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Assessing the Relationship between Strategic Intellectual Resource Configuration and Urban Mobility Performance in Nairobi City, Kenya

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Abstract
Urban mobility outcomes depend not only on infrastructure and funding but also on the knowledge, expertise, organisational systems, and stakeholder relationships required to plan and coordinate transport services. However, the contribution of intellectual resources to urban mobility remains insufficiently understood in complex urban transport environments. Anchored on Resource Orchestration Theory, which holds that value arises from how organisations structure, bundle and leverage their resources, this study examined the relationship between strategic intellectual resource configuration and urban mobility outcomes in Nairobi City, Kenya. The study adopted a positivist philosophy and a cross-sectional descriptive correlational research design. The target population was 765 stakeholders drawn from 20 institutions within Nairobi's urban mobility ecosystem. A sample of 263 respondents was determined using Yamane's formula and selected through multistage sampling, involving purposive selection of institutions and stratified random selection of respondents. Data were collected using structured questionnaires, of which 215 were valid for analysis (81.7% response rate), and analysed using SPSS version 30. Intellectual resource configuration had a moderate, positive and statistically significant association with urban mobility outcomes ($r = .549$, $p < .001$) and accounted for 30.2% of the variance in outcomes ($R^2 = .302$; $F(1, 213) = 91.96$, $p < .001$). Higher levels of professional expertise, institutionalised knowledge-sharing systems, organisational procedures and collaborative stakeholder relationships were associated with better perceived safety, efficiency and reliability of mobility services. Urban transport institutions should therefore prioritise specialised skills development, organisational learning, knowledge retention, and inter-organisational collaboration. Longitudinal research using objective mobility indicators is recommended to establish causal effects.

Introduction
Urban mobility, the ease with which people and goods move within a city, shapes access to employment, services and markets, and is commonly judged by the safety, efficiency and reliability of transport services. In urban Kenya, walking and *matatus* (privately operated paratransit) account for 89% of all adult commuting, and Nairobi's streets are regularly gridlocked at peak hours (Salon &

Gulyani, 2019). Congestion persists even at low car-ownership levels because the road network is small relative to the population and offers few alternative routes (Salon & Gulyani, 2019). Improving these outcomes depends not only on infrastructure and funding but also on the capacity of transport institutions to plan, coordinate and manage services.

The growing significance of the knowledge economy has shifted organisational attention from tangible assets towards intellectual capital (IC) as a strategic resource for enhancing performance, competitiveness, innovation, and adaptability (Obeidat, 2016; O'Cass & Sok, 2014). Intellectual capital comprises human capital, structural capital, and relational capital, which collectively provide the knowledge, expertise, organisational systems, and stakeholder networks necessary for effective resource utilisation and value creation (Qiao & Wang, 2021). Human capital refers to the knowledge, skills and expertise of employees, structural capital to the systems, procedures and knowledge-management structures that remain within the organisation when employees leave; and relational capital to the value embedded in relationships with external stakeholders. However, realising these benefits depends not merely on possessing intellectual resources but on strategically configuring and mobilising them to achieve organisational objectives (Khan et al., 2024; Mubarik et al., 2020).

In the public sector, human capital is equally critical, though measurement challenges remain acute. Civil service agencies face volatility, uncertainty, and bureaucratic rigidities that undermine talent retention and skill development (Fedotova et al., 2025). In the transport sector, Torosyan et al. (2020) argue that workforce planning, capacity-building and performance management can improve operational efficiency and support the delivery of mobility projects.

Intellectual resource configuration (IRC) is particularly important in the public sector, where institutional effectiveness increasingly depends on technical expertise, knowledge-management, coordinated processes, and stakeholder collaboration. Drawing on the intellectual capital literature (Qiao & Wang, 2021) and Resource Orchestration Theory (Sirmon et al., 2007), this study defines IRC as the extent to which an organisation's human, structural and relational capital are developed, aligned and deployed in support of its strategic objectives. Human, structural and relational capital are therefore treated as the three dimensions of IRC, and the overall configuration reflects their combined level. In urban transport systems, these resources support project implementation, operational efficiency, innovation, and responsiveness to citizens' mobility needs (Silva et al., 2021; Torosyan et al., 2020).

Nairobi's urban mobility is managed by several public agencies, including the Nairobi Metropolitan Area Transport Authority (NaMATA), the Kenya Urban Roads Authority (KURA), the National Transport and Safety Authority (NTSA) and the Nairobi City County Government. NaMATA was established through Legal Notice No. 18 of February 2017 as a coordinating agency for an integrated public transport system in the Nairobi Metropolitan Area (NaMATA, 2019). However, studies of public transport planning in Nairobi have reported weak coordination among the institutions involved, which manifests in poor planning and poor-quality services (Kanyama, [year]). The Nairobi Metropolitan Area Transport Authority's capacity-building initiatives highlight the importance of strengthening technical expertise in public transport planning and operations (NaMATA, 2023). Although intellectual capital has been linked to organisational performance in many settings, much of the empirical evidence comes from private sector firms, and few studies have examined how intellectual resources relate to mobility outcomes in public transport institutions in African cities.

This study therefore examined the relationship between strategic intellectual resource configuration and urban mobility outcomes in Nairobi City, Kenya. Grounded in Resource Orchestration Theory, it hypothesised that intellectual resource configuration is positively associated with urban mobility

outcomes. In doing so, it advances both theoretical understanding and practical strategies for resource configuration in the public sector.

Theoretical Review

Resource Orchestration Theory (ROT) extends the resource-based view by arguing that possessing valuable resources is not sufficient for superior outcomes; value is created when managers structure, bundle and leverage those resources (Sirmon et al., 2007, 2011). Structuring involves acquiring, accumulating and divesting resources to build a resource portfolio; bundling integrates resources into capabilities; and leveraging mobilises, coordinates and deploys those capabilities to exploit opportunities (Sirmon et al., 2007).

ROT is well suited to public transport management, where outcomes depend on how agencies assemble expertise, embed it in institutional systems and coordinate it across organisational boundaries. The three dimensions of intellectual resource configuration correspond to these processes. Human capital forms the resource portfolio built through structuring, as institutions recruit, train and retain staff with expertise in planning, engineering and regulation. Structural capital reflects bundling, as systems, procedures and knowledge repositories integrate individual expertise into institutional capabilities that persist beyond individual employees. Relational capital reflects leveraging, because no single agency controls Nairobi's mobility system and capabilities must be mobilised through relationships with other agencies, transport operators and communities.

ROT further holds that these processes must be synchronised, because resources create the most value when they are effectively combined rather than developed in isolation (Sirmon et al., 2011). This study hypothesises that:

H1: Strategic intellectual resource configuration is positively associated with urban mobility outcomes in Nairobi City.

Literature Review

Intellectual resource configuration comprises three dimensions: human, structural and relational capital. The empirical evidence on each dimension is reviewed below, followed by the research gap.

Human Capital Configuration

Human capital configuration refers to the deliberate alignment of employees' knowledge, skills and expertise with organisational goals through recruitment, training, retention, succession planning and performance management. In the private sector, firms that emphasise employee engagement, workforce planning and learning systems report stronger competitive outcomes (Wujarso, 2021). In public administration, human capital plays a decisive role in shaping institutional responsiveness, service delivery and long-term sustainability. Top management endorsement and adequate funding are preconditions for successful human capital development (Kraja & Spahija, 2023), and civil service performance frameworks rely heavily on administrative and political leadership to embed human capital strategies (Busenan et al., 2018). However, training and professional development are often constrained by budget limitations, rigid personnel systems and insufficient incentives for specialists (Khadka & Khadka, 2024). In Ukraine's public administration, Fedotova et al. (2025) found that civil servants regarded salary and increased responsibility as prerequisites for professional development, and concluded that the human capital management system lacked flexibility and adaptability to changing conditions.

Human capital has also been linked to organisational outcomes in public settings. Among 147 public officers in seven departments of the North Sulawesi Provincial Government, Indonesia, Sutrisno et al. (2024) found that human capital was directly related to competitive advantage, whereas knowledge-

management mediated only the relationship between structural capital and competitive advantage. In a study of 165 health professionals in Lahore, Pakistan, Khan et al. (2024) found that human resource configuration practices were positively related to innovation, with intellectual capital mediating this relationship. Succession management is a further concern in Kenya's public sector, where an ageing workforce, staffing gaps, skills mismatches and high staff turnover have been reported. Mark et al. (2025) found a strong, positive and significant relationship between leaders' intellectual stimulation and succession management in Kenya's public sector. For urban mobility agencies, poorly managed transitions may delay infrastructure projects, weaken stakeholder coordination and undermine policy continuity.

Structural Capital Configuration

Structural capital refers to the institutionalised knowledge embedded in organisational routines, systems, culture and processes that facilitate the creation, storage and dissemination of knowledge (Ali et al., 2023). Structural capital configuration concerns how these systems and processes are organised to support strategic objectives. In knowledge-based organisations, appropriate structural capital configurations are recognised as pivotal enablers of innovation and long-term performance (Zahedi et al., 2023). In public organisations in Tamaulipas, Mexico, and Arequipa, Peru, Pedraza Melo and De la Gala Velásquez (2022) found that human capital was positively related to organisational performance and that structural capital mediated this relationship. They recommended that public management prioritise both dimensions to improve processes, procedures and services. Using a cross-sectional survey of 194 employees of deposit money banks in Nigeria, Akpotu (2020) found that system configuration, work strategy and strategy focus were significantly related to knowledge-sharing behaviour. Strong structural frameworks can therefore reduce knowledge silos and support collaborative problem-solving. This is relevant to transport authorities, which depend on integrated information systems and cross-departmental coordination to deliver projects on time.

Relational Capital Configuration

Relational capital represents the knowledge and value embedded in an organisation's relationships with stakeholders, customers, suppliers, regulators, communities and partners (Hanifah et al., 2022). Relational capital configuration therefore concerns how these relationships are built and managed to secure resources, trust and coordination. Most empirical work on relational capital has been conducted in corporate settings. In a survey of 304 respondents in Chinese manufacturing, Zhang and Wang (2018) found that trust and commitment had significant effects on knowledge-sharing, complementary resources and co-governance, but no significant effect on relationship-specific investment. Among 360 Mexican SMEs, Ramírez-Solis et al. (2022) found that relational capital had a strong positive effect on innovation but a weaker direct effect on firm performance. Rivera et al. (2025) conceptualised intra-organisational relational capital as comprising an "agent" dimension (people's willingness and ability to act for others) and a "context" dimension (conditions shaping relationship quality), indicating that relational capital includes internal as well as external relationships. This is relevant to Nairobi, where urban mobility depends on coordination among NaMATA, KURA, NTSA and the county government, and weak inter-institutional coordination has been reported.

Conceptual Framework

Figure 1 presents the conceptual framework that guided the study. Drawing on ROT, strategic intellectual resource configuration is the independent variable. It is measured through its three dimensions (human, structural and relational capital), which are combined into a single composite score. Urban mobility outcomes, the dependent variable, are measured through stakeholders' perceptions of the safety, efficiency and reliability of mobility services. The hypothesised positive association between the two variables is stated as H1.

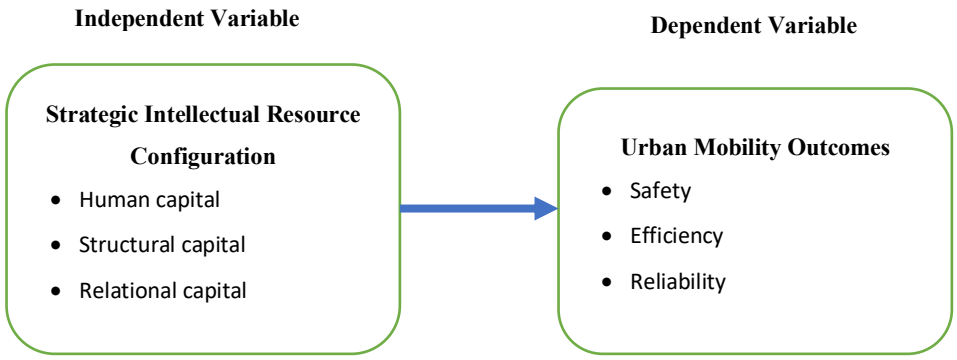


Figure 1: Conceptual Framework

Method

Research Philosophy and Design

The study adopted a positivist research philosophy and a quantitative approach. Positivism was appropriate because the study sought to test a theory-derived hypothesis (H1) through objective measurement and statistical analysis, treating the relationship between intellectual resource configuration and urban mobility outcomes as observable and quantifiable independently of the researcher (Saunders et al., 2019). A cross-sectional descriptive correlational research design was used to assess the relationship between intellectual resource configuration and urban mobility outcomes in Nairobi City, Kenya. The design enabled the measurement of naturally occurring variables and statistical examination of their relationships without manipulating them (Creswell & Creswell, 2018; Siedlecki, 2020); it therefore supports conclusions about association but not causation. Intellectual resource configuration was examined within the broader framework of strategic resource configuration, while urban mobility outcomes were assessed in terms of safety, efficiency and reliability.

Population and Sampling

The target population consisted of 765 stakeholders drawn from 20 institutions in Nairobi's urban mobility ecosystem, grouped into three categories: public sector agencies, private sector organisations and international development partners. The sampling frame was compiled from institutional records of technical, managerial and planning personnel in these institutions. Using Yamane's (1967) formula at a 5% margin of error, a sample of 263 respondents was obtained. A multistage sampling procedure was applied. In the first stage, the 20 institutions were purposively selected because they hold mandates or play operational roles in Nairobi's urban mobility. In the second stage, respondents were stratified by stakeholder category, and the sample was allocated proportionately to each stratum's share of the population. In the third stage, respondents were selected from each stratum by simple random sampling.

Table 1: Sample Size

Stakeholder Category	Agency	Population	Sample	Percentage
Private Sector	Matatu Owners Associations	13	4	1.7%
	Critical Mass Nairobi	16	6	2.1%
	Investment Banks	105	36	13.7%
	Kenya Private Sector Alliance	24	8	3.1%
	Kenya Association of Building and Civil Engineering Contractors (KABCEC)	25	9	3.3%
Sub-Total		183	63	23.9%
Public Sector	Nairobi Metropolitan Area Transport Authority (NaMATA)	28	10	3.7%
	Kenya Urban Roads Authority (KURA)	41	14	5.4%
	Kenya Roads Board	41	14	5.4%
	Kenya National Highways Authority	44	15	5.8%
	Transport and Public Works - Nairobi City County Government (NCCG)	39	13	5.1%
	Public Procurement Regulatory Authority (PPRA)	41	14	5.4%
	National Transport and Safety Authority (NTSA)	25	9	3.3%
	Public Private Partnership Directorate	8	3	1.0%
	Engineers Board of Kenya	35	12	4.6%
	Kenya Railways Corporation	58	20	7.6%
	National Environmental Management Authority (NEMA)	46	16	6.0%
	National Construction Authority	73	25	9.5%
Sub-Total		479	165	62.6%
International Partners	World Bank Group	17	6	2.2%
	Japan International Cooperation Agency	13	4	1.7%
	African Development Bank Group	11	4	1.4%
	European Investment Bank (EIB)	10	3	1.3%
	German Development Bank	12	4	1.6%
	French Development Agency	12	4	1.6%
	Department For International Development Kenya (DFID)	13	4	1.7%
	China-Exim Bank	15	5	2.0%
Sub-Total		103	35	13.5%
Grand Total		765	263	100.0%

Research Instrument and Measurement

Primary data were collected using a structured questionnaire with five-point Likert-scale items (1 = strongly disagree to 5 = strongly agree). Intellectual resource configuration was measured with items covering human capital, structural capital and relational capital. The item scores were averaged into a composite score for intellectual resource configuration. Urban mobility outcomes were measured with items on perceived safety, efficiency and reliability, and averaged into a composite score.

Validity and Reliability

The instrument was pilot-tested on 26 respondents outside the main study area. Cronbach's alpha showed high internal consistency for intellectual resource configuration ($\alpha = .935$) and acceptable consistency for urban mobility outcomes ($\alpha = .665$). Face and content validity were assessed through

questionnaire review and evaluation by experts in transport planning, whose feedback was used to refine item wording.

Data Collection and Response Rate

Questionnaires were administered online. Of the 263 questionnaires distributed, 215 were returned complete and usable, a response rate of 81.7%.

Data Analysis

Data were analysed using SPSS version 30. Descriptive statistics, including means and standard deviations, summarised the study variables, while Pearson correlation and simple linear regression analyses examined the relationship between intellectual resource configuration and urban mobility outcomes. Before inferential analysis, linearity and homoscedasticity were examined using a scatterplot of standardised residuals against standardised predicted values, and the normality was examined using a histogram. Statistical significance was evaluated at the 5% level (two-tailed), and 95% confidence intervals are reported for the regression coefficients.

Ethical Considerations

Ethical approval was obtained from the USIAU-A Institutional Scientifica and Ethical Review Committee (approval no. USIU-A/ISERC/US1221-2025). A research licence was obtained from the National Commission for Science, Technology and Innovation (NACOSTI) (licence no. 348383). Written permission to collect data was obtained from the management of each participating institution. Participants received an information sheet explaining the purpose of the study, its voluntary nature and their right to withdraw at any time without consequence. Each participant gave written informed consent before completing the questionnaire. No names or identifying details were collected; responses were reported only in aggregate, and the data were stored securely, accessible only to the research team.

Results

Strategic Intellectual Resource Configuration

Table 1 presents the means and standard deviations for the items measuring the three dimensions of intellectual resource configuration and the composite scores for both study variables. All items were rated on a five-point scale (1 = strongly disagree, 5 = strongly agree).

Human Capital Configuration

Human capital configuration plays a significant role in shaping urban mobility outcomes3.79 (SD = 1.24). Perceptions among respondents depicted stable perceptions with leadership support recording the highest mean (M = 3.90, SD = 1.27), followed by availability of skilled professionals (M = 3.83, SD = 1.32) which was considered to improve efficiency. Effective succession planning (M = 3.79, SD = 1.16) was positively rated, suggesting that continuity in staffing and leadership reduces delays in urban transport projects. The lowest SD showed the strongest consensus among respondents on the value of succession planning. The lowest mean score was obtained by high staff turnover undermining reliability (M = 3.64, SD = 1.20) indicating that respondents perceived it as less pronounced compared to other factors, with a relatively moderate SD as shown in Table 1.

Structural Capital Configuration

Findings indicated an average mean score of 3.81 (SD = 1.23) showing respondents' agreement that structural capital configuration significantly contributes to urban mobility outcomes. In particular, transparent procurement systems recorded the highest mean (M = 3.89, SD = 1.23), followed by strong organisational systems improving coordination (M = 3.84, SD = 1.25) and standardised procedures reducing project delays (M = 3.76, SD = 1.22). The item that integrated knowledge-sharing platforms

enhance collaboration among stakeholders scored (M = 3.76, SD = 1.23). These findings highlight the importance of formal systems, processes, and information-sharing mechanisms in improving efficiency and coordination across the urban mobility ecosystem. These results are presented in Table 2.

Relational Capital Configuration

Relational capital was found to significantly and positively influence urban mobility outcomes. The moderate standard deviation suggests a fair level of agreement across respondents. Partnerships with private sector actors improving innovation recorded the highest mean (M = 3.86, SD = 1.19), indicating strong agreement that collaboration with private entities fosters innovation in urban transport systems, with a correspondingly low SD reinforcing that this was among the most consistently held views in the construct. Similarly, respondents agreed that long-term relationships among stakeholders improve effectiveness (M = 3.82, SD = 1.13), highlighting the importance of sustained partnerships in achieving better mobility outcomes, and this item recorded the lowest SD in the construct, indicating the strongest consensus among respondents, suggesting a widely and consistently shared appreciation for the value of long-term stakeholder relationships. Collaboration with international development partners enhancing technical capacity scored (M = 3.77, SD = 1.22) while community engagement contributing to inclusive mobility outcomes scored (M = 3.77, SD = 1.26). The findings underscore the value of external partnerships and community involvement in strengthening both the technical and social dimensions of urban mobility systems. These results are presented in Table 1.

Table 2: Strategic Intellectual Resource Configuration

Human Capital Configuration	**Mean**	**SD**
Availability of skilled professionals improves the efficiency of urban mobility projects.	3.83	1.32
High staff turnover undermines the reliability of urban mobility services.	3.64	1.20
Leadership support is critical in aligning human capital with mobility outcomes.	3.90	1.27
Effective succession planning minimises delays in urban transport project implementation.	3.79	1.16
Average	**3.79**	**1.24**
Structural Capital Configuration		
Strong organisational systems improve coordination of urban mobility projects.	3.84	1.25
Standardised procedures reduce project delays in transport infrastructure delivery.	3.76	1.22
Integrated knowledge-sharing platforms enhance collaboration among mobility stakeholders.	3.76	1.23
Transparent procurement systems strengthen the long-term success of transport projects.	3.89	1.23
Average	**3.81**	**1.23**
Relational Capital Configuration		
Partnerships with private sector actors improve innovation in urban transport systems.	3.86	1.19
Strong collaboration with international development partners enhances technical capacity for mobility projects.	3.77	1.22
Community engagement contributes to more inclusive urban mobility outcomes.	3.77	1.26
Long-term relationships among stakeholders improve effectiveness of urban mobility programmes.	3.82	1.13
Average	**3.81**	**1.20**

Urban Mobility Outcomes

Perceptions of urban mobility outcomes were less favourable than those of intellectual resources and differed across the three dimensions. Mobility efficiency was rated highest (M = 3.61, SD = 1.19), particularly the efficient use of transport resources (M = 3.79, SD = 1.18) and the adoption of smart

traffic management systems (M = 3.77, SD = 1.13). Shorter travel times received weaker agreement (M = 3.41, SD = 1.25). Mobility reliability was rated moderately (M = 3.38, SD = 1.25). Respondents agreed that route design (M = 3.61, SD = 1.16) and real-time information systems (M = 3.51, SD = 1.21) support reliability, but tended to disagree that public transport meets commuters' time expectations (M = 2.74, SD = 1.38), the lowest-rated item in the study. Mobility safety was rated lowest (M = 3.03, SD = 1.26), indicating neutral views. Ratings were least favourable for the adequacy of infrastructure for road-user safety (M = 2.88, SD = 1.28), and views on whether safety measures address vulnerable groups were the most divided (M = 3.01, SD = 1.39). Overall, respondents viewed efficiency more positively than reliability and safety, with service punctuality and infrastructure safety emerging as the weakest areas. These results are presented in Table 3.

Table 3: Urban Mobility Outcomes

Urban Mobility Outcomes	Mean	SD
Mobility safety		
Existing transport infrastructure adequately enhances safety for all road users in Nairobi	2.88	1.28
Safety audits and enforcement measures have reduced accidents in urban transport	3.1	1.2
Integration of technology has improved safety in Nairobi's transport system	3.12	1.15
Current safety measures address the needs of vulnerable groups such as pedestrians, children and persons with disabilities	3.01	1.39
Average	**3.03**	**1.26**
Mobility reliability		
Public transport services in Nairobi meet commuter time expectations	2.74	1.38
Real-time information systems improve predictability of travel times	3.51	1.21
Route design contributes to reliable urban mobility in Nairobi	3.61	1.16
Reliable transport services encourage more people to use public transport instead of private vehicles	3.66	1.25
Average	**3.38**	**1.25**
Mobility efficiency		
Transport system makes optimal use of available road space and infrastructure to reduce congestion	3.49	1.19
Commuters experience shorter travel times due to efficiency improvements in public transport services	3.41	1.25
Adoption of smart traffic management systems enhances efficiency	3.77	1.13
Efficient use of transport resources improves service delivery	3.79	1.18
Average	**3.61**	**1.19**

Regression Assumptions

The linearity assumption was assessed using a scatter plot of Intellectual Resource Configuration against Urban Mobility Outcomes. The scatter plot revealed a positive upward trend, with the observations clustering around the fitted regression line. No noticeable curvilinear or non-linear patterns were observed, indicating that the relationship between the variables was linear. Therefore, the linearity assumption was satisfied, supporting the application of linear regression analysis in examining the influence of intellectual resource configuration on urban mobility outcomes.

The normality assumption was assessed using a histogram with a superimposed normal distribution curve. The distribution of Intellectual Resource Configuration scores exhibited a bell-shaped pattern, with most observations clustered around the mean and gradually tapering toward both tails. The data were considered normally distributed, and the normality assumption was deemed satisfied for subsequent regression analysis.

The homoscedasticity assumption was assessed using a scatter plot of standardised residuals against standardised predicted values. The plot showed that the residuals were randomly scattered around the zero line with no discernible funnel-shaped or systematic pattern. The spread of the residuals remained constant across the range of predicted values, indicating that the variance of the error terms was equal. Therefore, the assumption of homoscedasticity was satisfied, confirming the suitability of the regression model for further analysis.

Correlation between Intellectual Resource Configuration and Urban Mobility Outcomes

Pearson correlation analysis examined the relationship between intellectual resource configuration and urban mobility outcomes in Nairobi City, Kenya. The findings indicate a moderate positive correlation between intellectual resource configuration and urban mobility outcomes ($r = 0.549$, $p < 0.05$). This suggests that improvements in intellectual resources, such as human capital, structural systems, relational networks, and knowledge assets, are associated with improvements in urban mobility outcomes, including safety, reliability, and efficiency. These results are presented in Table 4.

Table 4: Correlation between Intellectual Resource Configuration and Urban Mobility Outcomes

		Urban Mobility Outcomes	Intellectual Resource Configuration
Urban Mobility Outcomes	Pearson Correlation	1	.549*
	Sig. (2-tailed)		0
Intellectual Resource Configuration	Pearson Correlation	.549**	1
	Sig. (2-tailed)	0	

* Correlation is significant at the 0.05 level (2-tailed).

Regression on Intellectual Resource Configuration and Urban Mobility Outcomes

A regression model was estimated to examine the effect of intellectual resource configuration on urban mobility outcomes in Nairobi City, Kenya. The analysis was undertaken to determine the extent to which variations in intellectual resource configuration predict changes in urban mobility performance indicators within the study context. The coefficient of determination ($R^2 = 0.302$) shows that approximately 30.2% of the variation in urban mobility outcomes is explained by intellectual resource configuration. This indicates that intellectual resources are an important predictor, though a proportion (69.8%) of the variation is influenced by other factors not included in the model. These results are presented in Table 5.

The ANOVA was used to determine the significant of the model in examining the effect of intellectual resource configuration on urban mobility outcomes in Nairobi City, Kenya. The results indicate that the regression model is statistically significant ($F(1, 213) = 91.963$, $p < 0.05$). This implies that intellectual resource configuration significantly predicts urban mobility outcomes and that the model provides a better fit. These results are presented in Table 5.

The unstandardised coefficient for intellectual resource configuration ($B = 0.283$, $p < 0.05$) shows that one-point higher score on intellectual resource configuration was associated, on average, with a 0.283-point higher score on urban mobility outcomes. This confirms a positive relationship between the variables. The t-value ($t = 9.59$, $p < 0.05$) indicates that the effect of intellectual resource configuration is statistically significant, meaning it is unlikely to have occurred by chance.

The regression equation was expressed as:

$$\textit{Urban Mobility Outcomes} = 2.382 + 0.283 \times \textit{(Intellectual Resource Configuration)}$$

The null hypothesis (H_0) stated that intellectual resource configuration has no significant influence on urban mobility outcomes in Nairobi City, Kenya. Based on the results, the t-statistic (t = 9.59) is significant at $p < 0.05$, which is less than the threshold of 0.05. Therefore, the null hypothesis is rejected and concluded that intellectual resource configuration had a moderate positive association with perceived urban mobility outcomes. These results are presented in Table 5.

Table 5: Regression Model

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.549a	0.302	0.298	0.53944

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	26.761	1	26.761	91.963	.000b
	Residual	61.982	213	0.291		
	Total	88.742	214			

Coefficients

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.382	0.107		22.226	.000
	Intellectual Resource Configuration	0.283	0.03	0.549	9.59	.000

a Dependent Variable: Urban Mobility Outcomes
b Predictors: (Constant), Intellectual Resource Configuration

Discussion

This study examined whether strategic intellectual resource configuration is associated with urban mobility outcomes in Nairobi City. Consistent with the study hypothesis which stated that strategic intellectual resource configuration is positively associated with urban mobility outcomes in Nairobi City, the overall configuration of human, structural and relational capital had a moderate positive association with perceived urban mobility outcomes (r = .549) and accounted for 30.2% of their variance. This is consistent with studies linking components of intellectual capital to organisational outcomes, including Mubarik et al. (2020), who report a contribution of human capital to organisational performance; Matute-Petroche et al. (2023), who examine the contribution of relational capital; and Khan et al. (2024), who link human resource configurations with innovation capacity. However, those studies examine individual components or mediating paths. The present study tested intellectual resources as a single combined configuration, so its findings cannot show which dimension contributes most. The agreement may be explained by the knowledge-intensive nature of urban mobility management, where planning, engineering, traffic management, data analysis and policy coordination require specialised expertise. It is also consistent with Torosyan et al. (2020), one of the few studies in the transport sector, who argue that workforce planning and capacity-building can improve operational efficiency. The results therefore support the proposition that the performance of transport systems depends partly on the ability of institutions to acquire, retain and deploy relevant knowledge and skills.

The finding also corresponds with Kraja and Spahija (2023), who emphasise the importance of leadership and human capital development in public sector performance. The study extends this literature by treating intellectual resources as a configuration of human, structural and relational capital rather than concentrating on human capital alone. This broader conceptualisation is important

because individual expertise may have limited organisational value if it is not embedded in systems, routines and relationships that allow knowledge to be shared and applied. Ali et al. (2023) associate institutionalised processes with accountability and performance, while Pedraza Melo and De la Gala Velásquez (2022) show that structural capital can strengthen the contribution of human capital to organisational performance. The present findings are consistent with this argument, although the study did not test how the three dimensions interact.

The findings are also consistent with ROT (Sirmon et al., 2007, 2011), which holds that value depends on how resources are structured, bundled and leveraged rather than on their mere possession. The study measured the configured level of intellectual resources rather than orchestration actions. Its positive association with outcomes is nonetheless what ROT would predict if Nairobi's mobility institutions differ in how effectively they build, integrate and deploy their knowledge resources. Recruitment and training (structuring), the integration of systems and procedures (bundling) and the application of expertise across agencies (leveraging) are plausible mechanisms, but they were not measured and remain to be tested directly. This interpretation also accords with Helfat and Peteraf (2009), who argue that outcomes depend on how capabilities are developed and deployed over time. In Nairobi's context, the ability of agencies to coordinate skilled personnel, institutional systems and stakeholder networks is likely to be especially important because responsibility for mobility is shared among NaMATA, KURA, NTSA and the county government, and weak coordination among these agencies has been reported (Chore et al., 2021).

The descriptive results add context to these findings. Respondents rated mobility efficiency more favourably than reliability and safety, and the lowest-rated items concerned the punctuality of public transport and the adequacy of infrastructure for road-user safety. These perceptions are consistent with evidence of persistent peak-hour congestion in Nairobi (Salon & Gulyani, 2019). Moreover, intellectual resource configuration left 69.8% of the variance in outcomes unexplained, which is consistent with the view that infrastructure, funding and technology also shape urban mobility.

Conclusion

The study concluded that intellectual resource configuration is a significant determinant of urban mobility outcomes. It was also concluded that effective deployment of human capital, particularly skilled personnel, leadership support, and succession planning, enhances operational efficiency and continuity in mobility projects. Similarly, well-developed structural capital, including transparent procurement systems, standardised procedures, and integrated knowledge-sharing platforms, strengthens coordination, reduces inefficiencies, and improves accountability in project implementation. Relational capital further contributes by fostering collaboration with private sector actors, development partners, and local communities, thereby enhancing innovation, technical capacity, and inclusivity in urban transport systems. The findings demonstrate that intellectual resources are not only individually important but also mutually reinforcing, and their effective configuration significantly improves urban mobility outcomes in Nairobi. Consequently, the null hypothesis that intellectual resource configuration has no significant influence on urban mobility outcomes was rejected. The study therefore concludes that strengthening human, structural, and relational capital significantly contributes to improved urban mobility outcomes in Nairobi City.

Given the positive association between intellectual resource configuration and perceived mobility outcomes, and since the dimensions were not tested separately, the following recommendations are directed at strengthening the configuration as a whole rather than prioritising any one dimension. Urban mobility institutions, including NaMATA, KURA, NTSA and the Nairobi City County Government, should develop human, structural and relational capital together rather than in isolation. For example, capacity-building programmes for planning and engineering staff could be linked to

documented procedures and shared data systems, so that expertise is retained within institutions and accessible to partner agencies. Because reliability and safety received the lowest ratings, efforts to strengthen intellectual resources should be directed first at these areas, for instance by using inter-agency coordination arrangements to improve the punctuality of public transport services and the safety of infrastructure for pedestrians and other vulnerable road users. Institutions should also monitor objective indicators of mobility outcomes, such as travel times, service punctuality and road-crash data, alongside measures of their intellectual resources. This would allow agencies to judge whether investments in skills, systems and partnerships are followed by measurable improvements,

Several limitations should be considered when interpreting these findings. The cross-sectional correlational design establishes association but not causation, and reverse or reciprocal relationships cannot be ruled out. Both variables were measured through perceptions reported by the same respondents in a single instrument, which raises the risk of common-method bias. Many items were phrased as statements about the value or effects of intellectual resources, so they may capture respondents' beliefs about their importance rather than the actual configuration within institutions. No objective mobility indicators were used, and the pilot reliability of the outcome scale ($\alpha = .665$) was below the conventional .70. The study measured the configured level of intellectual resources rather than the orchestration processes proposed by ROT, the three dimensions were not tested separately or jointly, and no control variables were included. Institutions were selected purposively, and respondents were clustered within 20 institutions; because this clustering was not modelled, standard errors may be understated. Normality of residuals was not formally tested, and there was some indication of unequal residual spread and one potentially influential case. Finally, the study was confined to one city, which limits generalisation.

Future research should use longitudinal designs and objective indicators, such as travel-time, punctuality and road-crash data, to establish the direction of the relationship. Multi-source data, with configuration and outcomes reported by different respondents, would reduce common-method bias. Multilevel or cluster-robust estimation would account for the nesting of respondents within institutions. Future studies should also test human, structural and relational capital separately and jointly, measure orchestration processes directly, and include control variables and other resource configurations, such as financial, physical and technological resources. Comparative studies across Kenyan and other African cities would show whether the association holds in other urban contexts.

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Data Availability Statement

The data supporting the findings of this study are available from the corresponding author on reasonable request. The data are not publicly available because of confidentiality assurances given to participants and participating institutions during data collection.

Competing Interests

The author(s) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.