

CURRENT LANDSCAPE OF THE AUTOMOTIVE FIELD IN THE ASEAN REGION: CASE STUDY OF SINGAPORE, MALAYSIA AND INDONESIA - A BRIEF OVERVIEW

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Abstract

Southeast Asia (ASEAN) Region is one of the most important automotive market globally with major carmakers have their assembling and manufacturing plants in the region. The region also produced significant development in the automotive field. In accordance with the spirit of the newly launched Asean Journal of Automotive Technology, this work is written to provide a brief overview of the recent progress in the automotive field which is happening in the region. This includes the progress in the connected and Autonomous Vehicle (AV), Advanced Driver Assistance System (ADAS), Active and Passive Safety as well as Green and Electric Vehicles (EV). The work aims to highlight the recent landscape of the region, with the focus on Singapore, Malaysia and Indonesia. From the survey, collectively, the region's prospect in the automotive field remains bright due to a lot of works have been done in adapting to the latest emerging technologies in the sector. With the rise of AV, it is important for this paper to be written to allow a wider understanding of the region automotive landscape before a more comprehensive AV deployment. Since the aim is to provide introductory idea to the beginners and researchers about the region's current automotive industry landscape, technical discussions are omitted. Consequently, it is mostly written in generic nomenclature for a better readers' understanding.

1.0 INTRODUCTION

The new age of transportation saw the main direction of the automotive field's focus to be shifted. In the past few years, the automotive industry has been disrupted by several emerging technologies (Rahman et al. 2017). Topics such as Vehicle-to-everything (V2X) (Ullah et al. 2019), Intelligent Transportation System (ITS) (Guerrero-Ibanez et al. 2015) and Advanced Driver Assistance Systems (ADAS) has garnered more attention than before (Brookhuis et al. 2019). Consequently, these developments stimulate the progress of Connected and Autonomous Vehicles (CAV) in large scales (Hamid et al. 2016). Globally, carmakers and start-ups are collaborating towards the full implementation of Autonomous Vehicles (AV). For example, Cruise Automation is acquired by General Motors Company (Cummings 2017), while BMW, Daimler and several other major carmaking corporations have recently published a white paper entitled 'Safety First for Automated Driving' which examines the topics (BMW Group, 2019).

However, despite the earlier prediction was anticipating the fully autonomous vehicle implementation to be as early in the year 2020, the estimation has since been extended to a more realistic timeline (Litman 2017). The road casualties involving autonomous vehicle which happened in 2018 implies that for a global full-scale implementation of Autonomous Vehicle, the understanding of the regional automotive landscape and environment should be included in the consideration too (Hamid et al. 2018). This requires multi-disciplinary studies about the desired AV's implementation location to be done since different regions have different traffic and environment conditions. Companies such as Sensible 4 in Finland is one of the examples doing such activities by extensively doing works on the topics of bad weather solution for autonomous vehicle (Heerwagen et al. 2019). This shows the importance of a specific geographic-based study before the implementation of autonomous vehicles in the said region.

1.1 Objectives and Structure of the Work

Despite the aforementioned details, most of the discussion on the said topics mainly covers the progress in the European, East Asian and North American regions. For a wide implementation of CAV in Southeast Asian (ASEAN) region, a study should be done beforehand to identify the preparedness of the region for the arrival of the highly disruptive technology. As such, in this work, the authors try to give a brief overview of the recent states of the automotive field in ASEAN. The work is expected to give a summary of the landscape of the automotive industry in the region, specifically in Singapore, Malaysia and Indonesia. The aim is to illustrate ASEAN's readiness and progress in adapting to the various emerging trends in the automotive sector. Hence, the discussion is not limited only on the Autonomous Vehicle, but instead, it gives an overview on what has been done in the region in recent years, which include the topics of Vehicle Safety, Advanced Driver Assistance Systems (ADAS) as well as Active and Passive Safety. It is hoped that the content of this paper will aid in the advancement of the automotive industry in the region and gives a more comprehensive picture of the current status of the sector in the region. Following the ethos of this journal in promoting ASEAN automotive works, this paper is also expected to provide introductory ideas for new researchers and beginners about the ASEAN automotive industry. It is important to be mentioned that this work is not aimed to be exhaustive, but rather indicative. Thus, detailed technical discussions are omitted.

The paper is organized as follows. In the next section, a short background on the ASEAN automotive industry is indicated, accompanied by the progress of

automotive sectors in Singapore, Malaysia and Indonesia in their respective sections. In Section 3, the future work suggestions for ASEAN Automotive industry are written. In the final section, a concise conclusion for the work is addressed.

2.0 ASEAN Automotive Industry

Southeast Asia is one of the most important markets in the global automotive industry. The region (ASEAN) actively assembles and manufactures vehicles, with Malaysia being as one of the 14 countries in the world with the capacity to design, engineer and assemble automobiles from the initial stage (PROTON, 2007). In a 2018 report on the ASEAN Automotive Industry, it is mentioned that compared to the expected global and Asian growth of the automotive industry, ASEAN yields a larger growth prediction with the value of 6.9%, compared to 3.2% and 4.0% for the global and Asian growth, respectively. Besides, the value also signifies an increment compared to the 2017 growth value for ASEAN, which is 5.4% (Baisden, 2018). This shows the importance of the region for automotive sector sales globally. Furthermore, a lot of assembling and manufacturing plants are established in the region by major carmakers. However, road casualties, traffic congestions as well as air pollution remains the issue in the region. Consequently, in recent years, work has been done by entities in the region to solve the issue. In the next subsections, these developments and activities are briefly written, which comprises the topics of Autonomous Vehicle, ADAS, Vehicle Safety as well as Green and Electric Vehicle (Figure 1).

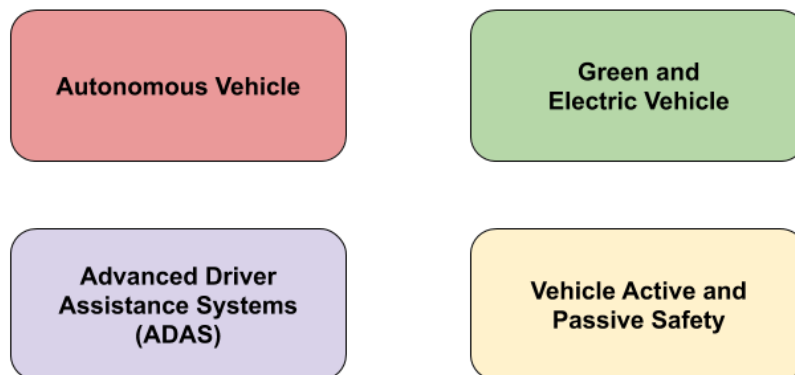


Figure 1. Overview of the recent progress in the Automotive Field in the ASEAN region.

2.1 Recent Progress in Automotive Field in Singapore

2.1.1 Autonomous Vehicle

Singapore is one of the main economic centres in the ASEAN region. The main progress of the Automotive field in Singapore in recent years is in the topics of autonomous vehicles and Intelligent Transportation

System (ITS) (Marczuk et al. 2015). Strong support from the Singaporean Government is evident since the past few years in putting Singapore into the global map of AV developments. The organization of 2019 ITS World Congress, which is co-organized by the Land Transport Authority of Singapore manifests this (ITS Singapore, 2019). Besides, the launch of the Centre of Excellence for Testing and Research of Autonomous Vehicles (CETRAN) in November 2017 is proven to expedite the development of Autonomous Vehicle in Singapore by attracting influential AV teams in testing their platform there (Huiling et al. 2017). This in return secures Singapore with the second place in the 'Autonomous Vehicle Readiness Index' by KPMG for two consecutive years (Table 1) (Threlfall, 2018) (Threlfall, 2019).

Year	Rank
2018	2
2019	2

Table 1. Singapore's spot in the Autonomous Vehicle Readiness Index by KPMG for two consecutive years (Threlfall, 2018) (Threlfall, 2019).

2.1.2 'AV Readiness Index'

In the 2019 AV Readiness Index, Singapore leads the points for the aspects of 'Policy and Legislation' and the 'Consumer Acceptance' towards AV (Threlfall, 2019). This subsequently attracts the main industry players to have their AV platforms validated in the country. In the context of AV Research and Development (R&D), Singapore government through the Agency for Science, Technology and Research (A*STAR) has demoed their AV Prototype to the Singaporean Prime Minister as early as 2015. Compared to other ASEAN countries, this is a step forward at the time (The Straits Times, 2016). Several main industry players in the AV Industry have also been operating in Singapore. nuTonomy was one of the examples. In 2017, Aptiv (the automation branch of Delphi, formerly known as Delphi Automotive) bought the company with the value of more than 400 Million dollar (Wiesbaden, 2018). Following the decision, Aptiv has now assembled extensive data on the roads of Singapore in their projects, NuScenes, which provide datasets for autonomous driving studies (NUSCENES, 2019) (Caesar et al. 2019).

Several startups in the AV fields have also emerged from Singapore. In addition to that, prominent research teams in the AV such as Urban Mobility Lab of the Massachusetts Institute of Technology (MIT) is now operating in Singapore (Shen et al. 2018) (Urban Mobility Lab At MIT, 2019) (Bailey et al. 2018).

From the brief survey, it is evident that the participation of Singapore in the AV is extensively prepared. However, challenges remain particularly in the context of real implementation, where further works

are required for it to be implemented in mixed-traffic conditions.

2.2 Recent Progress in Automotive Field in Malaysia

Malaysia is one of the main automotive powerhouses in ASEAN. This is partially due to the existence of PROTON Holdings Berhad (PROTON) and Perusahaan Otomobil Kedua Sendirian Berhad (Perodua), the national carmakers of the country (Wad et al. 2011). In addition, Malaysia is also the home to Sepang International Circuit, where Formula 1 races have been held there for nearly two decades (Mapjabil et al. 2017). These resources allow the country to do further works in the automotive field. Compared to what has been surveyed about Singapore, the Malaysian Automotive Industry is relatively larger. Thus, their research works topics are broader and more thorough. Concerning the recent trends in the automotive sectors, Malaysia has produced a lot of research in the context of AV, ADAS, and vehicle active safety (Intelligent Drive (Vehicle System Engineering), 2019) (Hamidun et al. 2013) (Kassim et al. 2019).

2.2.1 Advanced Driver Assistance Systems (ADAS) & Vehicle Active and Passive Safety

Universiti Teknologi Malaysia (UTM) with the support from PROTON has co-founded a research team which worked extensively in the topics of Advanced Driver Assistance Systems (ADAS) (Figure 2). The collaboration mainly is motivated by the aim to reduce the high number of annual road fatalities in the country. This group was largely active on the said topic during the year 2012-2017. Among the studied topics are 'Collision Avoidance System', 'Lane Departure Prevention System', 'Blind Spot Monitoring System' and 'Autonomous Emergency Braking System' (Zulkepli et al. 2017a) (Zakuan et al. 2017) (Hamid et al. 2017) (Zulkepli et al. 2017b). Apart from that, comprehensive works on the topics of 'vehicle dynamics' are also done throughout the process (Ariff et al. 2014) (Zulkarnain et al. 2012). Apart from doing the R&D in the said topics, the distinctive feature of the works done by the team is because some of them are designed to cater to the local road traffics of Malaysia. For example, Zakuan et al. developed a blind spot monitoring system for road vehicles with consideration of 'Malaysian Road Traffic Condition' (Zakuan et al. 2017). This is important as such works are not actively done in other regions due to different traffic conditions (i.e. absence of varied types of motorcycles on the road).



Figure 2. Experimental Platform that is utilised by the UTM-PROTON R&D Team for most of the mentioned ADAS works (Hamid et al. 2017).

Works have also been performed by UTM and PROTON in the context of vehicle passive safety. The Vehicle System Engineering laboratory, which is based in Kuala Lumpur has done extensive work in the magnetorheological damper topics. Among the anticipated outcome is to enhance the performance of the road vehicle passive safety and suspension, and subsequently improving the vehicle handling and comfort experience (Imaduddin et al. 2014a) (Imaduddin et al. 2014b). Apart from UTM, R&D works in the automotive field have also been done in other universities such as Universiti Malaysia Pahang and DRB-HICOM University of Automotive Malaysia, among many others (Chew et al. 2019) (Hanaysha et al. 2016) (Ng et al. 2018) (Razak et al. 2019).

These developments show the ability of Malaysia in yielding in-house R&D results with customized modifications for Malaysian road and traffic environments. Besides, the recent co-ownership of PROTON by GEELY, who is also the parent organization for Volvo Car Corporation is hoped to expedite the research and development works in the topics of vehicle safety in Malaysia (Shuen et al. 2019).

2.2.2 'ASEAN-NCAP' and Road Safety

One of the most important highlights of the automotive field in Malaysia in recent years is the launch of the New Car Assessment Program for Southeast Asian Countries (ASEAN-NCAP) in 2011 (ASEAN-NCAP, 2019) (Figure 3). Malaysia initiated the foundation of ASEAN-NCAP via Malaysian Institute of Road Safety Research (MIROS). MIROS is an institution which is founded to increase the knowledge of road safety, which in return is expected to reduce road accidents. MIROS has extensively done the work related to the road safety topics with the focus on Malaysian roads (Darus et al. 2018) (Isha et al. 2017). The aim is to increase vehicle safety standards in the region. Besides, the ASEAN-NCAP is introduced to maintain the minimum safety specifications for the road vehicles of the ASEAN market. This shows the earnestness of Malaysia in creating a safer road environment in the ASEAN region. Furthermore, the data that is studied by MIROS can also be used in advancing the AV performance once the driverless

technology is implemented in large scales in Malaysia and the ASEAN region soon.



Figure 3. The launch of the New Car Assessment Program for Southeast Asian Countries (ASEAN-NCAP) is one of the most significant highlights of the Malaysian Automotive Industry in recent years (Jawi et al. 2013).

2.2.3 Autonomous Vehicle

Like Singapore, Malaysia is also actively doing R&D in the autonomous vehicle field, despite on a smaller scale. Works have been done in the field of AV in Malaysia particularly by Universiti Teknologi Malaysia (Malaysian Investment Development Authority (MIDA), 2018). In 2019, the team, with collaboration with MooVita from Singapore showcased their driverless vehicle prototype in a 5G-related event to the Prime Minister, Dr Mahathir Mohamad. The event possesses high significance due to it being organized by Celcom which is a major telecommunication company in Malaysia and also involved the collaboration with Ericsson (Borneo Post Online, 2019). With 5G's potential in the AV field, the event signifies the vast potential of automated driving field in Malaysia (Hamid et al. 2019).

Furthermore, Malaysia continues to strengthen its plan for Connected and Autonomous Vehicles by launching 'NXGV25 Autocity', which is an economic corridor zone aimed to create a testbed for the CAV related works. The aim is to have the implementation of CAV in Malaysia as early as the year 2025, as well as to elevate the new mobility fields in the region (South Perak Region, 2018). Apart from road vehicles, Malaysia also yields significant amounts of research outputs on the topics of autonomous military vehicles by Universiti Pertahanan Malaysia (Kadir et al. 2015) (Kadir et al. 2018).

It is clear despite having slower progress compared to Singapore, Malaysia is informed of the AV disruptive feature, and is now gearing up for the future.

2.3 Recent Progress in Automotive Field in Indonesia

Compared to Singapore and Malaysia, Indonesia does not produce major active works in the field of CAV. However, it shows a vast potential in being the hub of Electrical Vehicles (EV) in the ASEAN region.

2.3.1 Green & Electric Vehicles

32.7 % of the energy consumption in Indonesia in 2011 came from fuel usage by the vehicles. The constant increment of the consumption is caused by the continuous interest of purchasing new vehicles by the public. This in return will cause a long-term energy crisis and pollution if remains (Pradhila et al. 2018). Thus, works have been done in the field of Green and Electric Vehicles. For example, an EV-bus project called 'Molina' is commenced with the aim to produce Indonesian EV Bus (Pradhila et al. 2018) (Jamaluddin et al. 2014). This is a very good initiative considering the pollution caused by the traffic congestions in Indonesian cities which consist of Internal Combustion Engine-based (ICE) vehicles in Indonesia (Sasongko et al. 2017).

Indonesian Government is also supportive by establishing a Presidential Regulation concerning the General Plan of National Energy (RUEN), where one of the main aims is to motivate the use of EV, which is expected to reduce the air pollution and energy consumption issue (Setiawan 2019). Apart from that, the introduction of the 'Low Cost Green Car' by the Government subsequently familiarizes the public with the concept of EV (Komaladewi et al. 2017). As for the predicted user acceptance towards the EV, a study by Guerra found that the price of the EV remains one of the main considerations for it to be fully accepted (Guerra 2017). All of this progress subsequently attracted global attention. For example, in 2019, it is reported that several companies such as Toyota, Tesla as well as Volkswagen are showing interest to build battery and hybrid vehicles' manufacturing plants in Indonesia (Potkin, 2019) (Suhartono & Listiyorini, 2019).

The survey above indicates the substantial potential of Indonesia in becoming a manufacturing hub for hybrid and electric vehicles in the near future. This in return will help in preparing for the AV arrival in the country.

3.0 DISCUSSIONS AND FUTURE WORK SUGGESTIONS

Based on the brief survey in Section 2 for each country, it is evident that Singapore, Malaysia and Indonesia are adapting to the recent emerging trends in the Automotive field, which include the ADAS, CAV and EV. Collectively, ASEAN shows enormous potential for a wider CAV implementation in the future.

However, challenges remain which include the topic of user acceptance, cybersecurity as well as the infrastructural requirement for the AV. For example, in the context of public readiness for new technology, despite having a successful implementation in developed countries earlier, bike-sharing faced the

issue of vandalism previously when it is implemented in several ASEAN countries (Mohd Salleh et al. 2019) (Mateo-Babiano et al. 2017). Thus, for the broader CAV implementation in ASEAN, prior education and social campaign regarding the AV is important to be presented to the public beforehand. This requires interdisciplinary collaborations to be done.

In addition, to improve the automotive sectors in the ASEAN region in preparing for the full AV implementation, collaborations between the ASEAN countries is required to help AV in reaching its objective in solving the transportation issues. For example, with further collaboration, the congestions issue during the border crossing between Southern Malaysia and Singapore can be solved, thus increasing the possibility for AV transportation between the two countries.

The wide acceptance by the ASEAN publics towards the ride-sharing and new mobility services such as Go-Jek and Grab amplifies the potential of full AV implementation in the ASEAN capital cities (Wiryo et al. 2018). Thus, as the arrival of AV is inevitable, it is apparent that multi-disciplinary collaborations are required to solve the future transportation and automotive issues in ASEAN with relation to the emerging technologies.

4.0 CONCLUSIONS

This work provides an overview of the current landscape of the automotive industry in the Southeast Asia region, with a focus on Singapore, Malaysia and Indonesia. Background of the ASEAN automotive industry, as well as the recent years' progress in the said sectors, are reviewed. Based on the survey, Singapore is actively progressing in the CAV field, while in Malaysia, works in the topics of ADAS, AV as well as Vehicle Safety are actively performed, including the introduction of ASEAN-NCAP. For Indonesia, it is seen as having the potential to become the EV assembling centres of the ASEAN region in the future. In all of the three countries, governments have been shown to be supportive in assisting their countries in adapting to the new emerging technologies in the automotive sectors. This in return aids the region (particularly these three countries) in anticipating the comprehensive arrival of CAV in the near future. Finally, it can be concluded that the ASEAN region possesses a broad and bright prospect in the Automotive field. With the right plans and strategies, it can be transformed into one of the CAV centres in the future. This study is important as it gives an overview of the current landscape of the automotive industry in the ASEAN region. Thus, it is expected to stimulate the discussion of the newer emerging automotive technologies in the region among the public audience and researchers.

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