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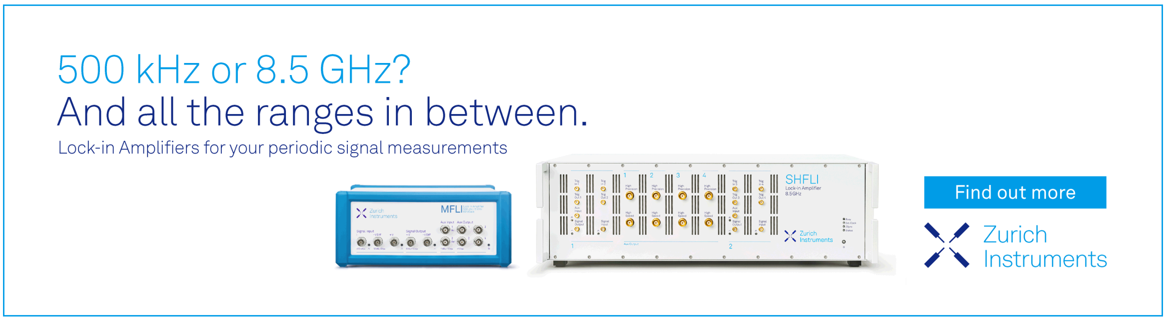

Bolstering Indonesia Electric Vehicles Ecosystem through Human Resources Development

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Abstract. The emerging of Electric Vehicles (EV) industry amidst Internal Combustion Engine (ICE) automotive industry has arisen a critical challenge on human resources development. The major shift of automotive component is happening and need a new labor skill for emerging EV automotive industry as well as transitioning ICE automotive industry. Hence, it is essential to delve the impact of labor amidst on going ICE to EV transition on automotive industry in Indonesia. The qualitative method through desk review approach was adopted for the paper work. There are two study objectives for this paper: (1) Current condition of Indonesia EV ecosystem and (2) Pathway of human resources development reflecting the current condition on Indonesia EV ecosystem. It is found that Indonesia EV ecosystem is on the right track based on its policy & regulation and industrial perspective. However, in terms of market response and human resource readiness, the evaluation is still needed. Lack of knowledge and information about EV technology hinder the progress. Therefore, the pathway of human resources development on Indonesia EV ecosystem is proposed on this paper. The pathway provides the mitigation map on upskilling and reskilling for labour in automotive industry in four work levels: engineer, manual technician, non-manual technician, and operator. The strong collaboration between stakeholders is needed to hasten the progress. Also, it is suggested that the blueprint and national roadmap for EV industry Indonesia are need to be formulated.

INTRODUCTION

The clean energy transition agenda has been fostering the way human life on less carbon footprint. Electrification has been progressing in every sector including mobility. The huge amount of carbon emission from Internal Combustion Engine (ICE) drives a promising invention on electric vehicles (EV) technology. Such commodity rises due to the green transition trend and also market penetration on EV product. McKinsey Center for Future Mobility has projected the largest automotive markets will be fully electric by 2035[1], [2]. Through Net Zero, Accelerated, and Business as Usual model trajectory, the EV growth will finger to more than 50% in just seven years from now[1].

Admittedly, the e-mobility transformation will also disrupt more than the automotive industry. Referring to McKinsey report, it is predicted that 75% of new car sales are EVs, including Battery Electric Vehicles (BEVs), Plug-in Hybrid Electric Vehicles (PHEVs), and Fuel Cell Electric Vehicles (FCEVs) by 2030[3]. This momentum will increase the EV ratio compare to ICE in the road by 1 in 4, respectively. On the same time, 91 billion euro will be created in the EV value chain and cause the major shift in the entire supply chain. Components for EV technology such as battery, battery management system (BMS), inverter to sensor will ramify into 52% in 2030

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compared to 26% in 2019. The ICE sunset commodities such as engine systems, transmission, fuel injection, etc. will decline into 11% (26% in 2019) in the automotive industry component by 2030[4].

The automotive industry that has been disrupted by EV technology component will be followed by the qualified human resources. International Renewable Energy Agency (IRENA) so-called this momentum as the emerging of green jobs. The term of green jobs refers to every employment related to clean energy transition agenda. It is projected that there will be nine million jobs opportunity created by green technology ecosystem[5]. Saul Griffith (2021) on his book Electrify argues that the main reason why green jobs will absorb the majority of labor in maximum quantity due to its wide-range of technology detail. Clean energy technology entails more employee in manufacturing, installation, and maintenance compare to fossil-fuel based technology. Renewables obtain their fuels for free, whereas fossil fuel cost money. Hence, it permeates more worker and maintenance to access those free renewable fuels[6].

Amidst the prominent market momentum of EV, there will be a challenge for workforce in the automotive industry. They need to acquire new skills related to the new EV technology in order to stay relevant with the production process. This will involve high technical skills and qualified operator to support battery production and assembly, quality assurance for battery management system and mechatronics, as well as electrical and electronic component production and maintenance[4]. On the other word, the major shift of automotive component will affect the relevant labor skilled demand. As a note, the ICE powertrains require 2000 components in approximate while EV powertrains demand only 20 components.

Hence, it is essential to investigate the impact of labor amidst ongoing ICE to EV transition on automotive industry, particularly in Indonesia. This study has pointed two main objectives on current condition of Indonesia EV ecosystem and the recommendation which reflecting to the current state. Then, the discussion is addressed, followed by suggestion to relevant stakeholders that possibly strengthen human resource development. It is expected, this study can provide the insight to mitigate the impact of EV technology disruption in the automotive industry.

METHODOLOGY

The methodology that has been used to obtain the study objectives is qualitative method through desk review approach. A desk review has been used to anatomize and criticize scientific literatures to gain the whole picture of current condition and obtain the best recommendation to the relevant Indonesia stakeholders. This study has delved into 16 scientific journals and one book that published from 2017 to 2022. The topics revolved in the keyword of electric vehicles, policy and regulation, energy transition, human resources, training and skill development, battery technology, automotive industry, disruptive clean technology to Technical Vocational Education and Training (TVET). Then, the result of desk review becomes a theory basis for mapping the current condition of Indonesia EV ecosystem and analysing the recommendation through human resources development pathway on responding the EV industry.

RESULTS AND DISCUSSION

Current Condition of Indonesia EV Ecosystem

This section, current condition of Indonesia EV ecosystem is assessed through policy & regulation, industrial & market response, and human resource readiness perspective. Needless to say, in terms of policy and regulation, Indonesia is on the right track to accomplish the electrification agenda on automotive industry. In 2019, through Presidential Regulation Number 55 Year 2019, Indonesian government released the pathway to accelerate the utility of battery electric vehicles for road transportation. The government targeted three million of EV four-wheeler and 14 million of EV two-wheeler by 2030.

Such target possibly be achieved by the government through three stages of strategy: (1) National market development in short, medium, and as well as long term, (2) Plan for industrial development in the medium to long term, and (3) technology development[4]. For accelerating the progress and creating the trickle-down effect, government also imposed other policy instruments, as follows: (1) Ministerial Regulation, Ministry of Home Affairs Number 8 Year 2020 about Basic Calculation of the Imposition of Motor Vehicle Tax and Motor Vehicle Transfer Fee; (2) Ministerial Regulation, Ministry of Transportation Number 44 Year 2020, concerning Physical Type Testing of Motorized Vehicles with Motor Propulsion using Electric Motors; (3) Ministerial Regulation, Ministry of Energy and Mineral Resources (MEMR) Number 13 Year 2020, regarding Provision of Electricity Charging

Infrastructure for Battery-Based Electric Motor Vehicles; (4) Ministerial Regulation, Ministry of Industry Number 27 Year 2020, about Specification, Development Road Map, and Conditions for Calculation of Domestic Component Level Value for Domestic Battery Electric Vehicles; (5) Ministerial Regulation, Ministry of Industry Number 28 Year 2020, regarding Battery-Based Electric Motor Vehicles in Completely Decomposed and Incomplete Decomposed State; (6) Presidential Instruction Number 7 Year 2022, concerning the Utility of Battery Electric Vehicle as Operational Service Vehicles and/or Individual Vehicles for Central and Regional Governments[7].

On the industry perspective, current selling of EV both two-wheel and four-wheel remains slow, although the trend continues to increment in number of basis points. Dominantly, the low-cost green car (LCGC) and electric motorcycle become the most developed product responding the Indonesian market purchasing power. Most of the existing scheme covers business to costumer (B2C) and business to business (B2B)[4], [8]. Furthermore, Attempts have been made to use these electric motorcycles to create an internet application for electric bike sharing. Traffic laws, however, have halted such companies since these electric motorcycles and scooters lack registration plates.

Market response remains normative. High price, low product quality, and weak after-sales services becomes three main problems for EV adoption in the end-user. Indonesian National Standard (SNI) is needed to guarantee the quality of domestic EV product. Under the Ministry of Industry, the standardization policies for battery safety have been prepared through SNI. Currently, Indonesia has 27 SNIs on Battery Electric Vehicle referred to global standards, such as International Electrotechnical Commission, International Organization for Standardization, and/or UNR)[7]. As stated in Presidential Regulation Number 50 Year 2019, domestically produced EV should be made of 35% with locally-made parts by 2021, increased 40% by 2023, and finally 60% by 2030. However, the biggest obstacle for fostering domestic EV production comes from the battery component. Although Indonesia has the biggest nickel reserves, the domestic battery industry still under developed.

In some point, the low EV adoption in Indonesia also caused by consumer perspective itself. Lack of knowledge and information about EV technology and its regulation (including government incentives) hinder the progress. The main information that possibly alter the end-user perspective revolves on EV technology, safety, environmental urgency, battery lifespan[9]–[11], after sales or maintenance as well as EV-related policies and incentives. Although the consumer has an intention to use the EV, government need to ensure its infrastructure both home charging and public charging. In terms of home charging, government has passed the incentive through households charging discount[7]. The electricity rate from 10 PM to 5 AM is reduced by 30% from the regular price per kWh. For the public charging so-called Public Electric Vehicle Charging Station (SPKLU), government intends to build 65 SPKLU across 14 provinces.

For the labour perspective, the EV momentum will threaten their employment while not followed by the development of related skill. Such condition will affect the Indonesia unemployment rate that possibly surge from today's 9.77 million people. Vocational graduate takes almost 50% portion of those unemployment number referring to Statistical Centre Agency (BPS). Without any mitigation strategy, the future projection data will be worsened by the EV disruption in automotive industry.

Human Resources Development Pathway on Indonesia EV Ecosystem

The main reason why ICE automotive industry labour needs to upgrade their skills to maintain their relevancy in new EV industry purely is about the technology[4], [12], [13]. If the ICE technology consists 200 parts to be maintained, the EV technology only has 20 spare parts. Thus, the emerging of EV industry will disrupt the entire automotive industry both direct and indirect ways. Figure 1 depicts the route of disruption for both conditions.

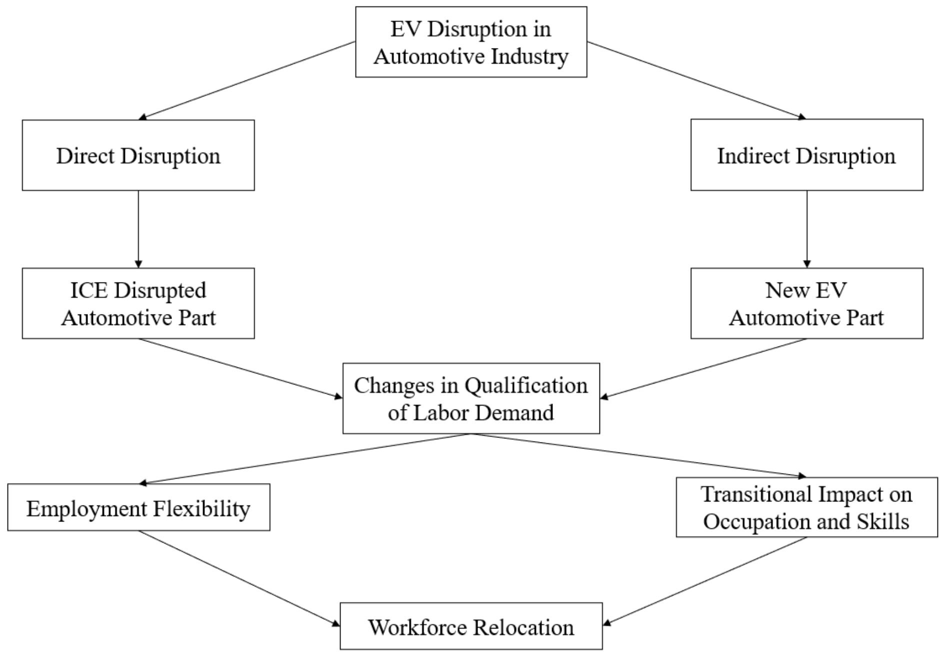

FIGURE 1. EV Disruption in Automotive Industry.

On direct disruption condition, the production of ICE automotive part will decline. It is affected by demand reduction that is in line with the soar of new EV automotive part. The consequence is clear, labour demand needs an update qualification to fulfil the current production line. Hence, there are two possible perspectives to avoid the lay-off for automotive industry. First, employment flexibility, which a good response for the EV disruption. Second, transitional impact on occupation and skills, which anticipating a massive alteration on occupation and skills requirement[14]–[17]. Those analysis will help the industry to propose the efficient way to maintain their human resources relocation adhering the EV technology trend.

Furthermore, it is forecasted that, at least, there are four work levels that will be influenced by the EV disruption. Highly skilled for engineer, technician with skilled manual and non-manual, and also low skilled so-called operator. Reskilling and upskilling are needed for each level. High-skilled engineers are the first group to be impacted, including those who work in quality assurance, quality management, and different disciplines including design, storage, and energy, as well as product design[4], [16].

The process of learning new abilities is highly complex and needs the transfer of technology from major automakers. New abilities include moving to work with hybrid engines, lightweight bodies and suspension, or battery management systems, in terms of goods and components[13], [18]. Engineers must use mechatronic programming and coding, artificial intelligence, or a lean automation system integrator when it comes to processes. The percentage of the industry's labours employed in this sector has increased from 10% to 20%. However, there is a difficult problem with a labour shortage in these disciplines as a result of a small pool of qualified trainers. Additionally, some training in these abilities has encountered intellectual property restrictions as a result of exclusive rights and the industry's intense competition[16], [17], [19].

Technicians make up the second and third categories. Here, the job need has an increase tendency from 20 to 50% and calls for a workforce with a variety of skills who can apply cutting-edge technology equipment and know-how. The skilled non-manual technician level includes positions in warehousing, logistics, and supply chain management, among other fields. Such individuals are anticipated to possess skill sets related to supply chain management, programmable logic control (PLC), enterprise resource planning (ERP), and material requirement planning (MRP), and supply chain management (SCM)[4], [7], [18]. Nevertheless, productivity and a person's attitude toward learning new skills are important factors in skill growth at this level. Therefore, all pertinent stakeholders should be in favour of the effectiveness of talent transfer.

Last but not least, the low-skilled operators. Empirically speaking, such position becomes the most vulnerable position since they are most threatening by automation and robotics. Demand for this group will fall substantially from 70% to 30%. They may be compelled to leave the sector during the transition era owing to difficulties in adjusting to technological innovation[4], [16], [18], [20]. These jobs are connected with labour-intensive roles, and the majority of them include performing repetitive activities, such as those involved with plant and machine operation.

Reflecting to above condition, it is strongly entailed the pathway to mobilize the human resources development to the new EV industry. Normally, the collaboration between relevant stakeholders becomes the key to foster the transition. From Government such as the Ministry of Industry, Ministry of Transportation, Ministry of Manpower, and Ministry of Education. Private sectors and academic institutions need to seek a mutual collaboration. In addition, equipping high-capacity ICE workers by offering in-house training with particular courses to aid in the reskilling and upskilling process involves, for example, presenting potential vocational school students to job careers or internship programs. Also, Technical Vocational Education and Training (TVET) on EV technology should be created. Figure 2 is the proposed pathway for human resources development on EV Industry according to this paper work.

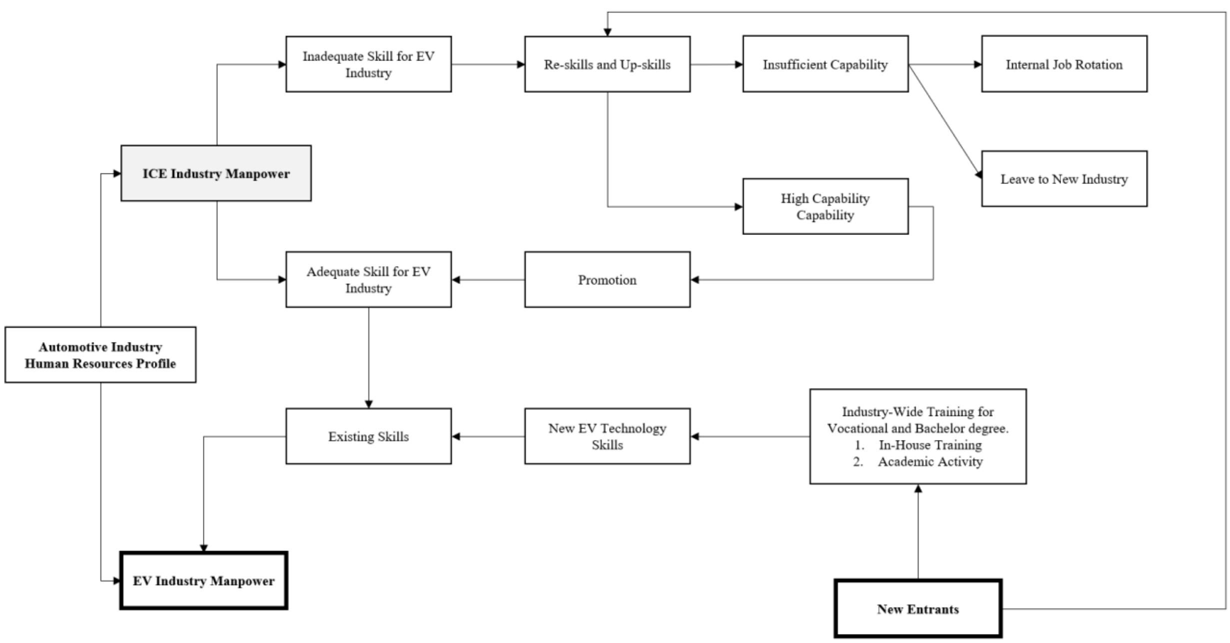

FIGURE 2. Human Resources Development Pathway on Indonesia EV Ecosystem.

Briefly, figure 2 point out the integration map for ICE industry and its labour to deal with human resources irrelevancy on emerging EV industry. When existing ICE production workers are required to upskill or reskill in order to meet EV production technology, this challenge may force some incapable labour to relocate, either to continue working in the companies in different positions or to leave the industry due to difficulties in upgrading or pursuing the new necessary skills[4], [16], [17], [19].

Furthermore, the EV development plan is essential for the industry's next stage of growth, especially positioning the government on whether to continue developing EV production or sustain ICE manufacture. Currently, Indonesia's automotive industry struggled with human resource development owing to an unclear roadmap. In other words, a well-defined roadmap would aid businesses in building the ability to adapt to new technologies[4]. A working committee made of people knowledgeable with the whole industry supply chain must be created in the host nation of car assemblers, in order to produce a policy that more clearly outlines the direction, particularly the country's position as a major component in the supply and production chain.

CONCLUSION

Human resources development pathway on responding EV industry has been proposed based on the current condition of Indonesia EV ecosystem. The disruptive exist due to the major shift of automotive component on ICE compared to EV technology. Hence, for avoiding the massive lay-off of labor on automotive industry that affected by EV component disruption, the transition on human resources profile and qualification are strongly needed. Through employment flexibility and transitional impact on occupation and skills. According to paper analysis, at least four work levels that will be influenced by the EV disruption; engineer, manual technician, non-manual technician, and operator. The smooth upskilling and reskilling possibly be achieved by strong collaboration between relevant stakeholders, such as government, private industry, vocational school, to Technical Vocational Education and Training (TVET) for conducting in-house training.

Furthermore, bolstering Indonesia EV ecosystem through human resources development can be hastened by the presence of the blueprint for change and the national roadmap of EV industry development. It should be clear and relevant with the ICE automotive industry necessity. The points that may be considered as part of blueprint are including (1) Taskforce for stipulating the direction of human resources development toward EV industry. The taskforce should be inclusive and entice all relevant stakeholders. (2) Incentive creation and fund for knowledge management that will ensure the inclusivity of transition and (3) Training database system for encouraging people and businesses to use training resources in order to keep up with industry changes and save in-house training expenditures.

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