THE IMPACT OF TRANSPORTATION AND LOGISTICS ON SUSTAINABILITY IN RAIPUR.

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ABSTRACT

This research paper examines the challenges and opportunities of implementing a sustainable transportation and logistics practices in Raipur, based on economic, social and environmental dimensions. Being the capital of Chhattisgarh, industrial and logistics hub located at strategic point in central India, Raipur's rapid industrialization, urban expansion and current state of infrastructures has led to challenges like over reliance of fossil-fuels powered vehicles, creating public concerns about high energy consumption and significant carbon emissions, limited accessibility by sub-urban and rural communities and environmental degradation. The dominance and convenience of rail-road transportation networks in Raipur necessitated the need to established inter-modal transport and logistics system to integrate and promote sustainable transport and logistics services, enhancing operational efficiency, fostering inclusive accessibility to transportation networks by marginalized communities, and optimizing the overall supply chain. Using both quantitative and qualitative approaches, the data collected is analyze to assess the cost implication, technology involved and sustainable policy frame work

for eco-friendly practices. Additionally, the primary objectives of this research study is to explore possibilities of adopting to renewable energy such as Electric Vehicles (E. Vs) and energy-efficient technologies, alongside leveraging opportunities for achieving urban resilience and long-term development. The findings underscore the need for public awareness, public-private engagements and robust regulatory framework to promote the adoption of green logistics practices. The study concludes with offering useful insights for stakeholders on how to balance economic growth with environmental preservation.

Keywords: Transportation, Logistics, Sustainability, Industrialization, Urbanization, Renewable Energy, Electric Vehicles, Supply Chain and Eco-friendly

INTRODUCTION

Transportation and logistics play essential role in modelling the sustainability of metropolitan hubs, particularly in fast emerging municipalities like Raipur, India. It appeared as a vibrant commercial and economic heart, accommodating an extensive array of industries comprising cement, steel, coal and Agriculture. Additionally, the city's speedy economic growth and industrial development have posed momentous challenges to its transport and logistics systems, directly affecting sustainability across economic, social and environmental magnitudes. Understanding the relationship among these aspects is vital to addressing the challenges and coupling the prospects that transport and logistics contributes for sustainable growth and development.

Transportation and logistics systems in developing economies are fundamental to nurturing trade and commerce, enhancing accessibility[2] (Banerjee & Dey, 2021). The strategic location of the Raipur and its connectivity with countrywide public roads and railways have made it a focal point for business in central India. However, the state of the current infrastructures is repeatedly stressed by growing demand of industrial and urban expansion, creating commuter traffics, late deliveries and incurred extra operational costs[17] (Kumar et al., 2022). The complications posed environmental challenges, increase carbon footprint and deter economic well-being.

Economically, the significant contribution of transportation and logistics towards economic development lies upon uninterrupted flow of goods, services and people from one geographical location to another. Bottlenecks in transportation and logistics can increase operational costs, minimizing economic competitiveness and deterring economic growth. Transportation and logistics accounted for approximately 14% of the

India's GDP, alongside 8-10% in developed countries[35].(World Bank, 2022). In contrast, high transportation and logistics costs, including inefficient supply chain networks have been discovered as a barrier to Raipur's economic growth and development[28](Singh et al., 2021).

The social perspective of transport and logistics systems involves determining an inclusive availability and accessibility to indispensable amenities, jobs creation and community space. The insufficient incorporated urban development planning has led to irregular economic growth, with rural areas habitually under-served by transportation networks[27] (Sharma, 2020). These social inequalities aggravate and worsening infrastructure gaps, restraining the opportunity and prospects for inclusive growth. Additionally, the intensification of emissions from means of transportation as a result of inappropriate transportation and logistics processes has led to deteriorating air value, unpleasantly distressing community health[14] (Ghosh et al., 2021). Substituting these challenges with opportunities demand a strategic approach that sustainably balances social justice with economic and environmental preservation.

From environmental context of transportation and logistics systems in Raipur, indicated over dependence on diesel and other fossil fuel-powered vehicles, which significantly contributes to greenhouse gas emissions, undermining efforts to combat warming and climate change[29] (Singh & Gupta, 2022). Moreover, the natural resources of the city are in alarming condition due to increased level of pollution, resulting from limited and insufficient waste management practices in the sectors such as recycling, reutilization and remanufacturing. In contrast, the opportunities that challenges present lies upon transition to eco-friendly practices such as electric vehicles, route optimization and promoting multi-modal transportation system across supply chain[23] (Patel & Roy, 2023).These tactics and measures could possibly conserve the environment while improving the most effective and resilient transport and logistics operation.

The government of India under ministry of urban development (2019) introduced smart city mission initiatives for developing freight corridors, offering foundation for addressing systemic inefficiencies in emerging cities of India[20]. Raipur and other cities in central India are expected to seize this opportunity to develop urban centers with sustainable practices. Consequently, the emergence of advanced technologies and innovation such as artificial intelligence(AI), internet of things (IOT) and machine learning provides some practical solutions for real-time tracking and streamlined logistics operations[6] (Chaudhary et al., 2021). By carefully understanding and implementing these

opportunities, Raipur can retain its position as a smart and model city in Chhattisgarh and central India, including achieving a long-term sustainable developmental goal.

Objectives of the Study

1. To analyze the impact of economic, social and environmental dimensions of transportation and logistics sustainability in Raipur.
2. To investigate the current state of transportation and logistics infrastructures in Raipur.
3. To explore challenges and opportunities of adopting sustainable transportation and logistics practices.
4. To provide actionable suggestions and recommendations for stakeholders on how to implement sustainable practices in Raipur.

Research Questions

1. What are the economic, social and environmental dimensions of sustainability in Raipur.
2. To what extent the present condition of transportation infrastructures in Raipur affects supply chain.
3. What are the type of vehicles commonly used in Raipur transport and logistics operation.
4. How Raipur's transportation challenges can be transforms into opportunity for its growth and development.
5. To what extent industries, businesses and communities in Raipur adopt eco-friendly practices.

This research study is limited to Raipur and its locality, but the finding can be useful to other developing cities and regions of India and beyond. Global, regional and national regulations, including trends and patterns will be discussed, focusing and emphasizing on Raipur and its locality. Raipur's transportation and logistics is ravaged by sustainability challenges which motivates the researcher to examine and address through identifying opportunities that would substitute these challenges with sustainable practices to Raipur's transportation and logistics.

This research is significance to Raipur's economic, social and environmental aspects of transportation and logistics sustainability. Consequently, the study is essential for the following:

1. Provide deep understanding of the role transportation and logistics services on economic, social and environmental sustainability of Raipur.
2. Exploring the current condition of Raipur's infrastructures and their implication on transportation and logistics operation.
3. Supplementing and enlightening stakeholders in making strategic decisions about the adoption of eco-friendly practices.
4. To advice policy makers to review sustainability policies, including offering incentives, subsidies and tax exemption to industries and businesses that adopt sustainable practices.
5. Recommending action plans to serve as case study for other cities in Chhattisgarh and beyond.

The findings of this study will provide a practical recommendation addressing sustainability challenges with potential opportunities, while contributing to academic discourse to Raipur's transportation and logistics sector.

LITERATURE REVIEW

Transportation and logistics are essential ingredient of economic growth and development of any economies, impacting economic, social and environmental sustainability. Raipur, the capital of Chhattisgarh with fast growing industries such as steel, coal, cement, agriculture etc, including its position as logistics hub in central India, experiences aa array of transportation and logistics challenges, comprising insufficient infrastructure, carbon emissions and traffic congestion. The implementation and integration of transportation and logistics sustainability practices can be crucial for addressing these challenges. The existing literature of the study will be review to provide a detailed and valuable insights and their implication to Raipur's sustainable development goals.

Economic Aspect of Transportation and Logistics

The foundation and fundamentals of any economic growth and development is cos-effective logistics system, facilitating trade, reducing operational costs and improving supply chain performance. Kumar & Sharma (2023) argued that integrating logistics operations plays a crucial role in reducing lead-time and enhancing operational efficiency in Indian cities[18]. Consequently, study by Singh et al. (2021) indicated that high transportation costs because of insufficient transport infrastructure deter economic growth and development in tier-2 cities such as Raipur[31]. Absence of intermodal and

multimodal transport alternatives, including higher transportation costs further exacerbates the insufficiencies, leading to delays in deliveries[11](Das et al., 2023). The emergence of advanced technology in logistics system such as block chain, IOTs, and e-commerce imposes additional pressure on the system. Gupta and Varma (2021) suggested the need to digitalized transportation and logistics routes, automating warehouses and managing demands through sustainable practices[15]. There is however limited adoption of sustainability practices in Raipur and other emerging cities due to costs, technical expertise and policy.

Social Context of Transportation and Logistics

Social equity and justice such as access to jobs, healthcare services, education and other relevant social amenities is significantly affecting transportation and logistics operation. Limited economic opportunities, and inadequate transportation and logistics options in Indian cities is significantly impacting marginalized communities in sub-urban and rural areas, limiting their mobility and access to transport amenities[1](Banerjee et el., 2020). Residents in Raipur relied heavily on private vehicles due to lack of adequate public transport networks, thereby increasing traffic congestion and social inequalities[9] (Chakraborty et al., 2022). Additionally, Rana et al. (2022), highlighted that improper planning of freight movement contributes safety risks, air and noise pollution, affecting quality of life negatively in residential areas[25]. The integration of motorized and non-motorized transport alternatives can be regarded as option for addressing these issues with inclusive focus on urban infrastructural planning[32](UN-Habitat, 2022).

Environmental Aspect of Transportation and Logistics

Greenhouse gas emissions, resource conservation, consumption and preservation are fundamental aspects of environmental impact of transportation and logistics system. The substantial share of India's carbon footprint is generated from logistics sector, with significant contribution from urban centers due to inefficient transport system and vehicular emissions[21] (MoEFCC, 2023). Subsequently, Das et al. (2023) emphasized the need for adopting eco-friendly logistics practices to reduce these impacts through the use of electric vehicles (E.Vs) and renewable energy-powered warehousing[12]. Similarly, waste management in logistics, such as recycling, sustainable packaging and last-mile delivery is constantly remains as significant challenge. Chakraborty et al. (2022) suggested the importance of sustainable logistics practices such as sustainable packaging and circular economy principles for mitigating environmental degradation through promoting favourable policies[8].

Global Experience and Local Transition of Sustainable Transport and Logistics

According to UN-Habitat index (2022), European cities reduces their pollution and traffic congestion by successfully implementing low-emissions zones and congestion pricing techniques[32]. This global perspective would provide valuable insights for addressing Raipur's transportation and logistics challenges. Implementing these sustainable practices in Raipur, other cities and India in general requires significant consideration of local socio-economic condition and stakeholder's participation.

The Role of Policy and technological Innovations on Transportation and Logistics

The integrated urban planning and the use of technology to address urban mobility challenges underscore the need to implement Smart City Mission in Indian emerging cities like Raipur[16](Gupta & Varma, 2021). However, an efficient and effective sustainable policy and governance plays critical role in promoting sustainability practices in transportation and logistics systems. Implementing policies usually experiences shortcomings and delays as a result of the bureaucracy involved and resource constraints[26] (Rana et al., 2022). In abstract, the emergence of advanced technologies in transportation and logistics sector like AI-enabled solutions, automations, GPS, WMS, TMS etc, enable real-time tracking and foster transparency in the overall supply chain, reducing bottlenecks and enhancing customer satisfaction[33] (World Bank, 2022). Moreover, Singh et al. (2021) argued that ensuring effective implementation of these technological interventions must be compiled with capacity-building initiatives[30].

This literature review explores multifaceted connection between economic, social and environmental dimensions of transport and logistics sustainability. Despite the challenges faced by transportation and logistics in Raipur, opportunities exist to promote sustainable practices through transition to renewable energy, policy reforms and public-private engagements.

METHODOLOGY

The study adopts a mixed-method of research approach integrating quantitative and qualitative data to explore the challenges and opportunities of sustainable transportation and logistics practices in Raipur, based on economic, social and environmental dimensions. Questionnaires were used to collect quantitative data from the respondents, alongside interviews conducted for qualitative insights of data. The aim of

applying this research approach is to provide comprehensive analysis by combining numerical data with in-depth perspectives from stakeholders.

Research Design

A descriptive research designed is employed to examine the present condition of transportation and logistics system and their impact on its economic growth and development. This design will guide the research in identifying patterns, challenges and opportunities, while laying a foundation for actionable recommendations[10] (Creswell & Creswell, 2018).

Population Sample

The population samples of this research comprises 85 participants selected randomly based on stratification with a limited demographical segments to capture the perspectives and experience of daily users of transport and logistics services, while reducing bias. A questionnaire containing demographic information and closed ended questions on economic, social and environmental impact of transportation and logistics services in Raipur. The distribution method is online and in person respectively, allowing participants share their views while facilitating statistical analysis[5] (Bryman, 2016).

Similarly, to reinforce and back-up the data for guiding the study, a semi structured interview is conducted among stakeholders in the logistics sectors, including environmental experts, transport managers, truck drivers, to gather their in-depth insights and experience over transportation and logistics practices. To maintain consistency across the interview, the questions targeted stakeholders' deep knowledge and experiences, perceptions challenges faced and opportunities for switching to renewable energy. A specific theme is explored with participant's consent to transliterated the demographic profile of the participants for data analysis.

DATA ANALYSIS

A quantitative analysis using descriptive statistics was employed to determine frequencies and percentages alongside rating the transportation and logistics systems. This statistical tool also examines the relationship between economic growth and environmental sustainability[24] (Pallant, 2020). Moreover, the qualitative data analysis conducted identifies recurring themes and patterns related to the challenges and opportunities in Raipur's transportation and logistics sector[4] (Braun & Clarke, 2006).

The reliability and validity were enhanced by triangulating the qualitative findings with quantitative data.

The study sustained severe nationwide and recognize established ethical guidelines, including protecting privacy and discretion of interview participants. The sample size of this research provide only exploratory analysis but may not necessary capture all views of varied population in Raipur. This limits the completeness of the findings. There is a need to expand the sample size, incorporating longitudinal data to address these limitations in future research.

FINDINGS

The quantitative analysis of the data collected through questionnaires, presented economic, social and environmental impact of transport and logistics operation in Raipur. While the qualitative analysis capture contextual data from interview conducted with stakeholders, focusing on the challenges and opportunities in transportation and logistics sustainability of Raipur. The results will be integrated with the existing literature to offer a practical solution for comprehensive understanding.

Demographic analysis of Questionnaire respondents

The study restricts the demographic credentials of the questionnaire respondents to only students, teachers, institutional staffs and households, including 60% males and 40% females respectively. By focusing on their gender, age and education due to their daily and frequent experience and usage of public transportation and logistics services.

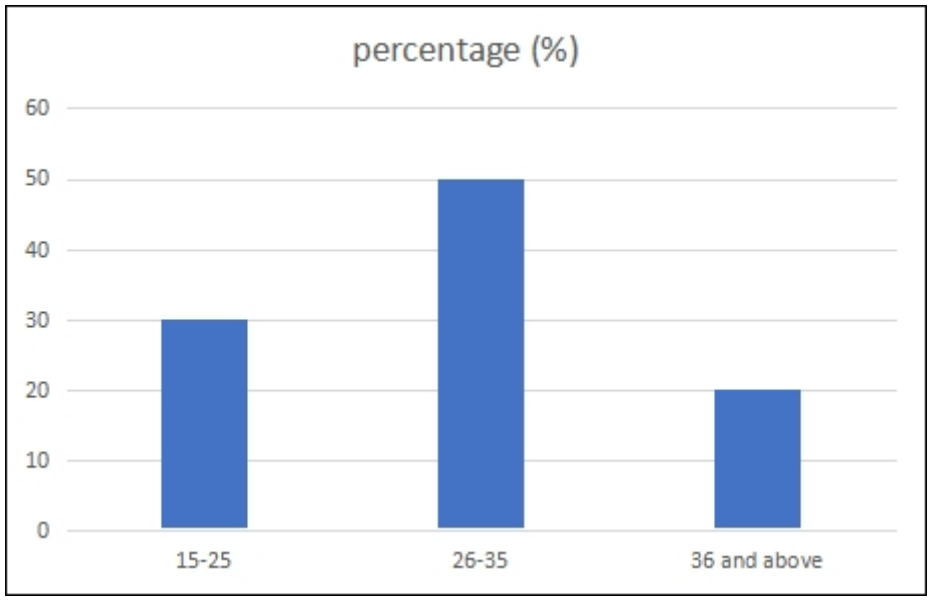
a. Educational status of the respondents

Status	*Percentage*
PG	***45%***
UG	***30%***
Others	***25%***

Table 1 : Education of the Respondents

Table 1 above, the data indicated that majority of the respondents possesses higher education, with the postgraduate as the highest with 50% and undergraduates 30% respectively. Consequently, others are households with the lowest response of 25% of findings

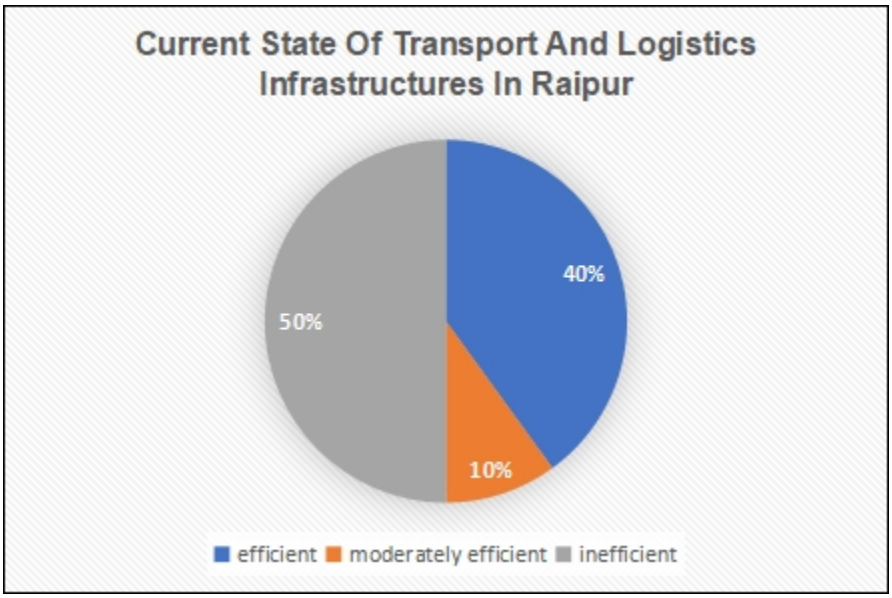
b. Age group of the respondent



Graph 1 : Age Distribution of the Respondents

Graph 1 above analyses the age distribution of the respondents, indicating significant responses of 55% between 26-35 age group. Respondents from 15-25 years are moderately participated with 35% responses, while the adults from 35 years and above with the lowest responses of 10% respectively.

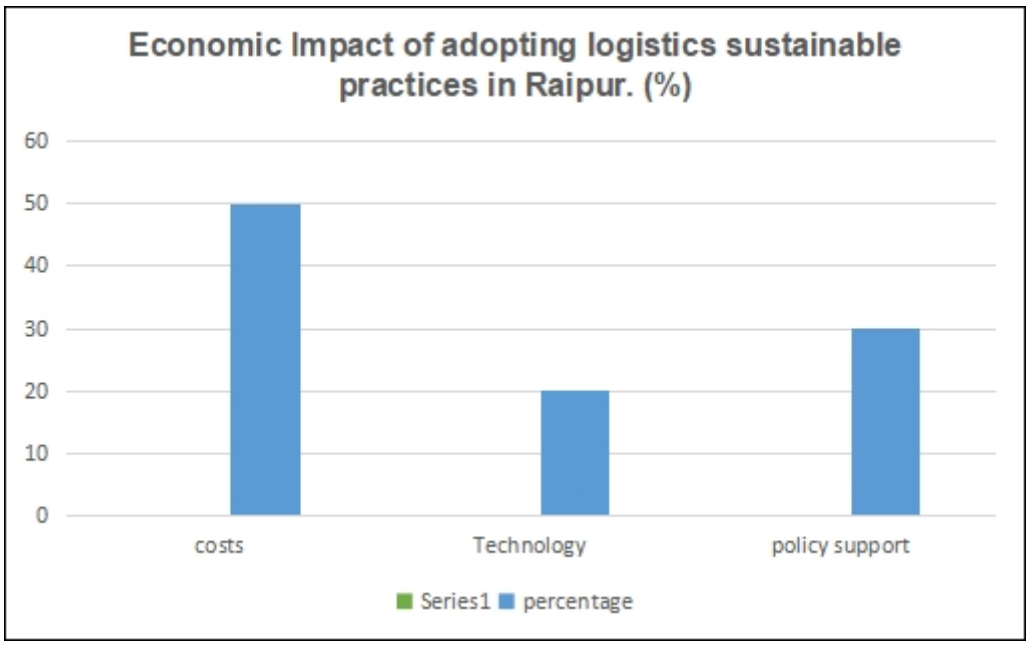
Current state Raipur's Transportation and Logistics System



Graph 2 : Raipur Transport Infrastructure

From the pie chart in *Graph 2* above indicated that 50% of the respondents rated the current state of Raipur's transport and logistics infrastructures as inefficient, alongside 40% opted for efficient and 10% considered their conditions as moderately efficient.

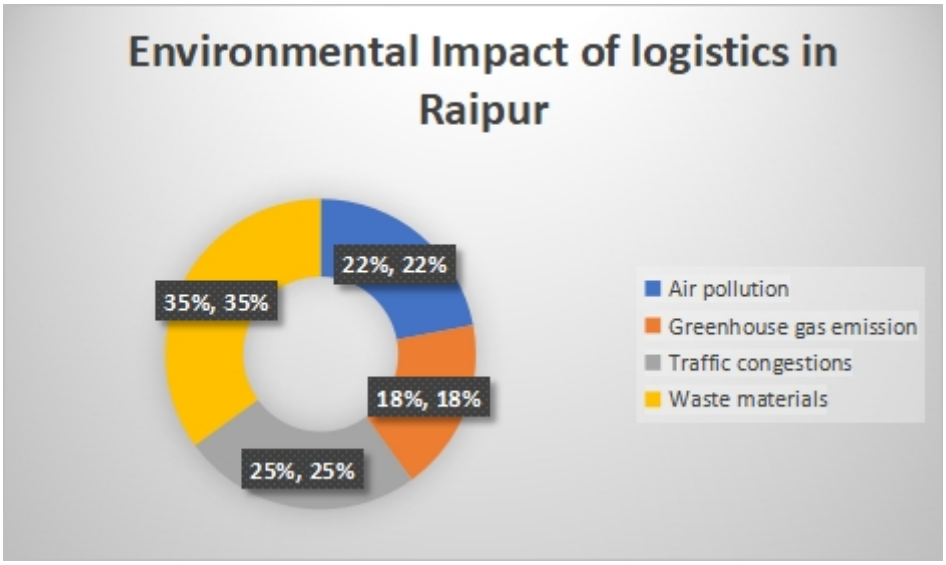
Economic Impact



Graph 3 : Economic Dimension

Graph 3 above illustrates data gathered from the respondents opinion on the possibilities of adopting renewable energy to mitigate the economic impact of transportation and logistics system of Raipur. Majority of the respondents emphasizes on costs of acquisition and implantation of green practices. Additionally, the average respondents claimed policy and government supports are part of the economic challenges, while the lowest portion of the responses sited technological complexity.

Environmental Impact of logistics in Raipur



Graph 4 : Environmental Impact

Data from environmental impact of Raipur's transportation and logistics system indicated that, air pollution and traffic congestion are mutually exclusive in providing major concerns on the environment, contributing 30% of climate change in Raipur city center. Other relationship from the remaining environmental data were 20% each among industrial emissions and waste materials.

Social Impact

Access to public transport services	***Percentages (%)***
Urban centers	***50***
Sub-urban centers	***30***
Rural areas	***20***

Table 2 : Social Perspective

The *Table 2* illustrated that 50% of the people in urban areas are dominantly enjoying essential amenities, unlike in sub-urban locations that perhaps moderately accessing transport and logistics services. The data also shows how rural communities are marginalized with only 20% of these transport services due to poorly condition of roads connectivity to rural areas, affecting delivery and overall supply chain.

The findings align with prior studies emphasizing the critical role of logistics efficiency in regional economic growth[34](World Bank, 2022). The high transportation costs and inadequate infrastructure are consistent with the challenges faced by developing urban centers in India[28](Singh et el., 2021). Addressing these issues through investment in

smart and green logistics, including infrastructure development that could significantly boost Raipur's economic prospects. Raipur's inclusion in India's smart cities mission presents a unique opportunity to address these challenges through innovative solutions and collaborative efforts[31].

Interview Analysis

The interview conducted with 20 stakeholders provide comprehensive insights of the challenges and opportunities impacting transportation and logistics sustainability in Raipur.

Challenges Identified

a) **Insufficient Infrastructure**: Insufficient infrastructures is the most crucial and challenging factor identified with common themes, comprising outdated vehicles and poor condition of roads. This led to traffic congestion and late deliveries, especially when transporting heavy or significant amount of materials over long distance as claimed by some truck drivers interviewed. Raipur's infrastructural conditions account for 40% of these challenges according to the data from the interview.

b) **Initial Costs**: The cost of switching to eco-friendly options and practices are considerably high which requires an aggregate capital investment as noted by an industry expert. This necessitates the need for collaborative efforts for implementing a green transport and logistics services.

c) **Technology**: The complexity and technological gap, including limited awareness are equally identified as barriers to implementing sustainable practices in Raipur's transportation and logistics services.

d) **Government policy and supports**: Some managers expresses their concerns about lack of favorable policies, incentives and supports to encourage industries, businesses and communities to switch to green practices for cleaner Raipur. One of the interviewee claimed that, the policies exist only on papers not in reality.

Opportunities

a) **Integrating Smart City Mission with sustainable transportation system**: Majority of the interviewee suggested the need to establish inter-modal transportation and logistics system to mitigate these environmental impact, connecting rail, road and waterways within the city, while decongesting the city and aligning Raipur's smart city initiative with Indian sustainable goals.

b) **Green Logistics**: The increasing global, regional and national advocacy provides a strong supports in promoting the use of electric vehicles (E.Vs) for long and short distance logistics operations. A logistics manager from the interviewee highlighted the need for the establishment of charging stations throughout Raipur to facilitate the transition program.

c) **Collaboration**: A significant number of the interviewees suggested the importance of public-private partnership to drive industry-wide gap through incentivizing the transition programs, while initiating policy changes and optimizing transportation and logistics route to enhance a sustainable practice in Raipur.

SUGGESTIONS AND RECOMMENDATIONS

The findings of this research proposed actionable suggestions for addressing the sustainability challenges and aligned the opportunities investigated among economic, social and environmental aspects. The suggestions are:

a) **Transformation and Expansion of the Existing Infrastructure** Raipur city should invest in inter-modal transportation system, logistics perks and smart transportation infrastructure in a strategic location within the city to consolidates logistics operation, while optimizing the overall supply chain. The inter-modal transport will connect rail, road and waterways, reducing high burden on a single mode and decongesting the city. The smart infrastructures such as GSP enabled fleet tracking, IOT based traffic management system to streamlined logistics operations. The smart city initiative can serve as frameworks for adopting these technologies and innovations[16] (Gupta & Varma, 2021).

b) **Promoting the Adoption of Eco-friendly Logistics**: Government should encourage the transition programs through offering incentives such as tax holiday or exemptions, or subsidies among others to promote the use of electric vehicles, biodegradable packaging and energy-efficient equipment in reducing fuel consumption and emissions. Additionally, dedicated charging stations at remote areas should be provided to facilitate the transition program[12](Das et al., 2023).

c) **Enhancing Affordable and Inclusive Public Transport Services**: Public mass transport services such as bus rapid transit (BRT) should be extended to underserved areas to enhance accessibility and ensure social justice. This

development can promote social equity and restore the quality of life for marginalized communities[3](Banerjee et al., 2020).

d) **Comprehensive Review of Urban Planning**: Raipur urban policy planning should be amended to address emissions and congestion control measures, including land use planning[19](Kumar & Sharma, 2023). The policy should focus on sustainability, inclusivity and efficiency.

e) **Stakeholder's Collaboration**: Public-private partnership with transparent processes and clear guidelines should be prioritized to ensure successful implementation[26] (Rana et al., 2022). This partnership is crucial for mobilizing funds and technical expertise for both infrastructure development and satisfactory service delivery.

This research study suggested a multifaceted dimensions of sustainability in Raipur's transportation and logistics system, including their roles in shaping sustainable development goal of Raipur. Similarly, the findings offer actionable insights for logistics providers, policy makers and public.

Recommendations

This study propose the following recommendations based on the findings and suggestion above to improve transportation and logistics sustainability practices in Raipur.

a) **Strategic Planning**: Incorporate a team comprising industry stakeholders, government, logistics experts and concern citizens to develop a sustainable master plan for Raipur's transportation and logistics system, implementing sustainability goals with national and global sustainable development goals (SDGs).

b) **Infrastructure development**: Establish a multi-modal system with integrated logistics infrastructure, equipped with advanced warehousing facilities to significantly optimizes supply chain efficiency[19](Kumar & Sharma, 2023). Expanding and upgrading the existing infrastructure in Raipur with improved connectivity to under-served areas can reduce congestion, emissions, costs and transit time.

c) **Adopting Eco-friendly Logistics**: Applying and promoting the use of renewable energy such as electric vehicles (E.Vs) and its charging stations within the Raipur city, including biodegraded packaging and energy-efficient equipment to lessen operating costs and preserve the ecosystem.

Government should incentivizes those that prioritize the use of E.Vs with subsidies and tax exemptions[12](Das et al., 2023).

d) I**nvesting in Technology and Innovation**: The use of digital tools such as block-chain, IOT, and GPS can help optimize transport and logistics operation in Raipur. For instance, fuel consumption and traffic delays can be significantly reduced, enhancing energy-efficiency while aligning logistics operations with smart city mission[16](Gupta & Varma, 2021).

e) **Financial Support**: Adopting eco-friendly practices requires huge capital outlay for initial cost of acquisition, utilization and maintenance. Leveraging Public-private partnership for mobilizing funds and required expertise can serve as successful example for cities like Raipur[35](World Bank, 2022).

f) **Policy framework**: To reduce carbon-footprint through regulatory measures, Raipur urban development plan should be promulgated to regulate Logistics and freight management[26] (Rana et al., 2022). This policy aimed at integrating emissions control, congestion management and land use planning.

g) **Expanding Raipur Public Transportation**: Extending (BRT) buses to sub-urban and rural areas for inclusive service delivery to reduce social inequality and reduce over-reliance on private vehicles for transportation. Infrastructure for Pedestrians walkways and cycling lanes should be constructed to reduce traffic jams and encourage use of non-motorized transport system.

h) **Public Training and Awareness Campaigns**: Public enlightenment and education should be frequently and eventually conducted for logistics providers and stakeholders on sustainable practices and transition to modern technologies[8] (Chakraborty et el., 2022). Waste reduction and recycling, carpooling and eco-friendly commuting topic should be emphasized and discussed[1](Banerjee et al., 2020).

CONCLUSION

This study examines the challenges and opportunities of transportation and logistics sustainability of Raipur, based on economic, social and environmental dimensions. The findings underscore the crucial role of sustainable transportation and logistics system in shaping Raipur sustainable development goals, enhancing economic growth, improving social justice and preserving the potentiality of the environment.

Raipur economic dimension of transport and logistics experienced challenges, ranging from infrastructure deficit, higher transportation and logistics costs, as well as inefficiency in the overall supply chain networks. This study explores initiatives such as expansion and upgrade of the existing infrastructure, promoting renewable energy campaigns and integrated logistics hubs and public-private partnership (PPP) to address these challenges.

From the social viewpoint, this research identifies inadequate sub-urban and rural accessibility to road connectivity, including urban transport amenities like (BRT) buses to local communities in Raipur. The development affects social equality and life expectancy of the marginalized and underserve communities. To address these challenges requires extending inclusive transport service to local communities to promote social equity and encourage a sustainable behavior across businesses and residents.

The environmental dimension of Raipur transportation and logistics comprise traffic congestion due to inefficient infrastructure management, vehicular emission as a result of over-reliance on diesel and fossil fuels powered vehicles, including incurring higher costs. These challenges necessitate the adoption of renewable energy solutions to reduce environmental impact and optimizes transport and logistics operation.

The study highlighted the need for a multiple stakeholders and integrated approach to objectively address these underlying economic, social and environmental challenges through proposing solution such as strategic planning, sustainable transition programs, inclusive transportation system, public-private partnership and policy review and implementation. Moreover, the study contributes to academic discourse and lay a foundation for future research direction through incorporating longitudinal and comparative data analysis, expanding the scope to provide valuable insights for scaling up sustainable practices.

Finally, leveraging and implementing the opportunities identified in this study can enhance Raipur economic prosperity and position it as a model city for sustainable transportation and logistics services.

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