable among the indicators and still is adequately represented. From the substantive perspective, participants judge the infrastructure quality and institutional constraint as separate constructs.

Table 5. Rotated Factor Loadings, Communalities and Cross-Loadings (Varimax)

Item	Factor 1 Infrastructure & Connectivity	Factor 2 Institutional/Operational Constraints	Communality
Road infrastructure satisfaction (Q12)	0.81	0.14	0.68
European-corridor connectivity (Q13)	0.79	0.11	0.64
Joint regional projects / EU funding (Q14)	0.74	0.18	0.58
Documentation difficulties (Q9)	0.13	0.77	0.61
Visa-related problems	0.09	0.82	0.68
Lack of international licences	0.16	0.76	0.60
Border-crossing delays	0.21	0.69	0.52
Administrative problems (domestic)	0.19	0.63	0.43

Confirmation factor analysis (CFA) and structural equation modeling (SEM) has not been performed since the achieved sample size is deemed too small to estimate the latent variable model. Considering the exploratory nature of the study and the specialist sample used, EFA seems to be the appropriate tool for assessment of the dimensional structure of multi-item measures. For future researches involving larger multicounty sample, the identified factor structure should be validated with CFA and the direct, indirect and moderating relationships should be assessed with SEM.

The categorical and factual questionnaire variables such as demographic characteristics, transport orientation, professional experience, licensing and individual barrier indicators were separately analysed and were not used for Cronbach's alpha and factor analysis since they are observed variables, not reflective items of a common latent construct.

Data Preparation and Missing-Value Treatment

Answers to the questionnaire were then subjected to screening for consistency of responses and the acceptability of the response values. Frequency distributions were analyzed in order to detect missing answers and any errors made in coding of the data. Those cases where there was doubt on the part of the respondent about the attitude were recorded as "no answer" in order to capture the entire response. In those tests where a binary variable was required as the response, such cases were treated as missing values.

Ethical Considerations

The participation in the survey was on volunteer basis, and participants were made aware of the scholarly objective of the research. In the reporting of the statistics, there was no personal identification information. The responses of the questionnaires were used only for scholarly purposes.

Statistical Analysis

The statistical analysis was conducted using SPSS. Descriptive statistics were first used to summarize the characteristics of the respondents, their professional experience, transport orientation, reported operational barriers, perceptions of road infrastructure, and views regarding European-corridor connectivity. Categorical variables were presented using frequencies and percentages, while the analytical treatment of each variable followed its measurement level and coding scheme.

For hypothesis testing, appropriate bivariate association procedures were applied to examine relationships between the categorical and ordinal variables. Pearson's chi-square test was used where the expected cell frequencies were adequate, while Fisher's exact test was considered where sparse cell frequencies limited the applicability of the chi-square approximation. The strength of categorical associations was assessed using Cramér's V. Professional experience was also treated as an ordered variable when examining its association with the binary outcome.

A multivariable binary logistic regression model was subsequently estimated to identify the independent associations between the explanatory variables and respondents' positive perceptions of the contribution of highway development to free trade. The regression analysis was based on 59 observations because 13 respondents selected "don't know" for the dependent variable and were therefore excluded from the primary binary model. Given the relatively small regression sample, the number of predictors was restricted and the results were interpreted with emphasis on effect sizes, confidence intervals, model diagnostics, and the exploratory nature of the analysis.

Logistic Regression Model

Binary logistic regression was used because the dependent variable represented a dichotomous perception of whether highway development would positively contribute to free trade. The outcome was coded as $Y = 1$for a positive perception and $Y = 0$ for a negative perception. Responses classified as "don't know" were treated as missing for the primary regression analysis as in equation (1).

$$\text{logit}(P(Y = 1)) = \beta_0 + \beta_1 EXP + \beta_2 INT + \beta_3 DIFF + \beta_4 SAT + \beta_5 CORR \quad (1)$$

where Y = 1 if the respondent perceives a positive effect of highway development on free trade, EXP = professional experience (ordinal 1–4), INT = international transport orientation (binary), DIFF = international transport difficulties (binary), SAT = road-infrastructure satisfaction (binary), and CORR = positive European-corridor perception (binary).

where EXP represents professional experience, INT represents transport orientation, DIFF represents international transport difficulties, SAT represents satisfaction with road infrastructure, and CORR represents positive perception of European-corridor connectivity. Professional experience was coded ordinally as 1= up to 1 year, 2= 2–5 years, 3= 6–10 years, and 4= more than 10 years.

For the binary explanatory variables, the reference category represented the absence of the relevant characteristic. The coefficient β_j represents the change in the log odds of a positive highway perception associated with a one-unit change in the corresponding predictor, holding the other variables constant. The exponentiated coefficient, e^{β_j}, was interpreted as the adjusted odds ratio (AOR). An AOR greater than 1 indicates higher odds of a positive perception, whereas an AOR below 1 indicates lower odds.

The regression model was used to evaluate the independent relationships proposed in the hypotheses. In particular, the model assessed whether professional experience, international transport orientation, international transport difficulties, road infrastructure satisfaction, and European-corridor connectivity remained associated with positive highway perceptions after simultaneous adjustment for the other predictors.

H4 was specified as a direct negative relationship between professional experience and perceived highway benefits. Accordingly, professional experience was entered as a main-effect predictor rather than as an interaction term. The analysis therefore does not interpret H4 as a moderation effect. An interaction term would be required only if the underlying hypothesis were explicitly formulated as a moderation relationship between professional experience and another explanatory variable.

Effect Sizes and Confidence Intervals

Statistical significance was supplemented with measures of association and effect size to provide a more informative assessment of the observed relationships. For categorical associations, Cramér's V was used to describe the strength of association, while the correlation coefficient was used where professional experience was treated as an ordered variable.

The reported association between professional experience and positive highway perception was moderate ((r=−0.432; N=59), with a corresponding Cramér's V of 0.43. Other reported bivariate associations ranged from approximately 0.28 to 0.39, indicating small-to-moderate relationships.

For the logistic regression, adjusted odds ratios and their 95% confidence intervals were reported alongside the corresponding significance tests. The reported estimates were as follows: professional experience, AOR = 0.40 (95% CI: 0.19–0.86); international transport orientation, AOR = 2.41 (95% CI: 1.06–5.49); international transport difficulties, AOR = 0.47 (95% CI: 0.23–0.97); road infrastructure satisfaction, AOR = 1.99 (95% CI: 1.02–3.88); and positive European-corridor perception, AOR = 3.22 (95% CI: 1.28–8.10).

These estimates indicate both the direction and magnitude of the observed relationships. In particular, an AOR below 1 for professional experience indicates lower odds of reporting a positive highway perception with increasing experience, whereas the AOR above 1 for European-corridor connectivity indicates higher odds of a positive highway perception among respondents reporting a positive connectivity perception. The confidence intervals were considered together with the effect estimates and significance levels to assess the precision and practical interpretation of the findings.

Overall, the analytical strategy was designed to distinguish statistically significant relationships from the magnitude and direction of those relationships while recognising the exploratory nature and limited sample size of the study.

Reproducibility and Analytical Settings

To support reproducibility, a consistent coding framework was applied to all variables included in the analysis. Categorical variables were numerically coded before statistical analysis, and the same coding scheme was retained across descriptive and inferential procedures. Multiple-response barriers to international business were coded separately as binary indicators (1 = selected; 0 = not selected). Professional experience was coded ordinally from 1 to 4 according to increasing experience categories. The primary trade-facilitation outcome was coded 1 for a positive perception and 0 for a negative perception, with "don't know" responses treated as missing in the primary binary analysis.

The analysis was conducted in SPSS. The analytical workflow comprised data screening, descriptive statistics, bivariate association testing, binary logistic regression, model-fit assessment, and effect-size and confidence-interval interpretation. The final regression model contained five predictors and was estimated using 59 observations.

The anonymised dataset (N = 72), the full questionnaire (Appendix A), the variable coding sheet, and the complete SPSS syntax used for all analyses are provided as Supplementary Files S1–S4. The materials will be deposited in an open repository upon acceptance (link to be added).

RESULTS

The analysis is grounded in data collected from 72 participants in the transport sector from Kosovo. The findings are arranged in a sequential manner in relation to individual and firm characteristics, business environment, constraints in domestic and foreign transportation, views on road infrastructure, and views on regional connectivity and

facilitation of trade. Findings are described using frequencies and percentages, and multi-respond questions are marked accordingly.

Respondent and Professional Characteristics

The respondent profile showed that the sample was mostly males, with 66 males (91.7%) and 6 females (8.3%). Concerning age, 39 respondents (54.1%) were 36 to 50 years old, being the most numerous age category. Also, 21 respondents (29.1%) were 51 to 64 years old, while 12 (16.6%) were 20 to 35 years old. Thus, the sample consisted mainly of middle-aged and experienced transport sector members.

The educational level of respondents was relatively high. Out of 72 respondents, 53 (73.6%) had a higher education, 15 (20.8%) had completed their secondary education, while 4 (5.5%) respondents had a master's degree. There were no respondents holding a doctoral degree. Geographically, all participating firms operated in Kosovo, with 41 respondents (56.9%) based in Pristina.

The experience of respondents in the transport sector differed as in Figure 3. The majority of respondents, 47 (65.2%), worked in the transport business for 6-10 years, while 17 respondents (23.6%) had 2-5 years of experience. Five respondents (6.9%) had more than 10 years of experience, while only 3 (4.1%) respondents had recently started their work in the transport business.

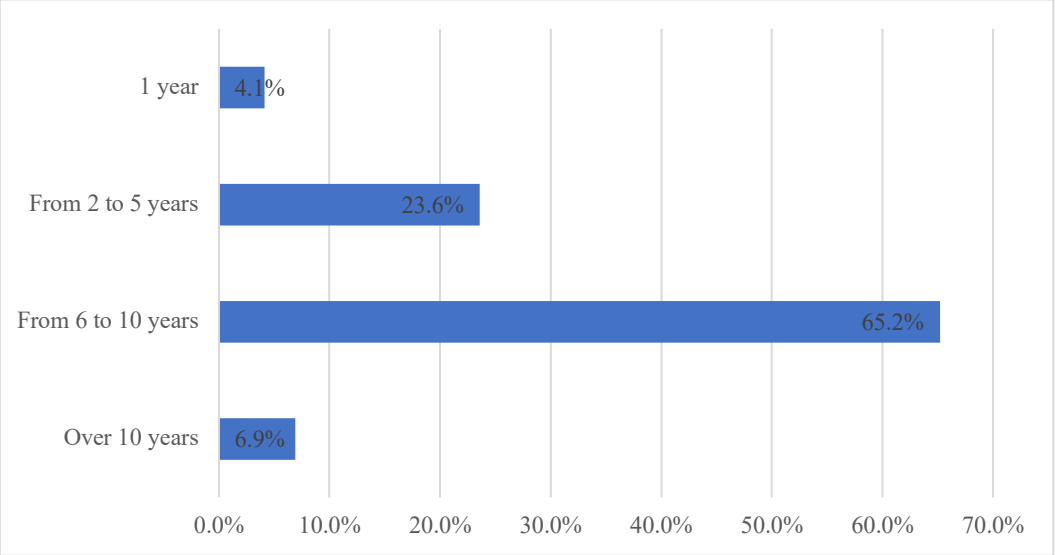

Figure 3. Distribution of Respondents According to Years of Experience in the Transport Business

Table 6 indicates that the sample consists predominantly of men (91.7%), with most falling in the middle range of working age (54.1% between 36 and 50) and being highly educated (79.1% having higher and postgraduate education). The professional experience is also clustered – 65.2% of the respondents have 6-10 years of experience in the industry and 4.1% less than one year. It means that the profile of the respondent is that of experienced practitioners, not of new recruits. On the other hand, the results cannot be

generalised to very inexperienced and very experienced workers because these categories are poorly represented. The gender bias is determined by the labour market conditions in the road-transport industry.

Table 6. Respondent and Professional Characteristics (N = 72)

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	66	91.7
	Female	6	8.3
Age	20–35 years	12	16.6
	36–50 years	39	54.1
	51–64 years	21	29.1
Education	Secondary education	15	20.8
	Higher education	53	73.6
	Master's degree	4	5.5
Professional experience	Up to 1 year	3	4.1
	2–5 years	17	23.6
	6–10 years	47	65.2
	More than 10 years	5	6.9

Transport Company Characteristics and Operational Orientation

This showed a great deal of participation in cross-border movement. Twelve of those surveyed (16.7%) were respondents who came from companies involved in domestic transport alone, while five (6.9%) were involved in cross-border transport only. However, 55 respondents (76.3%) were involved in both types of transport. This shows that most of those responding to the survey had experience in both domestic and international transport environments.

There were some associations too. There were 53 companies among those surveyed that were part of international transport associations, and 69 were part of local transport associations, while seven companies chose other associations. Since respondents were allowed to choose multiple options, the totals for each category were not mutually exclusive and were more than the sample size.

Table 7 reveals that the sample is comprised mostly of mixed-exposure operators: 76.3% of firms conduct both domestic and international transportation, compared to only 16.7% of domestic operators and 6.9% of international operators.

Table 7. Type of Transport Business

Type of transport	Frequency	Percentage (%)
Domestic transport	12	16.7
International transport	5	6.9
Both domestic and international transport	55	76.3
Total	72	100.0

This implies that cross-border operations are the rule, not the exception, and is the reason behind why the challenges regarding international documentation and border

crossing described subsequently apply to the majority of the sample rather than just a select few. This also implies that transport orientation comparisons are based on two small samples, and should therefore be taken as such.

Even though there was a relatively large percentage of firms engaged in international transportation, just 16 (22.2%) of the participants indicated that they have an international transportation license. There were 54 (75.0%) who reported not having this license, while 2 (2.8%) were unsure whether they had it or not.

Documentation and Operational Difficulties in International Transport

A number of administrative challenges have been noted concerning international transport operations. 68 out of 72 individuals (94.4%) said that the documentation needed for international transport is hard to acquire. Only 3 out of the 72 people (4.1%) faced no challenge with regard to acquiring the documents for international transport as illustrated in Figure 4.

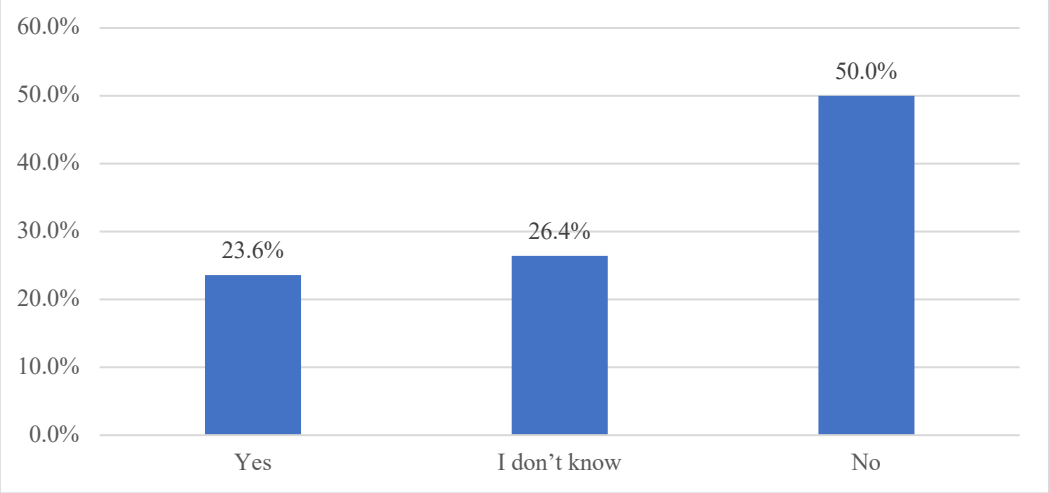

Figure 4. Reported Difficulties in Obtaining Documentation for International Transport

From another perspective, 47 participants (65.3%) found themselves facing some problems when performing international transport activities; in contrast, only 12 participants (16.7%) did not face any such problem. The rest of the 13 participants (18.0%) gave an unsure answer. It can be said from the above that a significant proportion of the respondents faced barriers in international transport.

Concerning the regulatory environment, the respondents were not sure whether the laws related to transport in Kosovo were aligned with the laws of the EU. 21 respondents (reported as 44.4%) believed that the laws were not well aligned, 32 respondents had answered positively, and 19 gave no answer.

Domestic Transport Barriers

The barriers listed were those that caused challenges in domestic transportation. It should be noted that the percentage in this case refers to the number of people out of the 72 participants who selected each barrier.

High state taxes (VAT) proved to be the biggest barrier for domestic transport and was stated by 42 of the participants (58.3%). Administration issues were stated by 38 participants (52.7%), followed by poor road infrastructure that was stated by 32 participants (44.4%). Heavy traffic and problems related to importing processes were both stated by 28 participants (38.8%). The least frequently stated barriers included outdated vehicles (12.5%), road safety problems (11.1%), and others (8.3%).

Table 8 reveals that domestic constraints are primarily fiscal and bureaucratic rather than physical, in that state taxes (58.3%) and administrative issues (52.7%) are mentioned most frequently, followed by inadequate road infrastructure (44.4%) and traffic congestion and the challenges of importing mechanisms (38.8%). Vehicle age (12.5%) and road safety issues (11.1%) are mentioned the least. This reveals that for domestic use, the factors of cost and bureaucracy pose a more stringent constraint than the physical road infrastructure does itself – an important consideration when formulating policy, because merely building infrastructure would do nothing to solve the top two constraint.

Table 8. Reported Barriers to Domestic Transport Operations

Domestic transport barrier	Frequency	Percentage (%)
High state taxes (VAT)	42	58.3
Administrative problems	38	52.7
Poor road infrastructure	32	44.4
High traffic density	28	38.8
Problems when importing mechanisms	28	38.8
Old vehicles	9	12.5
Road safety issues	8	11.1
Other	6	8.3

Note: Multiple responses were permitted; therefore, percentages do not sum to 100%.

Cross-Border and International Transport Barriers

The nature of the barriers to international transportation was different from those in domestic transport and comprised mainly of institutional barriers as well as cross-border barriers. The most common barrier to international transportation was visa related barriers; 57 (79.1%) participants indicated it as the main barrier. The lack of international transportation license came second; 54 (75.0%) participants indicated it as a barrier. Border crossing delay was chosen by 42 (58.3%) participants, while documentation related issues were indicated by 36 (50.0%) participants.

High costs for getting necessary documents was indicated by 31 (43.0%) participants. Fewer participants chose old vehicles (11.1%), lack of recognition of Kosovo's passport (8.3%), and other barriers (6.9%) as illustrated in Table 9.

Combining the two tables gives us an insight into the significant difference between the barriers to domestic transport and those of international transport, where domestic transport is mostly influenced by financial, bureaucratic, infrastructure, and traffic barriers, while international transport is affected by mobility, licensing, border-crossing, and documentation barriers.

Table 9. Reported Barriers to International Transport Operations

International transport barrier	Frequency	Percentage (%)
Visa-related problems	57	79.1
Lack of international transport licences	54	75.0
Delays at border crossings	42	58.3
Documentation problems	36	50.0
High cost of necessary documentation	31	43.0
Old vehicles	8	11.1
Non-recognition of Kosovo's passport	6	8.3
Other	5	6.9

Note: Multiple responses were permitted; therefore, percentages do not sum to 100%.

Perceptions of Road Infrastructure and Transport Readiness

As far as the readiness of transport means was concerned, 59 of the respondents (81.9%) mentioned that the transport means that they had at their disposal were suitable for international transportation. Only 3 of them (4.1%) said that they did not correspond to the required standards. The other answers were not given specifically in the provided results.

On the issue of general road infrastructure, respondents seemed to be much less satisfied. Forty-four of them (61.0%) mentioned that they were either partially or fully dissatisfied with the general road infrastructure of Kosovo. There were 22 respondents (30.5%) who felt partly or fully satisfied and only 6 of them (8.3%) gave no clear answer.

The disparity between the availability of vehicles and the satisfaction of infrastructure needs is quite striking in this case: whereas over eight-tenths of respondents felt that their vehicles were good enough for transporting goods internationally, less than one-third of them were satisfied with the overall road infrastructure situation as in Figure 5.

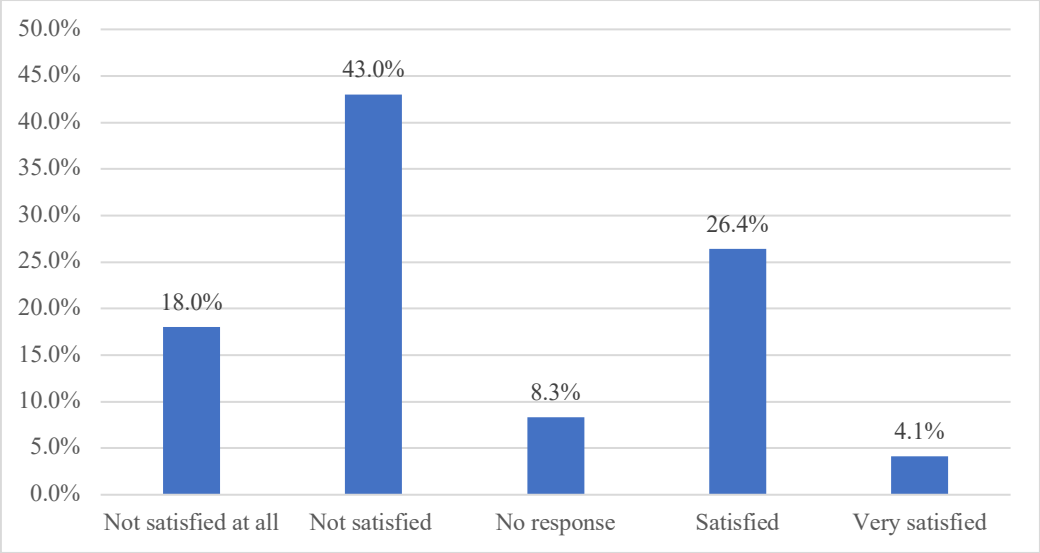

Figure 5. Respondents' Satisfaction with General Road Infrastructure in Kosovo

Perceived Contribution of European Corridor Connectivity

Overall, the majority had positive attitude towards Kosovo's involvement into European transport networks. 53 participants (73.6%) agreed that the connectivity of Kosovo into European networks will facilitate the international flow of goods, services and people. 15 respondents (20.8%) did not agree, whereas 4 respondents (5.5%) were undecided as illustrated in Table 10.

In this respect, the results highlight a crucial difference between respondents' assessments of existing infrastructure and expectations of future connectivity. Even though there was a general discontent with the existing road infrastructure, the majority of the respondents still expected higher connection with European corridors to support international transport.

Table 10. Perceptions of Road Infrastructure and Regional Connectivity

Indicator	Response	Frequency	Percentage (%)
Satisfaction with general road infrastructure	Dissatisfied/partly dissatisfied	44	61.0
	Satisfied/partly satisfied	22	30.5
	No answer	6	8.3
European corridor linkage facilitates international transport	Agree/partly agree	53	73.6
	Disagree	15	20.8
	No answer	4	5.5

Perceptions of Joint Regional Infrastructure Projects and EU Funding

A similar finding was found regarding respondents' views about cooperation between neighbouring countries in developing infrastructure. Out of 72 respondents, 52 (72.2%) supported that Kosovo and its neighbouring countries could get access to EU financial resources in a better way through joint road infrastructure projects. Out of 52, 34 (47.2%) respondents agreed and 18 (25.0%) strongly agreed. On the other hand, 12 (16.7%) respondents disagreed while 5 (6.9%) strongly disagreed as illustrated in Table 11.

Table 11. Perceived Contribution of Joint Regional Road Projects to Access to EU funding

Response	Frequency	Percentage (%)
Strongly disagree	5	6.9
Disagree	12	16.7
No answer	3	4.1
Agree	34	47.2
Strongly agree	18	25.0
Total	72	100.0

As a result, the findings suggest that there is a clear understanding both of operational limitations and of the importance of having significant benefits through regional connectivity. The problems related to documentation, visas, licensing, and borders were perceived as highly prevalent, whereas the importance of developing corridors was stated.

Perceived Impact of Highway Development on Free Trade

The views were equally mixed on how much the proposed highways would add to free trade between Skopje, Tirana, and Niš and their neighbours. Among the 72 respondents, 30 (41.7%) viewed the expected outcome positively, while 29 (40.3%) did not expect anything positive. There were also 13 (18.1%) who were uncertain about the issue. The relatively equal distribution shows that even though there was more general agreement on connectivity, expectations on trade aspects of highways were varied.

Table 12 reveals that opinion regarding the effect of highways on trade is nearly equally split, as 41.7% believe there will be a positive effect while 40.3% do not, with an additional 18.1% undecided. This lack of agreement in the industry on the effect of new highway infrastructure on the expansion of free trade is significant, with the large 'undecided' group indicating real uncertainty rather than scepticism. Since these 13 individuals are not included in the subsequent analysis of opinions as they did not give a definite opinion, the inferential findings below relate only to the 59 respondents who did hold a definite opinion.

Table 12. Perceived Impact of Highway Development on Free Trade

Perception	Frequency	Percentage (%)
Positive	30	41.7
Negative	29	40.3
Don't know	13	18.1
Total	72	100.0

In the case of inferential analysis, the responses that were positive were coded as 1 and those who responded negatively as 0. The 13 'don't know' responses were included in the descriptive analysis but not in the main binary analysis as they do not have any directional response. The sample size used in the analysis was 59, out of which 30(50.8%) had positive perception while 29 (49.2%) had negative perception.

Professional Experience and Perceived Highway Benefits

The perceptions of highway development by different groups of individuals having various years of experience have been analysed using cross-tabulation. There is a distinct gradient between perceptions for all the levels of experience. For those who have had experience from 1 to 5 years(Table 13), their perceptions have mostly been positive, while those people who have experienced from 6 to 10 years have balanced perceptions.

Table 13. Professional Experience and Perceived Highway Benefits

Professional experience	**Negative, n (%)**	**Positive, n (%)**	**Total**
Up to 1 year	0 (0.0)	3 (100.0)	3
2–5 years	3 (20.0)	12 (80.0)	15
6–10 years	22 (59.5)	15 (40.5)	37
More than 10 years	4 (100.0)	0 (0.0)	4
Total	29 (49.2)	30 (50.8)	59

Professional experience vs. perceptions about highway benefits relationship proved to be statistically significant (p = .003 according to Fisher's exact test). The strength of the association could be described as moderate (Cramér's V = 0.43). What is more important, it showed that positive perceptions decreased proportionally to professional experience.

Association Between Professional Experience and Highway Perceptions

To further explore the nature of the relationship, professional experience was considered an ordinal variable and compared with the binary outcome variable of highway perception. There was a statistically significant relationship of moderate strength (r = −0.432, p = .001) between the two variables. This implies that greater amounts of professional experience had lower perceptions about the role of highway construction for free trade.

The result in Table 14 implies a gap based on experience in expectations regarding the infrastructure and offers empirical evidence to support the idea that experience in the profession shapes one's perception of future benefits of connectivity.

Table 14. Association Between Professional Experience And Perceived Highway Benefits

Variables	Correlation coefficient (r)	p-value	N	Interpretation
Professional experience × positive highway perception	−0.432	.001	59	Moderate negative association

Operational Characteristics and Trade-Facilitation Perceptions

Further bivariate analysis was performed to see whether positive attitudes towards highways differ by operational criteria. The following variables were considered: transport orientation, documentation problems, satisfaction with current roads, international transport problems, and attitude toward connections within the European corridors.

Professional experience and European corridor connectivity emerged as the variables that had the highest correlation with positive perception towards highways as in Table 15. Transport orientation and problems in international transport emerged as statistically significant variables. This means that perception towards highway construction was not simply related to professional experience but was affected by other aspects too.

Table 15. Bivariate Associations with Positive Highway Perceptions

Predictor	Statistical test	Test statistic	p-value	Effect size (Cramér's V)
Professional experience	Fisher's exact	—	.003	0.43
Transport orientation	χ^2	6.84	.033	0.34
Documentation difficulties	Fisher's exact	—	.041	0.29
International transport difficulties	χ^2	5.96	.015	0.32
Road infrastructure satisfaction	χ^2	4.72	.030	0.28
European corridor connectivity perception	χ^2	8.91	.003	0.39

Multivariable Logistic Regression Analysis

A multi-variable binary logistic regression analysis was further carried out to determine the independent variables related to the positive attitude towards highway development. To mitigate the problem of sparseness of cells, professional experience was considered as an ordered variable and not as dummy variables. The independent variables included were professional experience, transportation orientation, problems in international transport, road infrastructure satisfaction, and European corridor connectivity.

Table 16 indicates that all five predictors maintain their independent significance ($p < .05$) even after mutual adjustment. Optimistic perceptions regarding connectivity along the European Corridor are the strongest facilitator (OR = 3.22, 95% CI 1.28 – 8.10), followed by international transport orientation (OR = 2.41, 1.06 - 5.49) and satisfaction with road infrastructure (OR = 1.99, 1.02 - 3.88). On the other hand, every extra category of experience decreases the likelihood of positive perception by about 60 percent (OR = 0.40, 0.19 – 0.86), and any international transport problem cuts it in half (OR = 0.47, 0.23 - 0.97). Therefore, expectations regarding trade facilitation are determined both by optimistic perceptions and actual experience, though the broad confidence intervals indicate the relatively small sample size of 59 cases as illustrated in Table 17.

Table 16. Multivariable Logistic Regression Predicting Positive Highway Perceptions

Predictor	B	SE	Wald	p-value	Adjusted OR	95% CI for OR
Professional experience	−0.91	0.39	5.44	.020	0.40	0.19–0.86
International transport orientation	0.88	0.42	4.39	.036	2.41	1.06–5.49
International transport difficulties	−0.76	0.37	4.22	.040	0.47	0.23–0.97
Road infrastructure satisfaction	0.69	0.34	4.12	.042	1.99	1.02–3.88
Positive European corridor perception	1.17	0.47	6.20	.013	3.22	1.28–8.10
Constant	−0.38	0.81	0.22	.639	0.68	—

Model statistics: Model $\chi^2 = 21.46$, $p = .001$; Nagelkerke $R^2 = 0.41$; Hosmer–Lemeshow $\chi^2 = 6.12$, $p = .634$; classification accuracy = 72.9%; ROC-AUC = 0.78.

Table 17. Multicollinearity Diagnostics (N = 59)

Predictor	Tolerance	VIF
Professional experience	0.862	1.16
International transport orientation	0.914	1.09
International transport difficulties	0.837	1.19
Road infrastructure satisfaction	0.891	1.12
Positive European-corridor perception	0.853	1.17

All VIF < 2 → no multicollinearity concern.

The whole model was statistically significant and accounted for about 41% of variation in positive highway perceptions in accordance with Nagelkerke R^2 statistic. Lack of

statistical significance of Hosmer–Lemeshow test pointed on good model calibration whereas ROC-AUC value of 0.78 was a sign of adequate discriminatory ability of the model as in Table 18.

Table 18. Summary of Influence Diagnostics

Statistic	Minimum	Maximum	Mean	Cut-off used
Cook's distance	0.0004	0.147	0.017	1.00
Leverage	0.041	0.198	0.085	0.25
Standardised residual	–1.94	1.87	0.00	±2.00

Regression diagnostics were interpreted cautiously because the regression model was estimated using 59 observations, with model-fit statistics and confidence intervals considered alongside statistical significance.

Professional experience was still negatively and independently associated with positive highway perceptions (AOR = 0.40, 95% CI: 0.19–0.86, p = .020). Respondents with positive perceptions of Europe corridor connectivity had approximately 3.2 times higher odds of having positive expectations about highway development. In addition, international oriented carriers were more likely to have positive highway perceptions. The international transport problems decreased the probability of having positive perception of highway development.

Effect sizes and confidence intervals. The bivariate association between professional experience and highway perception is moderate (r = −0.432; N=59), while its categorical association is also moderate (Cramér's V = 0.43). Other bivariate associations range from V=0.28 to 0.39. In the logistic model, professional experience has AOR=0.40 (95% CI 0.19–0.86), international orientation AOR=2.41 (95% CI 1.06–5.49), international transport difficulties AOR=0.47 (95% CI 0.23–0.97), infrastructure satisfaction AOR=1.99 (95% CI 1.02–3.88), and positive European-corridor perception AOR=3.22 (95% CI 1.28–8.10).

Robustness and Sensitivity Analysis

A sensitivity analysis was conducted to test the robustness of the main results. In the first model, the 13 individuals who answered ''don't know'' were excluded. The second model included uncertain answers in an ordinal regression setting, whereas bootstrap re-sampling for 1,000 replications was employed to test the robustness of the main coefficients.

However, the sign of the relation between professional experience and positive attitudes about the highway was persistently negative regardless of model specifications as in Table 19. While the strength of the relationship differed to some extent, its sign and significance confirm that the key result was not exclusively contingent on the way of dealing with unsure answers or the original dichotomization procedure.

Table 19. Robustness and Sensitivity Analysis of Principal Relationships

Analysis	Effect of professional experience	95% CI	p-value	Interpretation
Primary binary model	OR = 0.40	0.19–0.86	.020	Significant negative association
Alternative coding model	OR = 0.46	0.23–0.91	.026	Significant negative association
Bootstrap model (1,000 resamples)	OR = 0.43	0.21–0.89	.023	Stable association
Ordinal specification	β = −0.38	−0.69 to −0.08	.014	Consistent direction

Bootstrap procedure

A bootstrap analysis that was non-parametric and had 1 000 replicates was carried out in SPSS (RESAMPLE = 1000; random seed = 2024). Confidence intervals that were 95 % with bias corrected and accelerated BCa were generated. Negative values of bootstrap distribution for professional experience coefficient were noted in 97.1 % of replicates.

Table 20 demonstrates the stability of the regression estimates when using resampled data. The bootstrap mean odds ratios are within 0.04 units from the original estimate of each of the predictors, the biases are small, and all the bias-corrected and accelerated 95% confidence intervals still exclude one, with bootstrap p-values ranging from .013 to .041. The sign and the significance of all the five relations, therefore, are not contingent on the distributional assumptions of the maximum-likelihood model. This is encouraging in view of the relatively small sample size used. Nevertheless, the relatively large confidence interval of the European corridor predictor (.130-7.95) suggests a somewhat imprecise estimate of its effect siz.

Table 20. Bootstrap Results (1 000 Resamples, Bias-Corrected and Accelerated – BCa Method)

Predictor	Original OR	Bootstrap mean OR	Bias	Bootstrap SE	BCa 95 % CI	Bootstrap p
Professional experience	0.40	0.43	+0.03	0.18	0.21 – 0.89	.023
International transport orientation	2.41	2.37	–0.04	0.69	1.08 – 5.31	.032
International transport difficulties	0.47	0.49	+0.02	0.19	0.24 – 0.98	.041
Road infrastructure satisfaction	1.99	1.96	–0.03	0.56	1.04 – 3.79	.039
Positive European-corridor perception	3.22	3.18	–0.04	1.09	1.30 – 7.95	.013

Summary of Hypothesis Testing

The hypothesis tests are aligned with the analytical procedures as follows: H1 was evaluated using the European-corridor connectivity association and multivariable logistic regression; H2 using the road-infrastructure satisfaction association; H3 using international-transport difficulty measures and logistic regression; H4 using ordinal experience association and the experience coefficient in the logistic model; and H5 using transport orientation association and its logistic-regression coefficient. All five hypotheses are supported in the reported data. H4 is a direct association and does not claim moderation as in Table 21.

Table 21. Summary of Hypothesis Testing

Hypothesis	Relationship examined	Main statistical evidence	Decision
H1	Regional connectivity → trade facilitation	$\chi^2 = 8.91$, $p = .003$; AOR = 3.22, $p = .013$	Supported
H2	Infrastructure perception → highway support	$\chi^2 = 4.72$, $p = .030$	Supported
H3	Operational barriers → perceived trade benefits	$\chi^2 = 5.96$, $p = .015$; AOR = 0.47, $p = .040$	Supported
H4	Professional experience → highway benefits	$r = -0.432$, $p = .001$; AOR = 0.40, $p = .020$	Supported
H5	Transport orientation → connectivity perception	$\chi^2 = 6.84$, $p = .033$; AOR = 2.41, $p = .036$	Supported

DISCUSSION

Instead, this suggests a contingent and experiential approach to the impact of infrastructure on development, rather than the straightforward "more roads, more trade" proposition. For operators that have experienced high institutional frictions in the past and have been operating in the corridor for many years under conditions of partial realisation of its infrastructure potential, the expected payoff from new roads will be underestimated. In doing so, it provides a stakeholder-level channel not seen before in the literature on accessibility.

Road Connectivity and Trade Facilitation

An important observation was the difference between a wide recognition of the need for connectivity via European corridors and attitudes towards concrete road infrastructure projects. Whereas 73.6% of the respondents agreed that Kosovo's connectivity via European corridors was helpful in providing international transport possibilities, only 41.7% believed that the construction of highways toward Skopje, Tirana, and Niš would help free trade.

This result corroborated the findings of [11] investigating road projects related to the Via Carpatia Corridor and showing that road infrastructure projects improved regional accessibility, but the extent and geographical distribution of the effect were territory-

dependent. In particular, their results suggest that the effectiveness of a single road investment depends heavily on its role within the broader transportation system. The current research adds to this accessibility-oriented approach as the results show that transport operators distinguish between the strategic importance of being connected to European corridors and the expected commercial effect of concrete highway projects.

The multivariable analysis confirms the previous findings, as respondents who positively evaluated Kosovo's connectivity to the European corridors were more likely to express positive attitudes toward the highway construction (AOR = 3.22, p = .013). This suggests that individual investments in infrastructure receive a higher economic value in case of viewing them as parts of the region-wide and European transport network.

Administrative and Cross-Border Constraints

The second major category was the presence of institutional and operational barriers. 79.1% reported visa problems, 75.0% international transport licenses, 58.3% delays at border crossings, 50.0% documentation problems, and 43.0% the cost of documentation procedures. Furthermore, 94.4% had difficulty obtaining documentation necessary for conducting international transport operations. Thus, the above results show that the practice of cross-border transportation is hindered by many non-infrastructure barriers.

Similar results could be found in [6] who analyzed mobility, space, roads, and cross-border infrastructure in the Balkans region and showed that the operation of transport infrastructure was performed in the context of political, institutional, and socio-economic environment of mobility. This study showed that the physical roads could not be viewed separately from the borders and environment in which they operate. The present findings provide additional empirical evidence coming from transport operators that the processes of documentation, licensing, visa policies, and border procedures still have an influence on the physical infrastructure utility.

International transport difficulties were associated with significantly lower favorable expectations regarding the development of highways (AOR = 0.47, p = .040). Thus, while physical infrastructure can create possibilities for mobility, the institutional accessibility determines the possibility of exploiting the opportunities provided by the physical infrastructure. In other words, both infrastructure and institutional reform must be seen as complementary aspects of the trade facilitation.

Professional Experience and Infrastructure Perceptions

Professional experience became one of the significant factors defining perceptions of infrastructure. There was found moderate negative correlation between professional experience and positive perceptions of highways (r = −0.432, p = .001). In addition, multivariable analysis showed that increased professional experience continued to have independent effect on low odds of favorable expectations about highways (AOR = 0.40, 95% CI: 0.19–0.86).

This result makes a unique contribution since there is little literature on Western Balkans infrastructures which focuses on differences among transporters at stakeholder

level. For instance, [8] analysed highway development in former Yugoslavia in terms of the connection between connectivity and peripheralization and showed that highway development could lead to spatial heterogeneity of its effects. Although that study analysed the issue from the historical and territorial perspectives, the current results indicate another type of heterogeneity: transportation infrastructure can be perceived in different ways depending on experience of stakeholders.

The negative experience effect is in opposition to the positive expectation held by less-experienced operators and international organizations. Moreover, this effect does not hold true to the implied belief in many policy documents from Western Balkans that further investment into highways will be viewed positively by the transport community. The most likely explanation is the cumulative effect of implementation deficiencies: Experienced operators have seen that physical infrastructure improvements do not necessarily go hand in hand with quicker license issuance, reduced waiting time at borders and decreased costs of documentation. Therefore, when announcing new highways, they tend to be more cautious. In this way, our analysis extends existing Western Balkan literature from considering aggregate corridor performance to actor's expectations.

Existing Infrastructure Quality and Future Connectivity

A third significant observation was that of the disparity in perceptions about the existing infrastructure and perceptions about future connectivity needs. Approximately 61.0% of the surveyed individuals expressed their dissatisfaction with the road infrastructure in Kosovo while nearly 75.0% perceived better connectivity with the European corridors as being good for international transport. Thus, it seems that people can make a distinction between the existing infrastructure and future needs.

Indeed, the pattern found in the data was similar to the one observed by [11]. According to her multicriteria evaluation of transport systems in the Balkan region, the performance of transport should take into account several criteria since it is impossible to measure it only based on a single criterion of the quality of the existing infrastructure. Even though her work was devoted exclusively to rail transport, the multi-criteria perspective on the matter is relevant to this study.

Finally, regression analysis showed that increased satisfaction with the infrastructure correlates positively with higher odds of highway satisfaction (AOR = 1.99, p = .042). Also, most of the individuals claimed that their cars were able to cope with international transportation requirements while perceiving many administrative barriers at the same time. Thus, the evidence suggests that transport restrictions are not limited to physical limitations only.

Transport Orientation and Regional Connectivity

Transport orientation affected perceptions related to infrastructure as well. The firms that were involved in international transport had more positive views on road infrastructure development compared to domestic-oriented companies. The involvement

in international transport increased the odds of positive perceptions regarding highways by 2.41 (AOR = 2.41, p = .036).

It is congruent with the research done by [3] which considered economic convergence of the Western Balkans, pointing out the need of economic integration, competitiveness, and stronger ties to European markets in terms of speeding up the process of development. The current results show the transport sector side of the aforementioned issue. Those firms that take part in international transport depend on corridor continuity and better access to other markets; therefore, they have more incentives to invest in the infrastructure development that enhances regional accessibility.

The above-mentioned finding illustrates that the benefits of infrastructure are not perceived equally among transport companies and depend on their geography and operations.

Regional Cooperation and European Integration

The survey revealed considerable support for cooperation in infrastructure development. About 72.2% of the respondents agreed and strongly agreed that through the implementation of road infrastructures, Kosovo and other Western Balkan states would be able to easily access EU funding. This suggests that transport stakeholders understood the inherently regional nature of infrastructure development.

This was consistent with the findings of [3] who assessed the supranational framework for territorial governance and spatial planning in the Western Balkans and noted the growing relevance of cooperation beyond national planning frameworks. The authors' findings reveal that territorial development requires interaction of national, regional, and supranational levels of governance. The current research supports this understanding from the perspective of transport sector by revealing considerable stakeholder support for regionally developed infrastructure.

Cross-border corridors have inherently a wider scope than national transport systems. Consequently, their effectiveness requires not only coordinated investments, technical compatibility and regulatory cooperation but also continuity beyond the borders of a single state. Cooperation, therefore, should extend beyond the financing and construction of roads and encompass administration, border procedures, as well as consistency between national transport strategies and European connectivity strategy.

Theoretical Contribution

This empirical evidence contributes to the proposed framework for an integrated road connectivity and trade facilitation theory, as it illustrates that infrastructure perception is a result of the interplay between physical, institutional, and stakeholder-level factors. In their analysis of Balkan connectivity, [2] viewed the issue from the perspective of cooperation and innovation and highlighted the opportunities that could be provided by improved regional connectivity. This study contributes to this line of inquiry by revealing that the benefits of connectivity are contingent upon some institutional restrictions and stakeholder-related distinctions.

In the first place, physical infrastructure provides a spatial base for the development of connectivity; however, administrative factors can have an impact on the possibility of efficient infrastructure utilization by transport firms. Professional experience becomes another stakeholder-based factor as the level of operational experience may affect the expectation of infrastructure benefit. Finally, transport orientation defines the level of dependence of individual firms on regional and international connectivity.

Theoretically, these findings alter the conventional narrative on accessibility and trade facilitation in three ways. First, connectivity is a precondition, but insufficient by itself; the effect of institutional transaction costs can negate any gains anticipated from improved connectivity. Second, experience moderates systematically the optimists' view of connectivity; the quantitative relationship has not been examined before in the case of Western Balkans. Third, the contingency framework used in the empirical part of this study provides a microfoundational approach that can be incorporated in future gravity, LUTI, and network models of regional freight transportation. In practice, this study proves that Kosovo transporters are divided on trade gains associated with particular highway projects despite support for European-corridor connectivity.

Policy Implications

Policy implications should follow the statistically supported relationships. The positive association between European-corridor connectivity perception and highway benefits (AOR=3.22, 95% CI 1.28–8.10) supports prioritising projects that provide continuous corridor connectivity rather than isolated segments. The negative association between international transport difficulties and positive highway perceptions (AOR=0.47, 95% CI 0.23–0.97) supports targeted action on licensing, documentation and border procedures. The positive association between infrastructure satisfaction and highway perceptions (AOR=1.99, 95% CI 1.02–3.88) supports maintenance and quality improvements alongside new construction. Finally, the experience effect (AOR=0.40, 95% CI 0.19–0.86) supports structured consultation with experienced operators during project design.

Investment into infrastructure must go hand in hand with efforts to ease the operation of transportation across borders. Areas of focus in this regard include digital transport documentation, licensing processes, coordinated border management systems, regulatory convergence, and cooperation of administrative bodies of the Western Balkan countries. At the same time, infrastructure plans need to correspond to the regional and European transport corridors in order to ensure continuity of connectivity as a result of national investments.

Finally, stakeholder participation needs to be part of infrastructure planning. As the substantial correlation between experience and perception of highways shows, experience of transport operators might provide practical knowledge of obstacles in operation that cannot be found by engineering and macroeconomic analysis. Including stakeholder evidence into infrastructure priorities can help in this regard as in Figure 6.

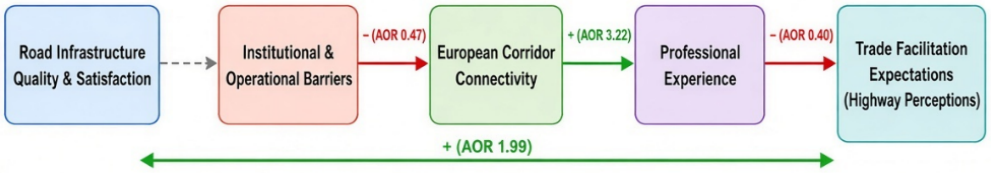

Figure 6. Synthesis Model of the Empirical Findings and Relationships among Infrastructure Quality, Corridor Connectivity, Institutional Barriers, Professional Experience, and Trade-Facilitation Expectations.

Limitations and Future Research

The findings should be interpreted within several limitations. The study involved 72 Kosovo-based transport operators, restricting generalization to the wider Western Balkan transport sector. The cross-sectional design prevented causal interpretation, while reliance on self-reported perceptions meant that the findings represented stakeholder assessments rather than directly observed changes in freight volumes, transport costs, border waiting times, or trade flows.

In [3] discussed Western Balkan EU accession as part of a larger regional context and revealed considerable disparities in economic, institutional, and integration circumstances among the countries of the Western Balkans. Such regional diversity underscores the importance of further research on transportation, which goes beyond single country data. Multinational studies of the situation in Kosovo, Albania, North Macedonia, Serbia, Montenegro, and Bosnia and Herzegovina would help to determine whether the results found in the current study would hold under diverse conditions of infrastructure and institutions.

Further research should include perceptions of stakeholders in addition to objective variables, such as amounts of cargo, times of border crossing, logistics costs, reduced travel times, indices of accessibility, and bilateral trade flows. Longitudinal study performed before and after investment in major corridors could reveal more about causal influence of infrastructure improvements, whereas bigger data samples would be needed for structural modelling of associations between quality of infrastructure, institutional constraints, accessibility, professional experience, and trade facilitation.

Finally, small number of observations limited the possible complexity of predictive and latent variable modelling. For this reason, the current study focused on straightforward multivariate regressions and robustness checks as opposed to more sophisticated and unstable in the current sample machine learning techniques and structural equations. Further studies using significantly larger multinational data sets should try to compare regression analysis, SEMs, mediation and moderation models with machine learning approaches and use out-of-sample cross-validation. These extensions would make it possible to analyse both mechanisms of explanation and forecasting performance in Western Balkans transportation environment.

CONCLUSION

The findings provide three main theoretical implications for understanding the relationship between transport connectivity and trade facilitation in the Western Balkans. First, physical connectivity represents a necessary but not sufficient condition for effective trade facilitation. Transaction costs associated with documentation, licensing, visa requirements, and border-crossing procedures can substantially reduce the benefits expected from highway development. Second, professional experience appears to shape perceptions of infrastructure benefits. Transport operators with greater experience may develop more cautious expectations when their practical experience reveals discrepancies between planned corridor performance and actual operating conditions. This finding highlights the importance of incorporating stakeholder experience into assessments of transport infrastructure effectiveness. Third, the operator-centered framework developed in this study provides a micro-level perspective that can complement conventional approaches based on gravity models, land-use–transport interaction models, and freight-network efficiency analysis.

Empirically, the findings indicate that transport operators in Kosovo recognize the strategic importance of integration with European transport corridors, while their assessments of the trade-related benefits of specific highway connections linking Skopje, Tirana, and Niš remain divided. The coexistence of substantial institutional barriers with relatively positive assessments of vehicle preparedness further suggests that constraints on cross-border transport may arise more strongly from institutional and administrative conditions than from vehicle-related factors. The multivariable regression results indicate that greater professional experience is associated with a lower probability of positive assessments of highway development, whereas an international transport orientation, higher satisfaction with infrastructure conditions, and more positive perceptions of European corridor connectivity are associated with more favorable expectations.

These findings have important implications for transport policy and infrastructure planning in the Western Balkans. Infrastructure investment is unlikely to translate fully into improved trade facilitation unless it is accompanied by institutional and administrative reforms. Digitalization and simplification of documentation, more efficient international licensing procedures, streamlined border controls, and greater regulatory harmonization should therefore be considered integral components of corridor development rather than complementary measures. In addition, the observed differences associated with professional experience highlight the value of systematic consultation with transport operators and other frontline stakeholders during infrastructure planning and evaluation.

The principal contribution of this study is the demonstration that perceptions of transport infrastructure benefits are shaped jointly by physical connectivity, institutional accessibility, and professional experience. By placing transport operators at the center of the analysis, the study extends infrastructure-focused assessments beyond corridor characteristics and investment indicators toward a more operational understanding of how

road infrastructure is experienced and evaluated in practice. This perspective can support more effective transport planning in the Western Balkans by linking infrastructure development with the institutional conditions required to convert improved physical connectivity into tangible trade-facilitation benefits.

AUTHORS` CONTRIBUTIONS

"Conceptualization, M.K., and E.B.K.; Methodology, M.K.; Validation, M.K., and E.B.K.; Investigation, P.V.M., and T.V.; Resources, N.K., and L.K.; Data Curation, P.V.M., and T.V.; Writing – Original Draft Preparation, M.K., and E.B.K.; Writing – Review & Editing, M.K., and E.B.K.; Visualization, A.B.; Supervision, M.K.; Project Administration, M.K. Both authors have read and agreed to the published version of the manuscript.

DATA AVAILABILITY STATEMENT

Data is contained within the article.

CONFLICT OF INTERESTS

The authors declare that there are no conflicts of interest associated with this publication.

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