

Integrated Transport System: Challenges and Potential Toward Sustainability in the Malaysian Transport System

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Abstract. Integrated Transport System (ITS) is the technology of utilising intelligent application in management of transportation systems. Generally, ITS involves the merging of various transport systems of multiple types of transportation, and managing the movement of the cargo or passengers according to data collected, in terms of destination, congestions, routing and costs, to name a few. The idea behind ITS is to facilitate a better experience for moving of cargo and passengers, by integrating suitable modes of transport, based on real-time data of the best available routes, time and cost. ITS also aims for better comfort and efficiency, to beat the typical adverse effects of transport systems, particularly congestions, delays, and subsequent wastes such as pollutions to the environment. This paper examines trend of ITS in Malaysian, particularly in the Kuala Lumpur and Klang Valley area, the potential and benefits that ITS can bring to improve on the current transport system.

1. Introduction

1.1. Background of transport system in Malaysia

The increasing urbanisation due to economic growth and industrialisation, has pushed the transport system its limits. Spur of businesses have allowed for the expansion of the suburban and towns surrounding the cities, to accommodate for more industrial areas to support the demand of the manufacturing, collecting and warehousing of various products. This directly causes the transportation industry to grow bigger, having to move the consumer products for daily supplies. Freight of goods, whether it be those that are imported or the locally produced items for local consumption or export for international market, introduces the ever-growing need for various modes of transport; land, rail, sea and air.

Naturally, to accommodate the growing economy, the government has concurrently developing and building more transport networks [1]. New highways are planned and built, while existing road networks are improved. Connectivity is the key to a good transport system [2]. These road networks connect and support the main logistics hub, like ports and airports, to facilitate better transporting of goods to the urban centres. A good example of this is Kuala Lumpur and the Klang Valley area, where the seaports of Port Klang are connected directly to the city. The nearby areas also saw developments and growth, where industrial areas that support the various industries were developed.



Public transportation networks were also developed, to cater for the increasing movement of people going to and coming back from the growing suburban industrial areas. Besides typical public bus systems, new rail networks (i.e. KTM Komuter, LRT and MRT), built in stages, to improve interconnectivity between the satellite towns and the city centre, with the KTM Komuter beginning operation in 1995, and the latest development in 2016, features the MRT line from the northern town of Sungail Buloh that goes all the way south to the town of Kajang in the Selangor state. The Express Rail Link (ERL) was also built to connect the heart of Kuala Lumpur to the Kuala Lumpur International Airport (KLIA), and began operating since 2002, with a daily ridership of around 27,000 passengers in 2015 [3].

2. Challenges in the Transport System

Taking Kuala Lumpur and the Klang Valley area (Kuala Lumpur, Klang, Petaling, Gombak and Hulu Langat) as an example, the population growth from 2010 to 2020 is expected to be at 1.7% per year (refer figure 1, Selangor Structure Plan 2010-2020). The current estimated population of Klang Valley for 2019 is 7.78 million (UN World Urbanization Prospects, 2019). Without a doubt, the source of the concentration of people to the Klang Valley area is due to the economic prospects and urban life. Daily, thousands of people commute from home to their workplaces, causes the transport system to be utilised to the max, especially in the rush-hours in the morning and at the end of the day. However, the Malaysian public transport system is still lacking and requires major improvements, in terms of accessibility, connectivity and reliability (i.e. timing, service availability) [4]. It is still not efficiently connected enough with the major residential areas scattered across Klang Valley [1]. Eventually, the whole Klang Valley transport system faces congestion everyday eventhough there are more than 15 major expressways, plus many other highway projects in the planning and developments stages (Malaysian Highway Authority, 2019).

Location	2010 (Million)	2020 (Million)
Gombak	0.83 M	0.88
Klang	0.98	1.41
Petaling	1.77	2.00
Kuala Lumpur	1.8	2.2
Hulu Langat	1.22	1.33

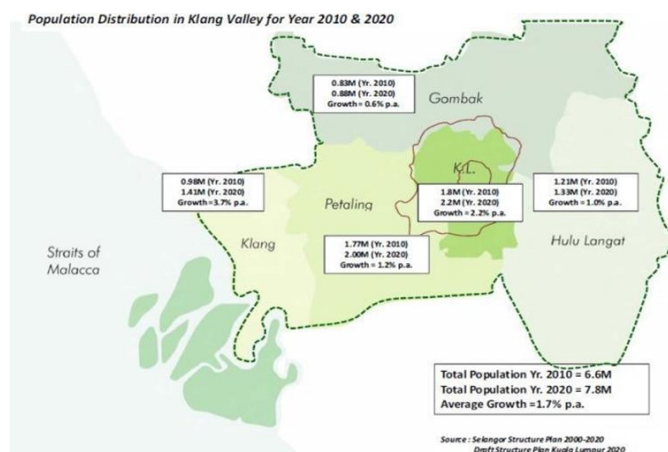


Figure 1: Population Distribution and Growth for Klang Valley for 2010-2020 (Source: Selangor Structure Plan, 2000-2020)

Other major issue coming from the Malaysian transport system is pollution and environmental detriment. More people mean more private vehicles are added onto the roads and highways [5] adding to the already existing congestion problems, discharge of hazardous emissions into the environment. And of course, the effects of pollution will manifest in health problems, not to mention global warming and disruption of Earth's natural climate. The adverse effects of urbanisation and population growth increase demand for systematic transportation, necessitates the construction of more road networks and rails and add on to the issue of traffic congestions, as existing road networks must be interrupted and diverted. Ultimately, the congestions become worse with time.

3. ITS in Malaysian Transport System

The idea of integrated and intelligent transport system is not new in Malaysia. There have been efforts to investigate the adaptation of the ITS in Malaysia since as early as 1999. An initiative project named “ITS Strategic Plan for Malaysia: A Way Forward” was carried out with the guidance of the Road Engineering Association of Malaysia (REAM), and produced a study that highlighted the general basis for developing of the framework for the introduction of ITS in the Malaysian transport system. Soon after, the Malaysian government endorsed the proposed plan in 2002, where the Ministry of Works were tasked with the responsibility to plan and organise the deployment of ITS for Malaysia (Association, 2009).

The Minister of Works together with a newly appointed ITS council began the work of materialising of ITS, through the “National ITS System Architecture”. This system architecture basically sets out the blueprint for all the elements that are required to ensure that ITS deployment in the country can achieve the short, medium and long-term goals. The system architecture shall ensure that the application of any technology, including future potential advancements, will improve the transportation system as whole, which means better efficiency of transporting of people and goods, as well as management of the modes of transport or the fleets that are involved [6]. Thus, the very principle of the system architecture is an open and flexible framework, to allow for smooth interoperability between all systems and subsystems of the transportation system, such as the transport vehicles and communication, plus data collection and solutions applications. The established ITS System Architecture also serves as a guide on how the various stakeholders should design their system components, to ensure interoperability among each other, though introducing base standards across the sectors. This helps Malaysian industry players, especially those ICT-based businesses to better navigate their dealings, so they can be competitive not just in the country, but also throughout the ASEAN markets.

The earliest application of ITS in the Malaysia can be seen in the implementation the centralised traffic monitoring of the major highways of Klang Valley, by the Traffic Management Centre (TMC) of the Malaysian Highway Authority (MHA), which began in 2005 (Malaysian Highway Authority, 2019). Initially, the National TMC, located at the MHA headquarters in Kajang, Selangor, is connected to the control centres of 12 major highways. The establishment of the TMC is to facilitate the real time supervision and management of the highway networks by collecting and analysing of live traffic data and produce immediate suggestions for mitigation of any traffic issues, and subsequent transmission of the updates to the road network users, through the relevant highway’s control centre, implementing tools such as short message system (SMS) and roadside variable message signs (VMS). The TMC also functions as an emergency control centre, and the focal integration point between other private highways and road networks by receiving the information from the highway control centres, which monitors the traffic through more than 200 cameras, as well as 155 Vehicle Detection Stations (VDS), along the major highways in Klang Valley, including the Penang Bridge. The coverage is planned to be increased to include future highways (The Star Online, 2007).

In Kuala Lumpur, ITS has been in play its role since 2005, with the Integrated Transport Information System (ITIS) cooperation between MHA, Malaysian Public Works Department (JKR) and Kuala Lumpur City Hall (DBKL). They focus on two main components, namely the Advance Traffic Management System (ATMS) and the Advance Travellers Information System (ATIS) (Association, 2009). The ATMS is the monitoring component of the ITS, utilising various data collection tools, such as CCTVs Automatic Incident Detection System (AID System) and the Automatic Vehicle Location System (AVLS) [7]. Data collected are relayed to the ITS transport management centre in Bukit Jalil, Kuala Lumpur for processing, and subsequent mitigation of any issues found. On the other end, the ATIS is responsible for delivering traffic condition information to the traffic users, through VMS, mass media and the internet, to manage traffic congestion and flow

[8].

4. The Future of ITS in Malaysia

4.1. The benefits of ITS

The implementation of ITS brings about various benefits that can be categorised into six criterias which are safety, mobility, customer experience, cost, service efficiency, and socioeconomic. Some technology of ITS might be focused on attaining a certain criterion of benefit, but indirectly bring others as well. For example, having ITS is safety improvement, such as The Automated Awareness Safety System (AWAS) is an example of monitoring and enforcement of traffic rules, where cameras capture traffic offenders breaking traffic rules, such as driving above the speed limits, running over the red light, and yellow box intrusion. The ITS implemented can alert any road user that stops inside the yellow box, through loudspeaker systems, to ensure traffic flow is not interrupted. With newer and better high definition cameras, paired with advancement of the algorithm or AI in real-time image processing, traffic users can be identified easily with the automatic vehicle registration number recognition [1].

A good logistics systems that monitors smooth connectivity of ships, to rail and road trucks, can allow for a more efficient delivery system for goods, in the same way that a real-time management of connected public transport system of ride-sharing, LRT, shuttle buses and bicycle rentals can allow for quick and smooth journey for people [10]. New technology means the potential of new businesses, such as ride-sharing apps, public transportation app, mobile ticketing apps, etc. which directly to the implmentation of e-commerce, electronic wallets, prepaid cards and self-service.

5. Implementation and Potential of ITS in Malaysia

Dynamic Traffic Signal Control System (DTSC) is one of the features in ITS where traffic flow can be managed by manipulating the traffic lights at major intersections. Traditionally, traffic police are dispatched to manually manage the traffic flow during rush hours. However, the DTSC uses sensors and cameras to monitor the vehicles on the road leading to the intersection [12]. A set of algorithms, along with traffic centre operators can used these inputs to determine and manipulate the frequency and duration of green and red lights at the junction, thus smoothing out traffic flow during congestions. Electronic toll collection systems are also being improved to ensure minimal congestion at the toll plazas. Starting with the Touch 'n Go system (TnG), utilising a prepaid card that is tapped on sensors to deduct toll payments, the system has evolved to using infra-red (IR) 'smart-tag' technology to detect passing cars' cards, and the latest advancement is in radio frequency ID (RFID) stickers which allow quicker detection within longer distance. Concurrently, user can now pay using electronic wallets, where toll charges are deducted directly from there (Touch 'n Go, 2019).

ITS now is more accessible to the larger spectrum of road users with the evolving of the internet technology. The greater availability powerful smartphones, has allowed transport system user to access the internet, through various mobile apps, created to intelligently provide route guidance, traffic conditions and expected travel times. Greater computing power allows for quicker processing of the real-time data collected, thus providing faster and more responsive mitigations and suggestions for improving of the user's journey [13]. These all are part of ITS in the traveller information systems. Another aspect that has seen improvement is parking of vehicles in the urban centres. Some time ago, among the issues of traffic congestions are caused by vehicles difficulty to find parking, thus prolonging the congestion on the roads as well as basement carparks. Nowadays, ITS has helped the establishment of Indoor Parking Management and Monitoring System (IPMS), which is connected to the Outdoor Parking Guidance System (OPGS) [14]. The availability of nearby parking spaces, monitored by the IPMS, are disseminated though the VMS of the OPGS. Also, there are now various

mobile apps that allow users to pay for their parking straight from their smartphones.

Now, a new angle of approach at the ITS System Architecture would be to engage and get infrastructure providers to be involved in the ITS concept from the very beginning [15]. Local authorities, town planners, architects, developers and contractors, should include ITS mindset in their conceptual and planning stage of infrastructure projects. For example, emphasis should be given for more stations combining buses, train and rail services, located at strategic locations with interconnectivity with bicycle routes, as well as, ride sharing/taxi services. Better planning will lead to better designs of infrastructure that can accommodate better integration of the transport systems.

6. Challenges of ITS in Malaysia

Deployment of ITS in the country's transport system has not happened without its own sets of issues. In the beginning, funding and technical support were not easily available. Installation and integration of the ITS tools in transport system required significant investment in terms of capital and expertise [4]. Since ITS employ a wide array of hi-tech tools and applications, not many suppliers or vendors were available. With the advancement of technology, newer and more advance tools and applications are available, with a wider choice of manufacturers, and installation cost has stabilised.

Initially, time is required for ITS to be accepted by the users. Introduction to something new requires dissemination of relevant information and familiarisation. It can be considered as the period for educating of the stakeholders. After some time, transport system users have adapted to the ITS tools, and the improvements can be seen. Once ITS has been in place, the interconnectivity between the various components of the transport system needs to be streamlined to ensure for a smooth operation [9]. This becomes more imperative, when conflict occurs, due to the differing policies and objectives of the various agencies behind the various interrelated components of the ITS. An example different operators of traffic management centres of highways and arterial public roads, might not efficiently function when each of them prioritise their own goals, instead of the common proposed solutions by the ITS tools.

Globalisation has brought about the spread of technological advancement to the country in much faster speed than it would had happened many years ago. Faster internet connectivity and ease of availability allow greater exposure of any new technology to the masses. One nice feature of ITS that is still being developed is the mobility aspect of it, specifically the integration of multiple modes of transportation. As the example given earlier, taking a person who wish to get from his home outside the city to his office at KL city centre; it would be more comfortable and cost effective, should there is an interconnected transport solution [2]. Now, efforts are on the way to accomplish this, by incorporating big data analytics, cloud computing, mobile apps and of course cross platform transportations. ITS advancements, do not only benefits the management of the transport system, in fact, they open-up new opportunities for businesses, thus promoting economic growth, which means improving the standard of living for the people involved. Currently, there is a shift in viewing e-hailing services, where once it was considered as a competition to taxis, it is now accepted as another method for securing customers, after integration of the two systems to accept each other [16, 17]. A lot more people now making income by participating in the various e-hailing services.

As discussed earlier, implementation of ITS is expected to improve the transport system. A direct effect that is hoped for would be lesser traffic congestions and smoother journey for the users, due to the better management of traffic flows, as well as reduction of private road users who can migrate to use the more efficient public transportation systems. Lesser congestion and vehicles, lesser emission release to the atmosphere. Ultimately, we can expect the improvement for the protection of the environment. Finally, with a healthier environment and general public, together with a more vibrant economy and better quality of life.

7. Conclusion

ITS enables the integration of all modes of transportation together with advance technological tools and application that uses valuable real-time data, to produce dynamic solutions to problems and issues occurring in the governed transport system. With ITS, more efficient, cost effective and safe logistics arrangement can be achieved in moving people as well as goods. ITS requires a lot of monitoring, data collection, processing and feedback, by various interconnected components of the transport system. The Malaysian government has laid out the plans for the deployment of ITS in the country's transport system with more initiatives to study on the establishment of the ITS System Architecture, by relevant ministries and governmental bodies. Many projects have been successfully implemented and refinement are always being done for future improvements. Various traffic management centres work together for the enhancement of traffic conventions and safety issues by studying the data collection, analyse and dissemination has enabled ITS to reach further to the mass users of the whole transport system networks. Travel management, route planning, and cashless payments are the norm in the new tech savvy society. Generally, ITS has brought about a lot of good for the whole transport system, with the nature of the flexibility and growability of the system architecture, we can always hope for many more future developments and progress to Malaysia's transport system.

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