Innovation for Sustainable Railway Usage and Maintenance In A Smart City. Study of Mobolaji Johnson Train Station Lagos, Nigeria

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Abstract- For decades, transportation has been taken into consideration as a hyperlink to all factors of lifestyles worldwide. In this case, the world's herbal environment, social wellbeing and monetary improvement all typically rely on transportation systems. As towns round us remodel and end up extra related and digitalized, the expectancy for public transportation is to comply with in each respect. From reducing aspect generation to comfort, safety, reliability and sustainability, how close are we from accomplishing the proper Smart Rail system? A smart city takes under consideration all of the fundamental factors that represent the city fabric, a good way to keep away from conflict (social, financial, financial, environmental and cultural), with a purpose to enhancing its dwelling environment. A smart city, is a sustainable one in which each has quality to stay in, feasible and gives equity to all the ones trying to secure a position in its existence. Using Mobolaji Johnson train station as a case study, this research work is aimed at revitalizing and sustaining the use of the railway system and its maintenance. This research work was carried out using the qualitative research methodology where people were interviewed using semi structured questions. 20 people were selected at random from 10 local government areas out of the 20 Local Government present in Lagos state. The respondent's answer to the questions asked goes to show that the smart train system like the Mobolaji Train Station will go a long way in helping to ease transportation problem in the state. In conclusion, the introduction of smart trains to smart city is a good and a show of technological advancements but this must be backed up with a high maintenance capability without which has led to the ruins of the traditional railway system. It was therefore recommended that the smart train system should not just be replicated in other parts of Lagos state but also in other urban areas within the nation.

Index Terms- innovation, sustainable, maintenance, smart city and train station.

I. INTRODUCTION

Transportation has to do with moving people and goods from one place to another over land (by road, rail, human portage, motorized and non-motorized vehicles), across water (ship, boat canoe etc.) and through air (helicopter, aircraft etc.). On a clearer note, transport involves moving goods, services and people from the source going through the various means of transportation to its final destination (Wikipedia contributors, 2018).

The advantages of transportation cannot be over-flogged. It influences the relationship that is existing between physical space and society. A change in transportation affects the organization of the activities of human being in urban and rural areas. It helps to structure the built environment, increase the rate of growth in the urban centers, as well as inter relationships with cities in a national urban system (Yago, 2013)

Transportation and property are essential in the physical and economic growth and development of towns and cities across the globe. The higher the rate of expansion in transport network system, the more the increase the value of property and land, and these can bring about accelerated economic and population growth (Goldberg, 2010).

Urban centers need coordination and geographical aggregation of specialized economic activities, with such coordination amidst urban area, and population in regions advanced or retarded by a change in transportation and communication technology. An initial concentration of such population in urban area is made possible through inter-regional transportation followed by population dispersals as centralized economic activities roll over into a wider metropolitan region by further intra-urban transport system developments (Pred, 1974). A change in transportation influences human activity in urban and regional areas, structuring the built-environment, bringing about urban growth, leading the interaction amongst cities in a national urban system; as one mode of transportation reached its technological end in extending urban areas and another replaces it. (Yago, 2013).

The urban areas across the globe shows a number of benefits in terms of concentration of people coupled with the demand for commercial properties and transportation. Ikeja the capital of Lagos state is a classical and practical example of a city that has rapidly developed since 1976. Therefore this study is aimed at the rate of maintenance and sustainable railway usage in a smart city with focus or using the Mobolaji John train station as a case study.

II. LITERATURE REVIEW

- ***Smart City***

The five major aspects of urban planning are public space, the common good, the citizens, administration, and infrastructures. Stations sit at the center of most of these elements. Each element is faced with numerous challenges: ranging from social, cultural, economic, environmental, or with respect to the resilience and efficiency of the services on offer. The importance of this model is that it showcases civil-society involvement in decision-making bodies, either in opinion-forming or in bringing new ideas to the table. Smart Cities primarily focuses on fostering social inclusion rather than exclusion.

One vital aspect of a smart city, is its capacity to rethink its urban infrastructure, be a pivotal force of innovation and birth technological step changes. The ideology of Smart Cities is explained in diverse ways in academic or urbanization articles. The agreement is that a smart city considers all the primary elements that constitute the urban fabric, in a way to avoid conflict (social, economic, financial, environmental and cultural), with a view to better its living environment. This system addresses participatory governance and efficient management of natural resources, to meet the needs of society (institutions, companies and citizens) supported by a SMART GRID. A smart grid encloses several notions. Among which are, a need to change the electricity supply value chain, to give from for infrastructure to feed energy resources back into the network from positive energy buildings.

Also, consumers need to be given a participatory role. This is can easily be achieved through better provision of information to consumers and local authorities about the importance of new technology for energy management, and bringing about easy access to information via smartphones or computers, about a building's energy consumption. Use of Smart Grids makes government to be actively involved in guarding against fears of uncertainty and risks associated with the use of new technology in this process. Governments should establish new regulatory frameworks to prevent users from all potential risks.

Infrastructure managers, and stations in particular, are to be free to expect developments so as to create an environment that encourages cities to become smart too (International Union of Railway, Smart Stations in Smart Cities)

There is no specific standard definition of or set of terms for a smart city. In 2014, an International Telecommunication Union conducted an analysis on over 100 definitions associated with smart cities, which gave rise to the following definition. "A smart sustainable city is an innovative city that makes use of ICTs and other means to enhance quality of life, efficiency of urban operation and services and competitiveness, while making sure that it meets the needs of both the present and future generations with respect to economic, social and environmental aspects." (International Telecommunication Union, 2014) Efforts are currently ongoing to develop comprehensive key performance test for smart cities. A United Nations inter-agency group is creating a set of key performance indicators with the sole purpose of turning them into a global smart sustainable cities index (Carriero, 2015). Different definitions of the term smart city shows that different definitions addressed different aspects. Thus, there's a need by the government and stakeholders to work hands-in-hands to come up with a common understanding of what smart city means in their specific national and city-level contexts.

This concept offers different opportunities for various countries. The primary need for cities in developing countries is to establish adequate urban infrastructure to cater for the rising pace of urbanization. In the process of addressing infrastructure demands, smart infrastructure applications showcase a way for such cities to attain leapfrogging in technology (Deloitte, 2014). In developed countries however, the problem is often to maintain legacy infrastructure systems that cannot be set aside due to cost, space and other considerations. In these countries, smart city applications may address more the optimal use of existing infrastructural resources and watching the operations of such legacy resources. However, in the developing and developed country contexts, the primary motive behind smart infrastructure establishment should be that they answer to the sustainable development needs of society.

Table 1.0 : The Smart City Model

SMART HEALTHCARE ¸ Facilities safety ¸ Individual safety ¸ Social function ¸ Social cohesion and interaction ¸ Availability of rescue services ¸ Health conditions and welfare	**SMART ECONOMY** ¸ Innovative spirit ¸ Ability to transform ¸ Entrepreneurships and news business models ¸ Collaborative activities ¸ International embodies ¸ Economic image and trademarks
SMART PEOPLE AND LIVING ¸ Cosmopolitanism ¸ Improvement of customers and users' experiences ¸ Participation in public life ¸ New services for customers and users ¸ Flexibility and ethnic plurality ¸ Entertainment activities, cultural facilities and touristic attractively	**SMART MOBILITY** ¸ New payment methods ¸ Inter-modalities, multimodalities ¸ Solutions for integrated mobility ¸ No barrier for people with reduced mobility ¸ Local, regional and international accessibility
SMART TECHNOLOGY **SMART** Accessibility ¸ Mobile apps ¸ Accessibility of the information ¸ Internet of things ¸ Big data & cloud **SMART** Protection ¸ Adaptability ¸ Cybersecurity ¸ Protection of private information ¸ Security & Privacy	**SMART ENVIRONMENT** ¸ Land revitalization ¸ Reducing pollution ¸ Environmental benefits ¸ Environmental protection ¸ Open space conservation ¸ Sustainable resource management

Source: Smart Stations in Smart Cities by Jean-Pierre (2017)

- **Smart Infrastructure**

The core characteristic that underlies most of these components is that they are connected and that they generate data, which may be used intelligently to ensure the optimal use of resources and improve performance. This section showcases some key aspect of smart city infrastructure.

- *Smart Buildings*

A smart building integrates the different physical systems present in an intelligent way to ensure that all the systems act together in an optimized and efficient manner. Smart building management systems can improve building energy efficiency, reduce waste and ensure an optimum usage of water by 30 to 40%,

- *Smart mobility*

Smart mobility is best described as approaches that reduce congestion and foster faster, greener and cheaper transportation options. Most smart mobility systems use data collected from a variety of sources about mobility patterns in order to help optimize traffic conditions in a holistic manner. For example, the bicycle-sharing system in Sao Paulo, Brazil, has saved 570 tons of carbon dioxide emissions since it began operations in 2012

- *Smart Energy*

Smart energy management systems use sensors, advanced meters, renewable energy sources, digital controls and analytic tools to automate, monitor and optimize energy distribution and usage. Such systems optimize grid operation and usage by balancing the needs of the different stakeholders involved

(consumers, producers and providers). There are a number of innovations in smart energy infrastructure, such as distributed renewable generation, micro-grids, smart grid technologies, energy storage, automated demand response, virtual power plants and demand-side innovations such as electric vehicles and smart appliances.

	L.G. A	POSITIVE					NEGATIVE				
		1	2	3	4	5	1	2	3	4	5
1	Alimosho	15	8	8	14	16	5	12	12	6	4
2	Kosofe	10	7	7	6	5	10	13	13	14	15
3	Mushin	16	15	13	15	14	4	5	7	5	6
4	Ikeja	18	15	14	17	18	2	5	6	3	2
5	Ikorodu	12	9	8	12	15	8	11	12	8	5
6	Surulere	13	11	11	10	12	7	9	9	10	8
7	Somolu	11	8	6	8	11	9	12	14	12	9
8	Lagos Mainland	17	14	12	12	14	3	6	8	8	6
9	Ibeju-Lekki	14	10	8	12	13	6	10	12	8	7
10	Badagry	16	12	10	12	15	4	8	10	8	5

- **Smart Water**

Cities are constantly trying to solve water scarcity problems with innovative technologies and the better management of water. Improved metering and flow management are key to a good water distribution system. A smart water management system uses digital technology to help save water, reduce costs and increase the reliability and transparency of water distribution. Physical pipe networks are overlaid with data and information networks. (Polson, 2013).

Smart Waste Management

Waste generation is increasing at a rate faster than that of urbanization (Hoornweg *et al* 2012). Cities are increasingly finding it difficult to source, separate and use different kinds of waste that can potentially be returned to a consumer life cycle. Waste management typically includes the monitoring, collection, transport, processing, recycling and disposal of waste. Smart waste management systems reduce waste and categorize the type of waste at the source, and develop methods for the proper handling of waste.

- *Smart Health*

The health and well- being of urban residents are of particular concern with regards to the sustainability, of urban areas

and their supporting ecosystems. Smart cities can develop the capacity to use technology such as big data to develop predictions or identify hotspots of population health (such as epidemics or health impacts during extreme weather events) (Jayasinghe, 2015). Smart health-care management converts health-related data into clinical and business insights, which include digital health records, home health services and remote diagnoses, treatment and patient monitoring systems.

- *Smart Digital Layers*

Smart digital infrastructure helps to increase understanding and the control of operations and optimize the use of limited resources in a city. One of the key value propositions of ICT in a smart city is the ability to capture and share information in a timely manner. If the information is provided in real time and is accurate, cities can potentially take action before a problem begins to escalate.

One way to consider digital infrastructure is in the form of different supporting digital layers, as follows:

- **Urban**: The layer where physical and digital infrastructures meet. Examples include smart buildings, smart mobility, smart grids (for utilities such as water, electricity and gas) and smart waste management systems.
- **Sensor**: This layer includes smart devices that measure and monitor different parameters of the city and its environment.
- **Connectivity**: This layer involves the transport of data and information from the sensor level to storage and to data aggregators for further analysis.
- **Data analytics**: This layer involves the analysis of data collected by different smart infrastructure systems, to help predict some events (such as traffic congestion).
- **Automation**: The digital enabling interface layer that enables automation and scalability for a large number of devices across multiple domains and verticals.

Research Method

The study is therefore conducted using a qualitative research methodology where people were interviewed using semi-structured questions. This study adopts a qualitative method as it will provide much quality answers to questions put forward through the researcher and is likely to provide a valuable insight which any other method might have do away with.

Ten (10) of the Twenty (20) local government area in Lagos state was selected for this study. A total of 20 people from each of this local government were questioned based on their user experience of Mobolaji Johnson train station.

Structured Questions
Have you heard of Mobolaji Johnson train station
Have you taken a ride on the smart train of Mobolaji Johnson
What was the experience like
Will you recommend it for someone
Should Mobolaji Johnson smart train be replicated in another part of the state

III. DISCUSSION

From the results as shown above, it can be seen or deduced that all the selected local government areas showed a considerable awareness towards the Mobolaji Johnson train station.

Of them all, Ikeja showed the highest degree of respondents awareness with 18 respondents claiming to be aware of the existence of the train station and 2 respondents said otherwise while people of Kosofe area with 10 respondents showed or have the least result in terms of awareness of this smart train station and 10 respondent of the 20 interviewed were unaware. In like manner, the 15 respondents each from Mushin and Ikeja claimed to have gone on a ride in the said Smart train and 5 respondents from each of the local government area are yet to take a rude on the smart train while 8 respondents from Alimosho local government area being the least claimed to have gone on a ride in the smart train and 12 said otherwise.

Also, when talking of the experience whether it's satisfactory or not 14 of the 15 respondents from Ikeja local government area who claimed to have taken a ride on the smart train showed a greater degree of satisfaction and as such wouldn't mind recommending it to people who are yet to go for a ride on the smart train. Likewise, Mushin people too, 13 of the 15 respondents also claimed to be satisfied with the operation and delivery of the station.

"It has been very wonderful using this train, going on the road for hours is stressful with holdups, also traveling by road to Abeokuta where I work from some parts of Lagos lasts about five hours or more due to traffic snarls or bad state of the roads, among other factors. I am very impressed with the service".

Another respondent has this to say, *"I have been following the development of the newly constructed railway from inception, up to the partial operations which began last year December. I looked towards seeing how it looks like, and what it will be like having a smart train in Nigeria moving from one location to the*

other, traveling by the old or traditional rail system was stressful and messy".

Going by the user experience, respondents from Ikeja topped the table with 17 respondents who are willing and ready to recommend this smart train to people second on the list Mushin with 15 respondents also very ready to recommend traveling by the train to others while respondents from Kosofe displayed a rather low enthusiasm at recommending this train station to others. Lastly, when asked about whether the smart train station should be replicated in some parts of the state and the nation at large, 18 respondents from Ikeja were positive about this as they believe it would vastly help to reduce transport problem or issues. On the other hand, respondents from Kosofe were not very positive in their answers to replicating this smart train in order part of the state and country, one cogent reason someone gave was the issue of cost of getting it done and maintaining it, as lack of maintenance culture has been the one crippling the nation's economy.

IV. CONCLUSION

Urban centers due to the congestion and concentration of people and things needs to be faster and better. Its approach and dealings should be quicker. This gives rises to the smart city model. It is a model in which every sector or aspect of it is smart; smart infrastructure, smart health care, smart technology, smart economy etc. The goal of this study was to revitalize the rail system means of transportation using Mobolaji Johnson train station as a case study. Residents of 10 of the 20 local government area in Lagos state were interviewed. There results were gathered and then analyzed. The result goes to show that people are well acquainted with the establishment of the train station and also would likewise recommend it to others.

In conclusion, going by the respondents' responses, it goes to show that Mobolaji Johnson train station will go a long way to easing transportation stress within the state. The introduction of smart trains to smart city is a good and a show of technological

advancements but this must be backed up with a high maintenance capability without which has led to the ruins of the traditional railway system. This introduction will doubtless raise the economy of the state.

It is therefore recommended that this smart train station be introduced to other parts of the state and cities in Nigeria as these will go a long way to building easing transportation stress involved in the movement of people and goods and invariably raising the nation's economy.

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