



How to Implement the Use of Telematics in Transport System in Antananarivo, Madagascar?

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ABSTRACT

Transport remains one of the pillars of development with a view to accelerating economic growth and reducing poverty. It facilitates the exchanges and the circulation of goods and people. Madagascar, as some African countries, lags considerably in the development of its regional trade, mainly due to the lack of reliable and adequate transportation system. Therefore, it has to be recognized that in order to achieve sustainable development, it is necessary to focus the efforts of the State and its development partners to the specific questions of transport and communications in Madagascar. So, the implement of telematics system might be one of the solutions that aim to develop the transport area. The aim of this paper is to undertake the implement of telematics in any area and environment, especially in some countries in Africa, in this case Madagascar, where this technology is not yet used. Also, the paper focuses on the expertise in transport engineering via transport system telematics in order to use telematics system in the proper way.

KEYWORDS: transport telematics, intelligent transport, sustainable transport

1. Introduction

The mobility of the population is an important indicator of economic development in a country. At the same time, it is also a factor which enable this development. Actually, the more inhabitants of a region move easily, the more they access to public services and markets. So, they are stimulated to produce more, to educate themselves and to have access to medical care more easily. However, in order to promote this ability to move from a region or a place to another one, an adequate and effective transportation system is needed. And telematics is one of the tools that is used in order to meet this requirement for a better, and even, sustainable transport system.

During those last two decades, some transport devices have evolved from an analogue machine with mostly mechanical and hydraulic control systems to a digital one, with a rapidly growing

volume of computer-based control systems. This transition continued with the integration of sensor-based intelligent vehicle functions that will further advance digital technologies in future automobiles. Then come the Intelligent Transportation Systems (ITS) which require increasingly capable in-vehicle digital systems. The reason why resulting digital car create a long-term market push and pull for telematics technologies. This all because a large portion of the population is dependent on communications and content and wants to extend this capability to their vehicles also. But telematics systems are not only involved in the ability to communicate but also encompasses security and safety functions for users.

2. Motivation of the paper

The means of transport and transportation infrastructures allow the population to move, to transport their goods and to carry out their daily activities. In other words, it is a support for the development of a city, even a country.

As a result, any problem that affects the transportation system may slow down or paralyze the economic growth in the region or the concerned country. Hence, a special attention has been given in how to improve and optimize the current transport system in Madagascar.

The main problems in the current transport system in Madagascar are:

- Traffic congestions in the mains cities, especially in Antananarivo, the capital city of Madagascar.
- Air pollution caused by the CO₂ emission in traffic congestion in Antananarivo where the atmospheric pollution can reach a peak of 360 µg / m³ during the day (World Health Organization statistics). Even if the use of polluting household fuels are also behind this figure, the main part is due to the carbon emission from traffic congestion.
- Lack of information about the traffic, information that might help in traffic management [2].
- Nonexistent schedule for the majority of public transportation.
- High rate of road traffic accidents, that causes injuries and death in many cases (29 deaths per 100 000 inhabitants from road traffic accidents) [3].

Therefore, this paper aim to propose a concept for the implementation of telematics into the current Malagasy transport in order to deal with the main issues linked to transportation.

3. The requirement of the implement a telematics system

Any transportation system can be interpreted as a set of elements and relationships linked into a functional entity (i.e. a set of technical means, human resources, and organizations involved in service delivery) [1]. And as a part of the technical means for this entity, telematics encompass many areas such as telecommunication, wireless connectivity, electrical engineering, IT, road transport. More concretely, this technology can involve any of the following:

- the technology of sending, receiving and storing information using telecommunication devices to control remote objects,
- the integrated use of telecommunications and informatics for application in vehicles and to control vehicles on the move,
- global navigation satellite system technology integrated with computers and mobile communications technology in automotive navigation systems, for pinpointing and locating the exact position of the vehicle.
- (most narrowly) the use of such systems within road vehicles, also called vehicle telematics.

4. What might be the concrete benefits of use of telematics in transport system in Madagascar?

First of all, telematics is an efficient tool for fleet management [2]. Indeed, with the location tracking, the owner can have information about the location of his vehicle at any time, even in remote places. This is because of the superior communication system that allows transparency and a free flow of data. Moreover, this also helps them in enhancing the overall execution. That will allow to tackle the issue of non-scheduled public transportation in Madagascar. Also, this information can be shared with the users of public transportation to solve the problem of long standing line and longtime of waiting in bus stops.

The capability of fleet telematics is not limited to simple vehicle location tracking. On the side of management of transportation system, telematics allows maintenance control. Regular maintenance is an often underestimated way to improve fuel efficiency. Effectively used, fleet telematics can be set up to alert managers when certain maintenance needs to be performed to their vehicles. In this case, telematics is used as a part of a decision making process for any kind of maintenance, especially for predictive maintenance. This improve also the productivity monitoring of individual equipment based on real-time location and status transmitted to fleet control center from the equipment.

Due to the lack of real-time data and information about the traffic, vehicles get stuck in traffic jam and people lose an important amount of resources (fuel, time...). However, the traffic data analysis allowed to create macroscopic traffic models using connections between average speed, traffic flow, and density in order to undertake the problem of traffic congestion [5]. And also, they provide to the drivers the most direct and closets routes—saving time and fuel.

In-vehicle telematics devices and telematics data are used to optimize the capacity of the vehicle and reduce its CO₂ emissions, especially in dense street networks and in urban areas [4].

Finally, telematics can be used in order to find risky driver behavior which is one of the main causes of traffic road accident. Actually, the travel behavior is defined as the driver's choice concerning which type of road to use, what time of the day to drive and how much to drive. The speed and GPS data, the acceleration, braking, speeding and cornering and the associated timestamps can also be used in a risk analysis model in order to determine how risky a driver's behavior is [6].

To conclude, telematics will play a major part in helping make the road freight sector more sustainable.

5. Case study : Methodology of implementation of telematics in Antananarivo, the capital city of Madagascar

According to a survey done by the communication agency Stilex to a selected inhabitants of Antananarivo in 2018, nearly 80% of questioned people find public transport more practical. Also, almost half of the respondents use them daily. However, on the average, the workforce spend between 30 minutes to 02 hours a day on public transportation. The mostly common complaints received from users are the time lost in traffic congestions, the absence of a precise timetable for public transport as well as non-compliance with the routes pre-established by the company [9].

All those issues motivated the proposition of concept for implement of telematics system into the public transport of Antananarivo.

5.1 Infrastructure

Infrastructure is an important mean that allows to implement Telematics. So, the evaluation of existing infrastructure, such as a good network system and communication equipment, will be necessary. In some remote regions in Madagascar, the network coverage remains a problem, so the investment on new infrastructure is required. However, for the particular case of Antananarivo, the city already has a good network coverage, as shown on the map Fig. 1, which will facilitate the use of telematics.

5.2 Technical requirement

The uses of telematics systems require some basics knowledge from both sides the users and the operators. From the operator point of view, these are some systems used to facilitate telematics implementation such as software telematics for fleet management. Then, telematics operators need to have knowledge on how the application works, how to enter the data, and how to build solutions. It doesn't mean they have to have hands-on experience as long as

they are aware of the capabilities of the application and how to drive the data into it and get the solutions.

From the side of users, in order to make the technology more convenient, the simplest design might be the most efficient. For instance, the use of intelligent human-machine interface (IHMI) provides an interaction of user and an information system (IS) in a natural way by means of intrinsic modalities of a human gesture, voice, facial expression, using artificial intelligence, that ease the adaptation of telematics [7].

5.3 Ethic point of view

By knowing the benefits of telematics system and understanding its social and economic impacts, companies and people will be more inclined to use it. Therefore, in order to get people more interested and motivated to use this technology, the first step will be to promote widely and explain its application, how does it works and its benefits.

Another important element is support: listening and understanding what the users are expecting from this technology and trying to meet those expectations. The perspectives offered by the technologies of the intelligent transportation systems should reflect the real needs of their users, therefore should be adapted and suitable for them. That allows to design a system which is suitable and adapted to the special area where it will be implemented, Fig. 2.

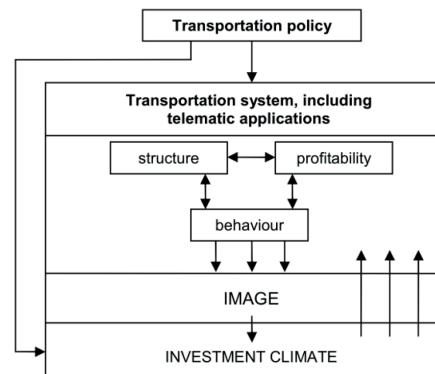


Fig. 2. Investment climate structure – behavior – profitability [1]

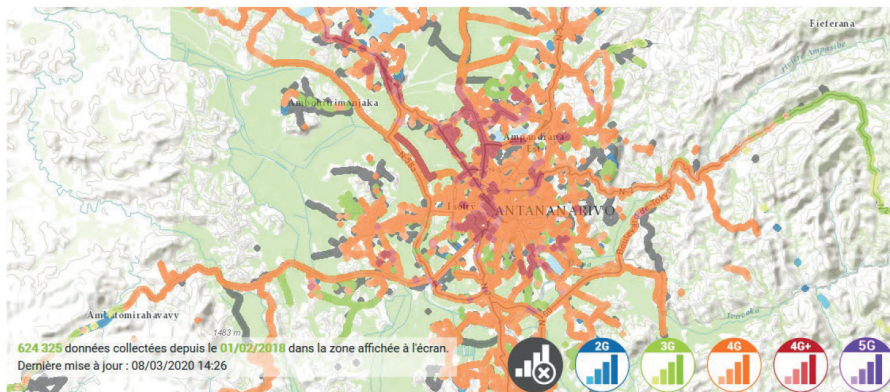


Fig. 1. Antananarivo network coverage [8]

6. Targeting a sustainable transport by the use of transport telematics

A sustainable transport refers to a various perspectives, including social, economic, environmental, cultural and technical, and covered a broad range of issues, including its definition, analytical framework, planning, policy, regulation and implementation [10]. Among those perspectives, the environmentally sustainable transport (EST) receives the most attention and comprises the biggest branch of research in order to mitigate the negative impacts of transport on environment and climate. Actually, it is assumed that transportation systems are also a generator of many kind of waste (vehicles, parts, packaging, carbon emission, etc.), that have impact on the environment and climate.

The use of public transport has recently been increasingly encouraged in many cities and countries all over the world. The motivation behind this promotion of public transportation system is to deal with the environmental problems linked to transport in general and to build practical urban areas, in other words, to build more sustainable cities which is one of the 17 Sustainable Development Goals (SDGs) set by the Union Nations.

In order to meet this target of a sustainable transportation system, many principles have been used such as the Car Free Developments [11] that prohibit or confined the use of private car in urban areas. The diminishment of the quantity of vehicles, and in this way a decrease in the requirement for stopping spots and street space, gives chances to expand green space and green systems in urban areas, which thusly can prompt numerous valuable wellbeing impacts. At the same time, this also motivate the use of the public transportation which are more and more available.

In order to support the mobility needs of all users and to allow a better integration of any modes of transport, the concept of transport planning through mobility management have been proposed. By the use of telematics, the accessibility of particular areas and services are now easier. On the other hand, this will also contribute to improvement of the quality of life for the public and the environment [12].

7. Conclusion

This paper has shown the importance of the implementation and adaptation of telematics into the transport system in Madagascar, especially in the particular case of the capital city, Antananarivo. As a support to the daily activities of the population, transportation system should be on the top of interest of the State in order to solve issues that can paralyze the economic growth of the city, and even the country. And also, to make the transportation system more sustainable, any point of view should be considered: economic, human and social, and environment and all of them can be encompass in the benefits of use of telematics. Even if the implementation of this system requires an important investment from the start, not only financially but also socially, the project may

well have important positive impacts on the daily lives of inhabitants in term of comfort of use, availability of transport system but also the safety while traveling. Over the long term, this will then be more than profitable for the country.

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