ENSAYO

Mobility and Connectivity: Challenges in Rural and Urban Costa Rican Communities

MSc, MBA, Tom Okot - ORCID: 0000-0002-4402-2127 [1]
Eng, José Antonio Barquero Ureña [2]
Eng, Jurgen Steven Cubero Rodríguez [3]
Eng, Flores Bravo, María Fernanda [4]

Fecha de recepción: 31 de julio de 2020 | Fecha de aprobación: 14 de agosto de 2020

Abstract

Recent studies have alluded to the constant mobility of people from rural to urban areas for several reasons, in Costa Rica 27% of the population still live-in rural locations. To achieve the ideal connectivity between these two areas would impact the mobility people, goods, services, and knowledge. Additionally, connectivity and mobility are cross-disciplinary efforts, takes into consideration technology and consumer characteristics to give the best solution. Transport and infrastructure development should provide different options and avoid automobile-centric mechanism as in the past years. Sustainable mobility and connectivity form part of a key strategic economic pathways for most countries. Research also confirms that urban development and environmental sustainability can coexist. Most of the strategic pathways being implemented in various economies include energy efficiency, renewable energy, and green mobility. Additionally, green mobility has the following immediate short-term alternatives; walking, cycling and use of public transport and other climate and people-friendly innovative transport modes. This article evaluates the option of implementing sustainable mobility in Costa Rica's national strategic development plan. With this approach we can ensure equitable access as well as protecting the environment and improving on the economic livelihood for all.

Key words:

Shared mobility, connectivity, rural and urban, community development, Eco-mobility

1 Professor and Head of Business Administration Department at Latin American University of Science and Technology - Costa Rica. All correspondences should be emailed: tokoto199@ulacit.ed.cr (author role-principal investigator).
2 Final year MBA student specializing in operations management at Latin American University of Science and Technology - Costa Rica, email: jbarquerou750@ulacit.ed.cr (author role-contributing investigator).
3 Final year MBA student specializing in operations management at Latin American University of Science and Technology - Costa Rica, email: jcuberor491@ulacit.ed.cr (author role-contributing investigator).
4 Final year MBA student specializing in operations management at Latin American University of Science and Technology - Costa Rica, email: mfloresb906@ulacit.ed.cr (author role-contributing investigator).

Introduction

According to Umaña-Barrios & Gil (2017), there is still constant mobility of people from rural to urban areas for several reasons, in Costa Rica, 27% of the population are still living in rural locations. To achieve the ideal connectivity between these two areas would impact the mobility of the people, good, services and knowledge (Cerdas Ramírez, 2019). Additionally, connectivity and mobility are a cross-disciplinary effort, takes into consideration technology and consumer characteristics to give the best solutions. Transport and infrastructure development should provide different options and avoid automobile-centric ideas as in past years (Gramaglia, et al., 2016). This article evaluates the option of implementing sustainable mobility in Costa Rica's national strategic development plan. With this approach we can ensure equitable access as well as protecting the environment and improving on the economic well-being for all (Van & Steel, 2017).

The relationship between urban and rural areas are considered complex, due to all the factors we need to pay attention to, starting with the physical distance. Also, we can mention other significant factors like human and financial capital, information and technology, and governance interactions and partnerships.

Sustainable mobility and connectivity form part of a key strategic economic pathways for most countries. Research also confirms that urban development and environmental sustainability can coexist (Godínez-Zamora et al., 2020). Most of the strategic pathways being implemented in various economies include energy efficiency, renewable energy, and green mobility. Additionally, green mobility has the following immediate short-term alternatives; walking, cycling and use of public transport and other climate and people-friendly innovative transport modes.

Sustainable mobility means to have a look at dynamics and patterns of displacement of the population. These dynamics of mobility respond to factors such as the reason for the displacement, age, employment situation; also, the available transport offer, travel time, comfort and safety that determine the preference for a type of a particular transportation mechanism. The usage for a transportation mode is a direct reflection on how the quality of public service transportation is in the country (Black, 2002).

According to Ch'ng (2017), the essential pillars for planning an Eco-mobile transport system in the rural-urban connectivity, require an integrated planning and policy framework. For the system to perfectly function, it must foster the following key determinants thus: people-oriented transit, inter-modality and finally it must enable infrastructure and service development as shown in Figure 1.

Figure 1.
Essential Pillars for planning an Eco-mobile transport system.

Source: Adapted from Obregon, Sin & Kodukula (2017).

The scope and approach

For this analysis we used as reference scientific and case report articles, local newspapers articles, interviews with experts in this topic and several meetings with industrial engineering students from Hamburg University. After this research we were able to have an accurate idea of the current situation of Costa Rica and Germany in terms of connectivity and mobility between those two areas (rural and urban). Also, we were able to give informative recommendations with this information and propose a strategy than can improve the local and global economy. Additionally, it is important to mentioned also that the articles we used also referred to the current situations of countries as Japan, Italy, and USA in terms of mobility and connectivity.

Current global mobility and connectivity trends

More than half of the planets' inhabitants live in cities. By 2050 the figure will have increased to almost two-thirds of the entire humanity. According to Porru et al. (2020), this predictable agglomeration of urban center presents us with multiple challenges that the United Nations was compelled to include these

challenges in its sustainable development (SDG) agenda for 2030. These can be seen especially in SDG goal 11, thus Sustainable Cities and Communities.

However, it is almost impossible to achieve this goal without an integral review of the way we live in cities. And in this transformation, admitting to the importance of sustainable mobility will be one of the key drivers to achieve sustainable cities and communities. The world is crying out for the elimination of fossil fuels, reducing traffic in cities and betting on sustainable means of transport as we already mentioned.

The emissions produced by various transportation means are not only an irreversible problem for global warming but are also one of the main causes of air pollution. This environmental problem affects our health much more than we think and causes around seven million deaths a year worldwide (WHO, 2021). Sustainable transport combines the economic axes, social and environmental issues for obtaining a transport system that generates greater economic benefits, improvements in the well-being of users and the least possible environmental impact.

Additionally, the transition from a traditional transportation sector to a system with an axis of sustainability generates benefits on adaptation, climate change mitigation reducing emissions from GEI; at the same time, it allows improvements in the peoples' quality of life by increasing accessibility, affordability, and social cohesion, as well as reducing externalities of the system lower vehicle congestion and related costs (CEPAL, 2018).

Sustainable Mobility in Costa Rica

The current Costa Rica's public transportation system has some opportunities in terms of route design, longer travel time. It is expected that with the new acquired trains, the transportation system is expected to improve exponentially. However, the current transportation system does not satisfy peoples' demands. As a result, it produces negative effects, thus most of the population opt for an individual transportation mechanism to avoid the current deficiencies in the system. As a result, this tendency has caused unsustainable patterns of transport, causing serious consequences, both socially and environmentally. Costa Rica transport sector is responsible for 54% of emissions which according to MINAE, 41% is individual transport related (Alpízar et al., 2017).

According La Nacion newspaper the time to travel across the area Metropolitan is usually the double of hours it would take during critical hours. The government in 2019 planned a decarbonization (2018-2050) that shows the route of transition to a modern economy, green environmental and emission-free. Additionally, this strategy also includes a plan to innovate the private and public transportation to electric transportation (2018-2030) (Koepff, 2015). This is a long-term plan, as a result, at this moment, it will

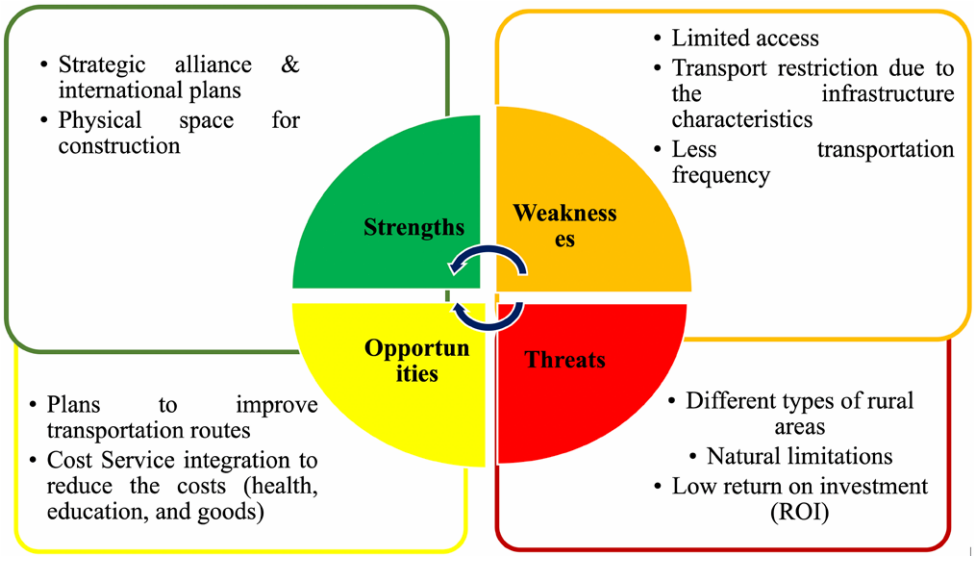
be too early to react to the impacts and effects of the plan. However, there is a clear and concise benefit if the country implements a sustainable mobility system in Costa Rica doing benchmarking with other countries (Miyazaki et al., 2018).

In addition, the Costa Rican government has developed efforts to innovate and transition to stable systems which are efficient and interconnected, for example, sectorization and integrated networks buses, the fast passenger train (TRP), electronic collection, improvements in quality of service as comfort, security, and connectivity (Estado de la Nación, 2018).

However, in addition to the above analysis, Costa Rica's rural areas have the following opportunities for growth; these areas have municipal plans to improve on transportation routes and service integration to reduce costs as shown in Figure 2.

These plans are further strengthened and supported at national level through the ministry of transportation.

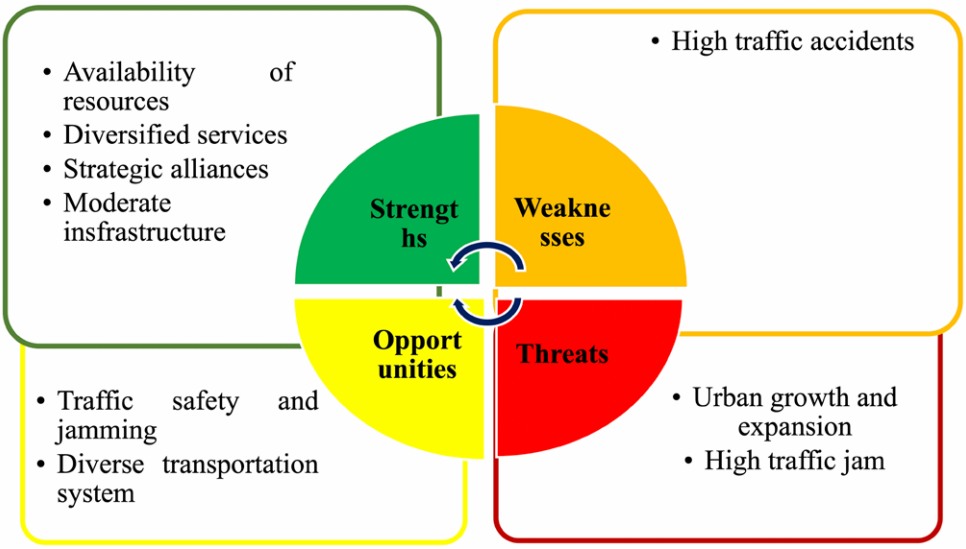
Figure 2.
SWOT analysis for rural areas.



Source: Own elaboration.

In addition to the similar support received at both municipal and national level in rural areas, the urban areas by their nature of development and over population, face the following weaknesses: high and dense traffic, these also result to high frequencies of accidents. However, one of the predominant opportunities in urban areas include diverse transportation systems and alternatives as compared to rural areas, as demonstrated in Figure 3.

Figure 3.
SWOT analysis for urban areas.



Source: Own elaboration.

As a comparative analysis there is a clear different between the rural and urban areas in terms of strengths, weakness, opportunities, and threats in Costa Rica; the urban area has more advantages in terms of economy potential: infrastructure, services, and resources. However, in terms of environment and space, it is a weakness. The population in Costa Rica, to compensate the inefficiencies of public transportation, the vast majority has devoted to using individual transportation, which is impacting the air emissions and besides that the traffic safety and jamming. Related to the rural areas is basically the opposite there is not an active economy with good and flexible transportation that produce and positive impact in terms of environment.

Mobility is not an issue that affects exclusively Costa Rica it is a challenge that is present in every country around the globe (Pinna et al., 2017). Whether it is moving people within large cities, or moving

people across desolate rural areas, governments are heavily investing in alternatives of how to improve mobility (König & Grippenkoven, 2017).

Germany as a benchmark country in sustainable mobility

In this study. Germany was selected as a country to benchmark because of its territory, like Costa Rica, a significant share of its territory is rural (Van Zeebroeck & Florizoone, 2019). Additionally, it is a country with strong mobility policies. Due to this, a comparison of both countries will help understand better the challenges that Costa Rica faces and how they can be rectified in the future. Germany has a privileged geographical position in Europe. It is part of the central part of the continent and shares border with 9 different countries. Additionally, it has a great variety of elevation ranges and access to Europe's major rivers such as the Rhine and Danube (SMARTA, 2020).

This represents great leverage against its neighboring countries in terms of where the country is located. But it also represents a big challenge because like Costa Rica, the variety of elevation ranges, makes it more difficult to make public transportation accessible to everyone (Wang et al., 2018). Even though, Germany has strong mobility policies, there is no mention of rural mobility in the national framework and no policy on rural transport is foreseen and yet about 20% of the population lives in rural areas. This percentage is similar to the 27% of the population living in rural areas in Costa Rica (Rivera & Porras, 2018).

Another common factor both countries share is the aging group. For example, in 2019 there were more people above the age of 60 than people under 30 (SMARTA, 2020) and in Costa Rica it is expected that the number of senior citizens will triple by 2040 (INEC, 2015).

To address the mobility issue, in the region of Baden-Württemberg Germany a service called Bürgerbus was implemented. This service is a shared volunteer-based community transport service which aims to complement conventional public transport services in low density areas with sustainable services, thanks to volunteer driving (either minibus or large passenger cars). It also targets to be a way of transportation for the elder people (Parkhurst et al., 2014). As discussed previously, aging is an issue that is present in both countries, and as people get older it gets riskier for them to drive around. In this case, Bürgerbus comes into the equation by giving the elders a solution to still be able to move from one place to another, without having to drive themselves.

This service is partially funded by the state, so with this, it can be cheaper for people in rural areas that typically receive lower income. In Germany, local transportation is funded together by a combination of national, federal state and local funds, besides the user contribution (SMARTA, 2020).

One of the reasons a service like Bürgerbus is feasible in low density areas is because it relies on most of its work on volunteers, which represents at least 60% of their expenses (SMARTA, 2020). Thanks to

this, the community receives the benefit of having a low-cost transportation method. To ensure that the vehicles fulfill all the regulations, the local government contributes approximately 30, 000€ as subsidies. Whereas for the tariffs for the ride, there are various options, which depend mainly on the type of cooperation with the local transport companies.

This approach of using shared transportation, helps maintain a sustainable way of moving people around rural areas. Without it, transporting people in rural areas would be, not only more difficult in terms of how much it will cost, but it will also require high cost/maintenance means of transportation. Using shared transportation services, help keep the usage of individual alternatives of transportation (cars) and optimize space utilization.

A solution of shared transportation system like Bürgerbus, it can also help release space and speed the way people move around the city. In San José, according to Koepff, (2015), driving from two places in opposite sides of the city can take 20 minutes. Doing the same route in public transportation, can take as much as 90 minutes. This issue is due to the lack of having a robust transportation network. None of the routes are designed to connect with other to optimize the time it takes to move around the city, and since there are no hubs to interconnect routes, people must walk between 1000 m and 1500 m.

As a result of this more time is required to travel using public transportation, which in the end makes people opt for buying a car (when possible) and therefore, increase the number of individual cars that only makes it even harder to travel quickly from one place to another.

Conclusions and Recommendations

As it was discussed, rural mobility is an issue in different parts of the world but implementing shared transportation services which is constantly supervised by local governments can make a great difference. Additionally, this is also an alternative in areas in which there is low population density to justify higher investment in infrastructure or transportation services that require larger populations for it to be accessible. During this research we mentioned the importance of connecting both areas to improve the quality of life of the citizens.

Bürgerbus is a viable solution to be implemented in Costa Rica's rural areas since the communities thrive by, because of its economic acceleration capacity in terms of jobs and mobility of people. Whereas at the same time, providing a low-cost alternative for transportation which is a volunteer service-based to complement public transportation. It also, helps people to stop putting themselves at risk by having to drive under unsafe conditions.

Costa Rica's government is generating a visionary contribution on the road to decarbonization of the transport sector and the transition to a sustainable transport system, moving to zero emission technology.

However, those contribution are long term until 2050, the citizens must be educated and challenged to visualize the negative impacts of individual vehicles and provided with a variety of sustainable alternatives. Costa Rican citizens can start with small changes by applying the principles of sustainable transport, thus avoid, change, and improve. In addition to promoting the use public transport for a few days a week to go to work "Big things come in small packages."

The sustainable mobility in Costa Rica must be improved in both areas to have a balance and improve on the quality of life in terms of transportation and the means people use. The urban areas transportation must move to zero emission technology like in Germany, by using the metro and other alternative options as bicycles (Melkonyan et al., 2020). It is also important to mention that the use of the bicycles is a culture, currently, the country is not ready to use bikes as an alternative transportation option due to road infrastructure and the way cars and bikes interact.

Costa Rica has a long journey to fully achieve favorable better transportation infrastructures and sustainable system optimization of innovative alternatives. Most of these delays can be directly attributed on governmental policies and financial shortcomings to invest in innovative mobility and connectivity. The biggest transformational change towards achieving improved transportation infrastructure and an optimized alternative, lies in its cultural adjustments. Cars are considered culturally as a necessity; this ideology hinders the use of public transport or any other novel alternatives like Bürgerbus innovative systems.

References

Alpízar, F., Piaggio, M.& Pacay, E. (2017). *Valoración económica de los beneficios en la salud asociados a la reducción de la contaminación del aire: el caso de la Gran Área Metropolitana de Costa Rica*. http://hdl.handle.net/11362/43184

Black, W. (2002). Sustainable Transport and Potential Mobility. *European Journal of Transport and Infrastructure Research*, *2*(4), 67. https://doi.org/10.18757/ejtir.2002.2.4.3722

Cerdas Ramírez, P. (2019). *Movilidad sostenible en Costa Rica: Utopía o realidad*. https://municipal.cegesti.org/articulos/articulo_%2025_270519.pdf

Ch'ng, S. Y., Obregon Prescott, I., & Kodukula, S. (2017, March 14). *Eco-mobility in the Context of Rural-Urban Connectivity* [Paper]. Intergovernmental Tenth Regional Environmentally Sustainable Transport (Est) Forum in Asia, Vientiane, Lao People's Democratic Republic. https://www.uncrd.or.jp/content/documents/5128Eco-Mobility%20in%20the%20Context%20of%20Rural-Urban%20Connectivity.pdf

Economic Commission for Latin America and the Caribbean(ECLAC). (2018) *The Inefficiency of Inequality. ECLAC*

Godínez-Zamora, G., Victor-Gallardo, L., Angulo-Paniagua, J., Ramos, E., Howells, M., Usher, W., De León, F., Meza, A., & Quirós-Tortós, J. (2020). Decarbonising the transport and energy sectors: Technical feasibility and socioeconomic impacts in Costa Rica. *Energy Strategy Reviews*, *32*, 100573. https://doi.org/10.1016/j.esr.2020.100573

Gramaglia,M.,Trullols-Cruces,O.,Naboulsi,D.,Fiore,M.,&Calderon,M.(2016).Mobilityandconnectivity in highway vehicular networks: A case study in Madrid. *Computer Communications*, *78*, 28-44. 10.1016/j.comcom.2015.10.014

INEC. (2015). *La población adulta mayor se triplicaría en los próximos 40 años*. http://shorturl.at/mxWY2

Koepff, J. (2015). *El transporte público en la Gran Área Metropolitana de Costa Rica*. http://library.fes.de/pdf-files/bueros/fesamcentral/12310.pdf

König, A., & Grippenkoven, J. (2017). From public mobility on demand to autonomous public mobility on demand–Learning from dial-a-ride services in Germany. *Logistik und Supply Chain Management*, 295-305, https://elib.dlr.de/104956/

Melkonyan, A., Koch, J., Lohmar, F., Kamath, V., Munteanu, V., Schmidt, J. A., & Bleischwitz, R. (2020). Integrated urban mobility policies in metropolitan areas: A system dynamics approach for the Rhine-Ruhr metropolitan region in Germany. *Sustainable Cities and Society*, 61, 102358.

Miyazaki, Y., Naito, K., Suzuki, H., & Watanabe, A. (2018). *Development of certificate based secure communication for mobility and connectivity protocol* [Paper]. 15th IEEE Annual Consumer Communications & Networking Conference (CCNC), 1-4. DOI: https://doi.org/10.1109/CCNC.2018.8319258

Parkhurst, G., Galvin, K., Musselwhite, C., Phillips, J., Shergold, I., & Todres, L. (2014). Beyond transport: Understanding the role of mobilities in connecting rural elders in civic society. In R. Means, V. Burholt, & C. Hennessey (Eds.), *Countryside Connections: Older People, Community and Place in Rural Britain*, 125-157. Policy Press. http://www.policypress.co.uk/display.asp?K=9781447310303&sf1=keyword&st1=Countryside+connections&m=1&dc=3

Pinna, F., Masala, F., & Garau, C. (2017). *Urban policies and mobility trends in Italian smart cities*. *Sustainability, 9(4), 494*. https://doi.org/10.3390/su9040494

Porru, S., Misso, F. E., Pani, F. E., & Repetto, C. (2020). Smart mobility and public transport: opportunities and challenges in rural and urban areas. *Journal of Traffic and Transportation Engineering,* 7(1), 88-97. https://doi.org/10.1016/j.jtte.2019.10.002

Programa Estado de la Nación. (2018). *Estado de la Nación en Desarrollo Humano Sostenible*. http://repositorio.conare.ac.cr/handle/20.500.12337/2983

Rivera, R., & Porras, A. (2018,). Población, empleo y pobreza en los territorios rurales de Costa Rica. *Rupturas*. https://doi.org/10.22458/rr.v8i2.2113

SMARTA. (2020). *Good Practice - Bürgerbus*. https://ruralsharedmobility.eu/wp-content/uploads/2019/08/SMARTA-GP-BurgerBus.pdf

Umaña-Barrios, N., & Gil, A. S. (2017). How Can Spatial Design Promote Inclusivity, Gender Equality and Overall Sustainability in Costa Rica's Urban Mobility System? *Procedia Engineering*, 198, 1018–1035. https://doi.org/10.1016/j.proeng.2017.07.147

Van Lindert, P. H. C. M., & Steel, G. (2017). Mobility and connectivity: driving rural livelihood transformations in Africa. *IIED Briefings*. https://dspace.library.uu.nl/handle/1874/365499

Van Zeebroeck, B., & Florizoone, W. (2019). *Insight Paper - Germany*. https://ruralsharedmobility.eu/wp-content/uploads/2019/08/SMARTA-IP-DE.pdf

Wang, Q., Phillips, N. E., Small, M. L., & Sampson, R. J. (2018). Urban mobility and neighborhood isolation in America's 50 largest cities. *Proceedings of the National Academy of Sciences, 115*(30), 7735-7740. https://doi.org/10.1073/pnas.1802537115

World Health Organization. (2021). *The global health observatory. Explore a world of health data*. https://www.who.int/data/gho/data/themes/theme-details/GHO/air-pollution