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Fluvial Mobility in the City of Douala: The Development of a Bimodal Terminal Between Bonaberi Quarters and River Wouri in the Littoral Region of Cameroon

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Abstract: The city of Douala is experiencing rapid demographic growth, leading to pressure on its transport infrastructure. (Dittrich-Webuer et al 2008) road traffic and lowering greenhouse gas emissions. The methodology adopted combines both qualitative and quantitative approaches. It involves a site survey, field surveys, interviews and analysis of cartographic and statistical data. This article investigates the feasibility and impacts of developing a bimodal terminal in Bonaberi, combining road and river transport via the Wouri River. Survey results show that 70% of users are interested in a regular and secure river transport service. Travel time modeling indicates that river transport could reduce journey durations by 30–40% (20–30 minutes compared to 60–90 minutes by road). Socio economic projections depicts that the project could create 300–600 direct and indirect jobs and reduce logistics costs by 20–25%. The study concludes that establishing a bimodal station would strengthen urban connectivity, generate employment, and improve quality of life, depending on the extent to which it is bolstered by consistent policies on waterway maintenance and intermodal integration. Analysis of the potential of the Wouri River suggests that the river fulfils all the required conditions to be at the heart of this transport by river project. We envisage to implant the project on the west bank of the river at altitudes between 7-9m.

Keywords*: River Mobility, Bimodal Station, Intramodality, Sustainable Transport, Urban Planning.*

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I. INTRODUCTION

Despite the fact that fluvial mobility has been undermine in the transport policy of Cameroon (Meli 2025). It plays an important role in the communication and economic development of the country. Cameroon is endowed with a dense hydrographic network which is estimated at 2,320 kilometres of navigable route. According to data furnished by the ministry of transport the country has considerable potentials for fluvial transport especially in the Southern and Eastern regions of the country with rivers such as river Sanaga, Logone, Benue, Wouri, Nyong and especially the Congo river through river Sangha as well as coastal rivers such as Dibamba that drain in to the Atlantic Ocean near Douala.

African Development fund underscores that despite this potential, fluvial transport is underutilized with challenges linked to maintenance of navigation routes and integration to other modes of transport. Within the framework of sustainable development and disenclavement of rural areas, the revitalization of fluvial transport appears as a strategic opportunity as it does not only help to decongest land routes but also help to reduce logistic cost and above all favours regional integration. The problem which this article intends to solve is how the development of a bimodal terminal in Bonaberi quarters through river wouri can ameliorate urban mobility and reduce traffic congestion in the town of Douala?

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Existing literature on urban mobility in Douala is mostly centered on the problem of road transport, road infrastructure as well as railway while fluvial transport is inadequately studied.Infact most of the studies on multi modal terminals are based on a combination of rail route or rail and air leaving a significant void in the study of bimodal fluvial terminal. Furthermore very little studies have tackled the specificities of third world towns such as Douala where fluvial infrastructure are often underutilized despite greater potentials. This article deemed it appropriate to propose concrete planning to fill this void which will efficiently integrate the two modes of transport in a complex urban system. By studying this specific integration it responds to the urgent needs and sustainable solutions to ameliorate mobility in Douala.

➢ *Problem Statement*

Fluvial mobility plays an important the

The problem which this article intends to solve is how the development of a bimodal terminal in Bonaberi quarters through river wouri can ameliorate urban mobility and reduce traffic congestion in the town of Douala?

➢ *Main Objective*

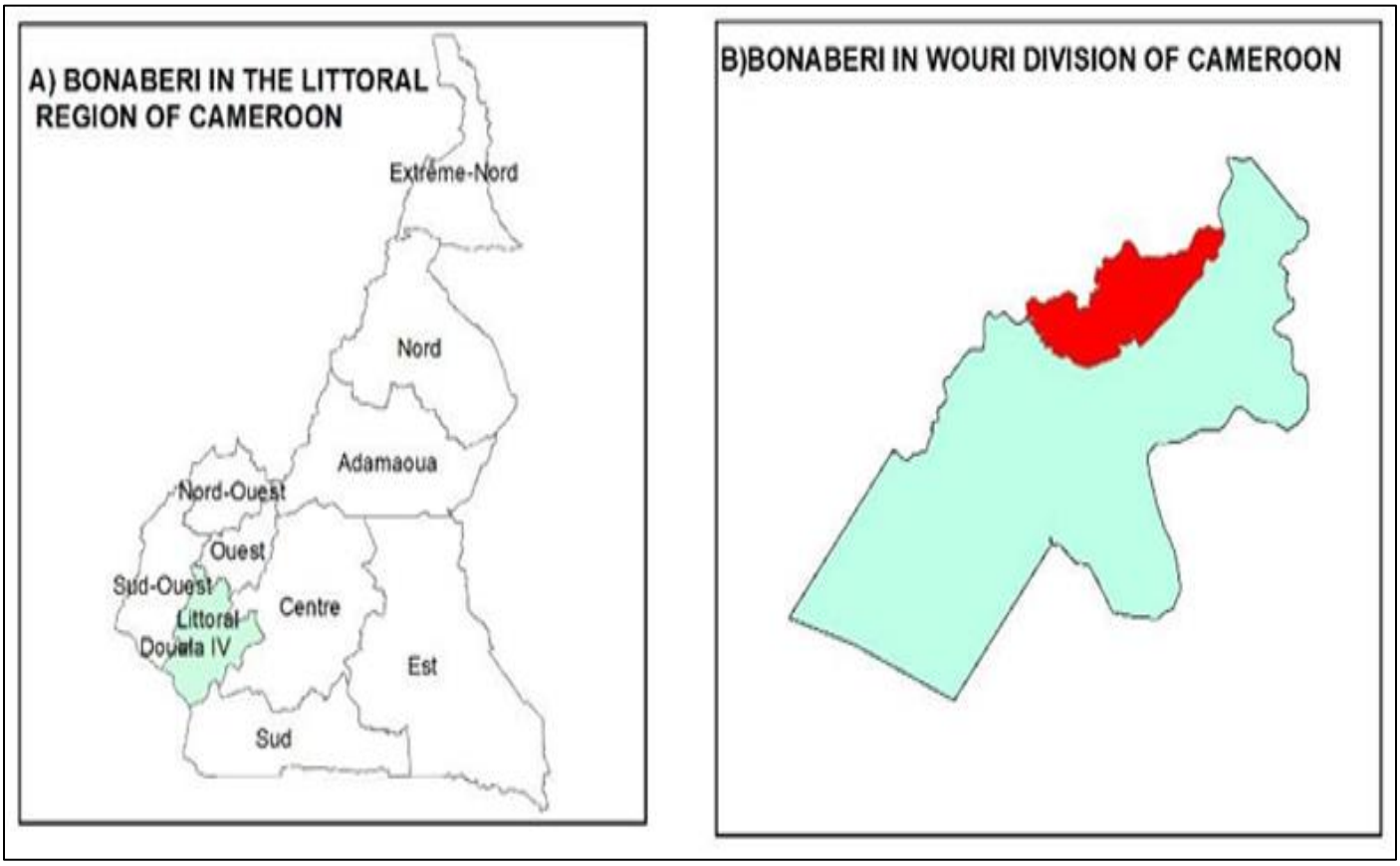
The main objective of this article is to carry out studies on fluvial mobility and to show how a Bimodal terminal in Bonaberi (Douala IV sub division) passing through river wouri can ameliorate urban mobility and promote sustainable use of transport infrastructure in the city of Douala. The specific Objectives include the following:

- To identify and examine the factors influencing the construction of a Bimodal terminal between Bonaberi and river Wuori.
- To identify and examine the potential socio economic and environmental impact of the Bimodal terminal.

II. LOCATION OF STUDY AREA

Bonaberi(Douala IV Sub division) is located on the right bank of river Wouri to the West of Douala and constitute an important centre for industrial and commercial activities in the city of Douala.Its position on the main road axis leading to the West of country makes it an important collecting centre and distribution of goods. Bonaberi is located between latitudes 4°3’ north of the equator and longitude 9°39’ East of the Greenwich meridian (Fig 1). From the centre of Douala to river wouri is 8km.Worthy to note that river wouri is the main infrastructure that links Bonaberi to the rest of the town. River wouri is one of the main rivers of Cameroon located in the Littoral region. It waters the economic capital; Douala.

River wouri is derive from the confluence of two important rivers such as the Nkam and Makombe about 40km in the North East of Douala close to Edea . It drains in to the Gulf of Guinea (Atlantic Ocean) by a majestic estuary at the level of Douala



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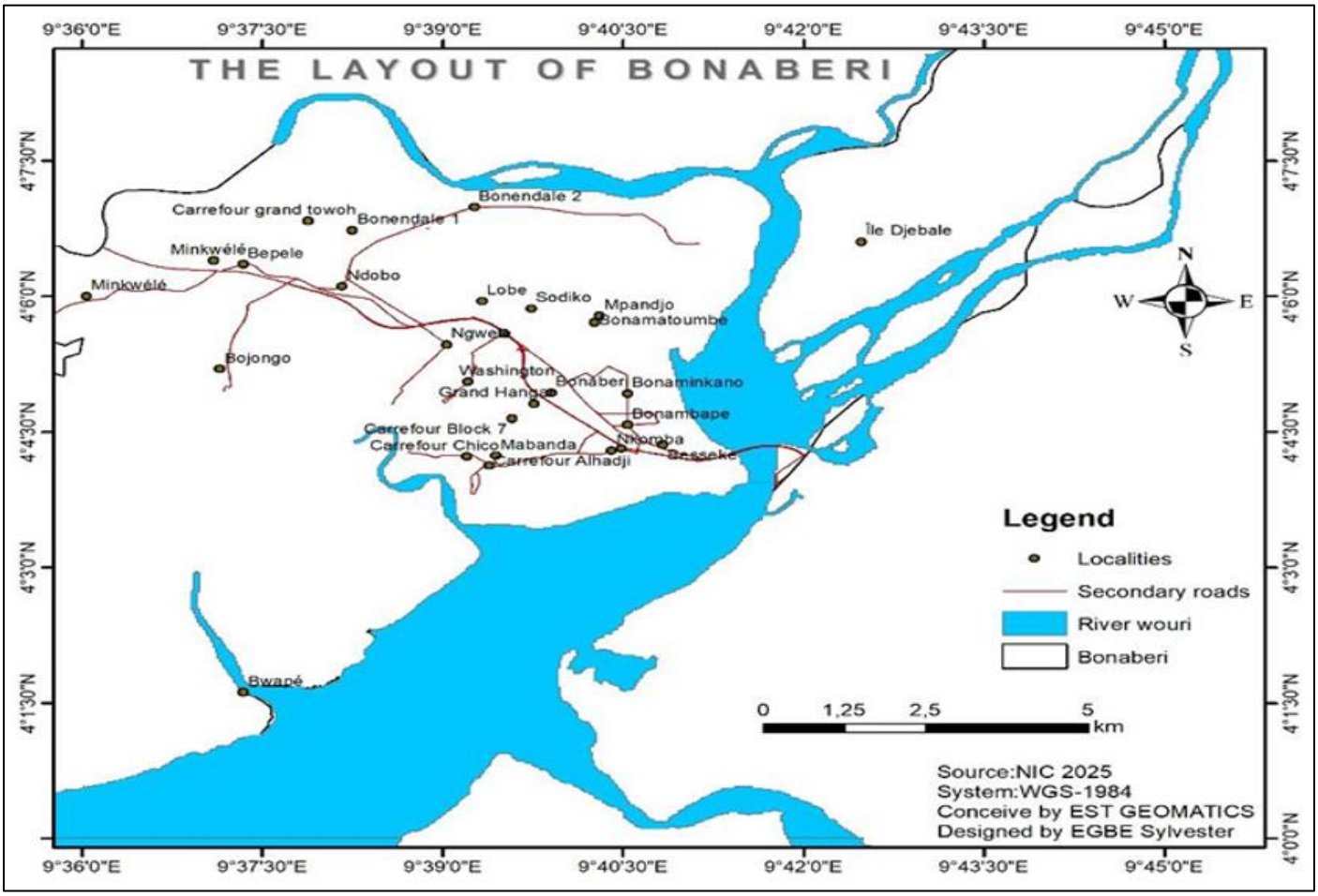

Fig 1 Location of Bonaberi

The main course of the river is about 160km (from the Nkam-Makombé confluence).By considering fluvial system as a whole (From the source of Nkam for example), its length exceeds 250 km.

It drains a dense and humid drainage basin which is a characteristics of the equatorial zone.

Photo 1 Section View of River Wuori Field Work 2025

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A section view of river wouri a vector for fluvial mobility in the city of Douala The banks of the river are gently undulating and provide suitable sites for the Installation of barge or docks.

III. RESEARCH METHODOLOGY

Primary and secondary sources of data were collected and processed. The secondary phase involved the survey of Literature from text books, articles in journals, magazines, dissertations, theses, periodicals, maps as well as websites before embarking on field visits. Primary data were collected from participant observation, questionnaires administration. The GPS tool was used to collect data as regards traffic congestion and appropriate sites for the construction of the terminal. The Arc GIS 10.8 version, was used to locate the study frame, operational zones. Apart from the GIS software, quantitative data was analyzed using the Excel to derive pie and bar charts

IV. RESULTS

A. *Factors Favoring the Construction of a Bimodal Terminal*

➢ *Geomorphology and Landscape*

The construction of a bimodal terminal (road and water) greatly depends on the landscape (Meli 2025) which is quite flat thereby permitting construction and its slopes are invaluable assets for adaptations. Closely linked to this is proximity to access roads as the project side is close to the main road from Bonaberi and from Rond point Deido and above all there is ample space to extend the services of the terminal .The landscape characteristics of river Wouri are characterized by an estuary surrounded by vast mangrove Forest. This ecosystem is amongst the most important in central Africa and extends thousands of hectares from one part of the river to the other. On the other hand the banks are generally low and often swampy due to the influence of tides. Douala has developed on the left bank (Bonanjo) while Bonaberi quarters has developed on the right bank. Besides it's an important industrial cluster. This amplifies the possibilities for the construction of a bimodal terminal.

➢ *Historical and Economic Consideration*

Cameroon derives its name from river wouri. In the 15th Century when Portuguese explorers arrived the river they named it "Rio dos Camarões" (River of prawns) due to the presence of several prawns at the estuary of the river. Today this name is widespread throughout the country. Historically river wouri was the main navigable route to the hinterland, today the river is used for barge traffic for the transportation of containers and goods between the main port and the Bonaberi Industrial district. This explains why the autonomous port of Douala is the biggest deep sea port in the CEMAC zone. It is the main gateway in to and out of Cameroon economy and that of other neighboring countries such as Chad, Central African Republic. The economic activities of this zone includes:

Fishing which is an important economic activity for the livelihood of the surrounding population, Agriculture especially small scale subsistence agriculture that involves the cultivation of plantains, banana and cocoyam, Extraction of sand through dredging of sand from the river bed is a major economic activity here though with environmental consequences. This explains why the construction of a bimodal terminal is inevitable.

➢ *The state of Existing Infrastructures*

Bonaberi is linked to other parts of Douala through a network of roads such as the National road N3 and the Wouri Bridge.(Table 1) However these infrastructures suffer from chronic congestion notably due to the augmentation of heavy duty vehicles that ply the road axis let alone passengers vehicles of all sorts. On the other hand the secondary roads are poorly maintained with narrow and degraded roads which slows down intra urban mobility. From the fluvial perspective, wouri is not actually used as an important navigable transport route. Port infrastructures are almost nonexistent which limit the exploitation of the fluvial potential of the region. Some Small private vessels are used but without veritable logistic organization or Security.These infrastructures if properly harnessed will be a catalyst to fluvial mobility in Douala.

Table 1 State of Existing Infrastructures

Infrastructures	Actual state	Description
National Road N3	Saturated frequent traffic jam	Requires decongestion
Wouri bridge	Saturated during rush hours	Critical point of congestion
Secondary roads	Degraded and limited	Grossly insufficient for fluid mobility
Fluvial infrastructures	Practically non existent	Need for replanning to permit anchoring of ships

➢ *Evaluation of Opinion of Users in Terms of Fluvial Mobility*

To better understand the needs in fluvial transport in the study area, an investigation or enquiry has been realized from different groups of users notably workers, business persons and enterprise of the Bonaberi industrial zone. This enquiry has permitted to collect data on the patterns of movement, preferences in terms of transport and the ability of users to use fluvial services as an alternative of road transport.

- Mode of present transport: 75% of respondents use taxis or bikes for movement,10% move using bus services.
- Mobility related problems: traffic congestion (78 % of respondents), frequent delays (62 %), road transport is quite expensive (45 %).

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- Desire to circulate using fluvial transport : 70 % of respondents affirmed that they are interested in regular fluvial transport so as to avoid traffic jam
- Frequency of movement: close to 60% of users effectuate more than 10 trips a week between Bonaberi and other parts of Douala.

Table 2 Synthesis of Enquiry Results on the Needs of Fluvial Transport

Criteria	Percentage
Use of taxis/Bikes	75 %
Desire for fluvial transport	70 %
Problem of traffic congestion	78 %
Number of weekly trips (>10)	60 %

➢ *The Figures Present Enquiry Results of Users*

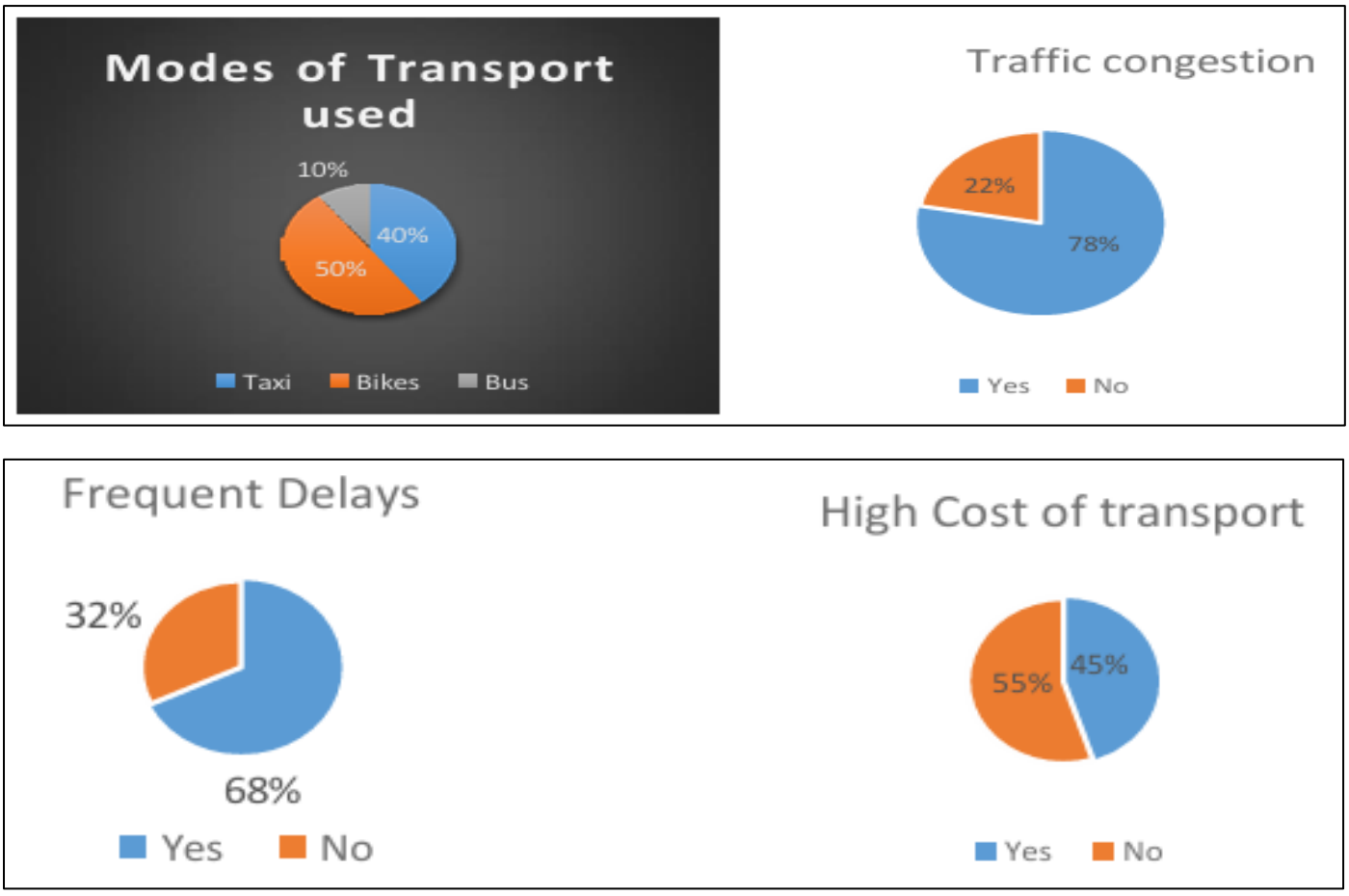

Fig 2 Analysis of Opinion of Road Users

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The analysis of circulation between Bonaberi and the surroundings of Wouri depicts that road transport is exclusively the main mode of circulation, the main roads include the National road N3 is often saturated and the main point that links the two banks the wouri bridge is at the center of most traffic congestions.

The absence of fluvial infrastructure has led to over dependence on road transport which does not only lead to chronic congestion but an augmentation of transport cost notably for goods transported between Bonaberi and industrial zone located east of river wouri.

Photo 2 Traffic Congestion at Bonas Sama Fieldwork 2025

The photograph depicts traffic congestion at the entrance to the Wouri Bridge with different categories of vehicles such as delivery vans, taxis, tricycle and private cars. This is the rationale for river transport as an alternative mode of transport.

Business men transporters of goods, tourist, and students are the different categories of users.

- *Evaluation Results of Urban Socio-Economic Impact*

Comparisons amongst mode of transport shows that the development of fluvial mobility can considerably ameliorate the efficiency of movements. Road transport is highly penalize by congestion meanwhile fluvial transport can offer a more rapid and ecological alternative

Comparison between fluvial and road transport Characteristic of road and fluvial transport.

- *Socio Economic and Environmental Impact of Fluvial Mobility Economic Impact*

Fluvial mobility and bimodal terminal offers numerous economic opportunities They permit the transportation of goods through water which is an aspect of economic and ecological mode of transport. This can stimulate local and regional economic activities thereby favouring trade.

The construction and the use of fluvial infrastructures generate employment and provide an activity for local enterprises likewise the public sector especially in terms of transport and logistics etc.

The development of fluvial tourism can also create positive economic outcomes for trade and proximity services found along the banks of river Wuori.

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V. ENVIRONMENTAL IMPACT

➢ *Finally Fluvial Mobility has Positive Environmental Impact:*

Fluvial transport emits very limited greenhouse gases as compared to road and air transport with the same volume of goods transported.

The banks and surroundings of rivers often sheltered a rich and endangered biodiversity. By favoring sustainable development of human activities, fluvial mobility helps to preserve the natural ecosystem in a remarkable manner.

We equally notice that fluvial mobility and bimodal terminals are powerful tools to ameliorate mobility and connectivity in towns especially in third world towns.

Studies carried out at the international level shows that fluvial mobility can be an efficient and environmental friendly solution to towns especially in terms of reduction, of greenhouse gas emissions, reduction of transport cost and improvement of the quality of life of city dwellers

For example the port of Hamburg, in Germany, was an important hub for commercial exchanges between East Europe and the dredging of water ways for some of its activities. In the same way the town of Venise in Italy presents a fine example of sustainable mobility for the next three years.

➢ *Infrastructures Link to Fluvial Mobility*

Some important infrastructures necessary for efficient transport mobility includes:

- *Planned Navigable Routes:*

Rivers network, navigable lakes and canals with widths and depths adapted to sailing ships are essential to permit efficient fluvial mobility.

➢ *Impact on Local Economy*

One of the main objectives of the development of a bimodal terminal is to stimulate local economy. This terminal can transform Bonaberi in to an attractive economic hub favouring trade, investment and balance regional development

- *Commercial Dynamization*

Firstly Access to markets: Thanks to the bimodal terminal local business men can benefit from improved access to markets out of Douala. This permits the rapid provision of cheaper goods. Secondly new investors are attracted .The existence of a modern transport infrastructure is a prerequisite for investment. The bimodal terminal can attract businesses that wish to establish logistic operations in the area.

Table 3 Potential Economic Impact

Type of Impact	Description	Potential Impact
Increase in Trade	Increase in the volume of local transaction	More than 30 % sales for local businesses
Reduction of cost for logistics	Decrease in transport cost for business men	Economy of 20-25 % on the cost of expedition
Valorisation of real estate	Increase in the price of land and goods	Increase in 15-20 % of land values
Regional investment	Attract business enterprise and transport logistic	+50 % of investment in the logistic sector

- *Job Creation and Competence Development*

The bimodal in Bonaberi will create a reasonable number of jobs during construction and after the opening of the terminal. This section concentrates on the types of jobs generated and the opportunities of skill development for the local populations.

The construction phase will generate temporal jobs for workers employing engineers, technicians. This can equally furnish jobs for local artisans who will benefit from the regional economy.

Once operational the terminal will need workers for the reception of passengers, manage operations and Security. These personnel's will serve the local community thereby favoring local employment.

The augmentation of passenger traffic and goods has brought about the opening of new businesses (restaurants, shops) and transport services thereby creating supplementary jobs and other operations

Inonder to maximize the benefits of these jobs it is imperative to put in place a training programme for the development of skills of workers especially in the domain of logistics, reception, and management

Table 4 Estimates of Jobs Created

	Estimates	Duration
Construction	250 temporal workers	Duration of construction (2-3 years)
Exploitation of the terminal	75 permanent jobs	From the opening of the terminal
Trade and services	150 permanent jobs	From the opening of the terminal
Training and Development	50 jobs Link to training	Continue from 1 to 3 years

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- *The Figure Illustrate Jobs Created According to Sectors*

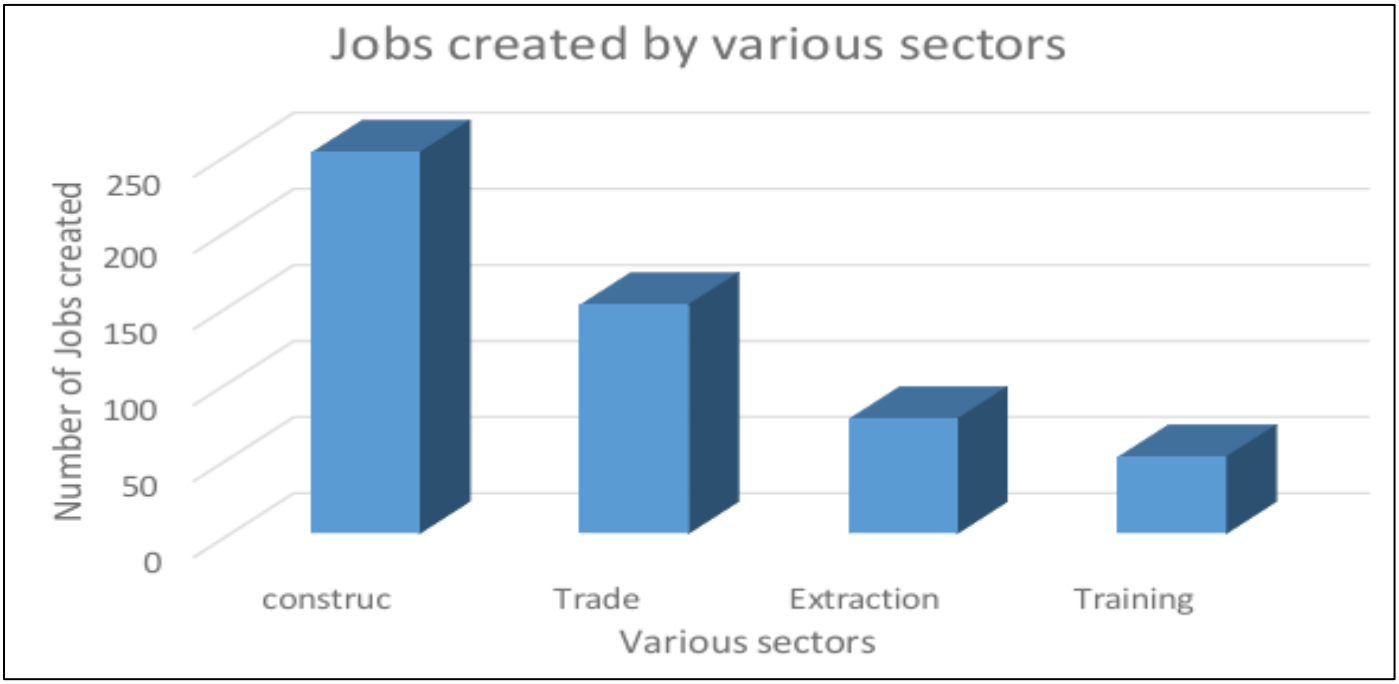

Fig 3 Distribution of Direct and Indirect Jobs Link to the Bimodal Terminal

➢ *Impact on the Standard of Living of Inhabitants*

The development of a bimodal terminal must equally have important impact on the quality of life of the inhabitants of Bonaberi and its environs. This include ameliorations in terms of mobility, access to services and reduction of cost of living.

➢ *Improvement of Mobility*

- *Reduction of Journey Time:*

The integration of fluvial and road transport reduce journey time for users which is particularly important for workers and students that arrive their varions areas of activities easily.

- *Alternatives to Road Transport:*

The bimodal terminal offers an alternative to road transport thereby decreasing over dependence on taxis and bikes which are often expensive.

- *Reduction of transport cost Economical for Users:*

Generally fluvial transport is less costly than road transport which permit users to economise their daily transport fare

- *Easy Access to Services:*

The bimodal terminal ameliorate the access to public and commercial services in other quarters thereby permitting essential services to be more accessible to the inhabitants of Bonaberi.

An analysis of the socio economic impact of the development of the bimodal terminal in Bonaberi shows considérable potential benefits for the local economy such as job creation, improvement on the quality of life. The augmentation of commercial Dynamics, creation of new jobs and improvement of transport conditions helps to transform Bonaberi in to a veritable pole of Exchange. However inonder to maximize the advantages It is necessary to anticipate and manage social and environmental risk associated with this initiative. The putting in place of a training programme for sustainable development will be crucial to ensures that local communities fully benefit from these changes.

VI. CONCLUSION

This article has an objective to study the feasibility and development modalities of the fluvio road bimodal terminal in Bonaberi as a structural solution to revitalized fluvial mobility and improve connectivity in the city of Douala. Throughout this research the analysis demonstrate that the Project is inscribed in the logic of modal diversification indispensable for an Afro metropolitan town confronted with unprecedented crisis of mobility.

Several lessons are drawn from this study. Firstly from the theoretical perspective literature review confirm the fact that fluvial mobility though undermined in the transport policy of Africa, serves as a important leverage for sustainable development. International experience from Hamburg to Lagos through Venise provides a plethora of lessons. Firstly it underscores the necessity for integrated planning, a particular attention should be ascribed to technical, social, environmental meetings on these types of projects. The analysis of the context of Douala revealed that there are underexploited potentials. River wouri which is the natural vetebral column of the metropole actually suffers from lack of investment, predominance of informal

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activities and serious environmental problems. This study will create avenues for further investigations of economic model precisely on transport terminal. A detail cost benefit analysis involving positive externalities (reduction in congestion and pollution) and reflection on integration of other flexible modes of transport such as bikes, treking or pedestrians on an intermodality plan. Finally this work concludes that the development of a bimodal terminal in Bonaberi is not only feasible but highly strategic for the future of Douala

REFERENCES

➢ *Textbooks*

[1]. BANISTER David, 2008, Sustainable Mobility: The Role of Transport in Urban Planning (livre sur le transport écologique).
[2]. BANISTER, David, 2008. Transport écologique : Définition et enjeux.
[3]. CHRIST Martin, 2016, Logistics and Supply Chain Management (livre sur la logistique fluviale).
[4]. CHRISTOPHER, Martin, 2016. Logistics and Supply Chain Management. 5th ed. Pearson UK.
[5]. DABLANC, Laetitia, 2007. Goods transport in large European cities: Difficult to organize, difficult to modernize. In: Transport Policy, Volume 14, Issue 4.
[6]. Dictionnaire des Transports, Institut National des Transports, 2017, Dictionnaire des Transports (ouvrage de référence).
[7]. FAUGIER, Jean, 2024. Mobilité touristique et systèmes de transport.
[8]. GEERLINGS, Harry et VAN DUIN, Ron, 2011. The future of intermodal freight transport: Operations, design and policy. Edward Elgar Publishing.
[9]. RODRIGUE Jean-Paul et NOTTEBOOM Theo, 2013, The Geography of Transport Systems (livre sur l'intermodalité).
[10]. RODRIGUE, Jean-Paul et NOTTEBOOM, Theo, 2013. The Geography of Transport Systems. 3rd ed. Routledge.
[11]. RODRIGUE, Jean-Paul et NOTTEBOOM, Theo, 2020. The Geography of Transport Systems. 5th ed. Routledge.

➢ *Articles*

[12]. AFT, 2019, Barges et Péniches dans le Transport Fluvial (article dans Revue des Transports Fluviaux).
[13]. Allo, 2023, Véhicules Fluviaux d'Assistance (article dans Revue de Sécurité Fluviale).
[14]. DABLANC, Laetitia, 2007. Goods transport in large European cities: Difficult to organize, difficult to modernize. In: Transport Policy, Volume 14, Issue 4.
[15]. Geerlings H. et Van Duin R., 2011, Inland Waterway Transport: Environmental Impacts and Benefits (article dans Journal of Transport Geography).
[16]. JC France Industrie, 2011, Véhicules Flottants pour la Collecte des Déchets (article dans Revue Industrielle Française).

➢ *Net Search*

[17]. ACTU-TRANSPORT-LOGISTIQUE, 2021. Port fluvial de Rhenus en Allemagne. [En ligne].
[18]. AFD (Agence Française de Développement), 2020. Étude "Mobilité urbaine à Douala". [Rapport].
[19]. AFD, (2020), Étude "Mobilité Urbaine à Douala"
[20]. AFT, 2019. Barges et Péniche. [Image en ligne].
[21]. ALLO, 2023. Véhicules fluviaux d'assistance. [Image en ligne].
[22]. Banque Mondiale, (2023), Rapport sur le Potentiel Fluvial Camerounais
[23]. Banque Mondiale, 2023. World Bank Transport Report. [Rapport].
[24]. France3 Region, (2023),[consulté le September 03, 2025]., Navette Fluviale
[25]. FRANCE3 REGION, 2023. Navette fluviale. [Image en ligne].
[26]. ICI ALSACE, 2016. Gare fluvio-routière du port autonome de Strasbourg. [Image en ligne].
[27]. JC FRANCE INDUSTRIE, 2011. Véhicule flottant pour la collecte des déchets. [Image en ligne].
[28]. MINTP CAMEROUN (Ministère des Travaux Publics du Cameroun), 2022. Rapport annuel sur les transports. [Rapport].
[29]. MINTP Cameroun, (2022), Rapport sur les Infrastructures de
[30]. Sud-Ouest, (2011), [consulté le September 03, 2025]. Ferries et Bateaux-Bus
[31]. SUD-OUEST, 2011. Ferries et Bateaux-bus. [Image en ligne].
[32]. WIKIMEDIA COMMONS, 2020. Le port de Rotterdam, Pays-Bas. [Image en ligne].
[33]. WIKIMEDIA COMMONS, 2022. Système de gestion de transport fluvial. [Image en ligne].
[34]. Wikipedia, (2022), [consulté le September 03, 2025]. Port de Hambourg .
[35]. Wikipedia, 2022), [consulté le September 03, 2025]. Port de Lagos
[36]. WIKIPEDIA,(2022) Images des ports de Hambourg, Venise et Lagos. [En ligne].
[37]. Wikipedia,(2022), [consulté le September 03, 2025]. Port de Venise.
[38]. World Bank, (2023), Transport Report

➢ *Legislatives And Normative References*

[39]. CONVENTION C152 (OIT) : Convention (n°152) sur la sécurité et l'hygiène dans les manutentions portuaires, 1979.
[40]. ISM CODE (OMI) : Code international de gestion de la sécurité.
[41]. ISPS CODE (OMI) : Code international pour la sûreté des navires et des installations portuaires.