

## **INTO IR4.0: CHARTING THE SOCIAL AND OCCUPATIONAL CHANGES IN INDUSTRIALISED MALAYSIA**

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### **ABSTRACT**

*The COVID-19 pandemic may have disrupted the socioeconomic fabrics of the world, but it also has spurred the incorporation of the Fourth Industrial Revolution (IR4.0) technologies into organisational operations, work settings, service deliveries and our everyday life. The workability and cost-effectiveness of these technologies will motivate companies to enhance their incorporation into respective organisational and operational designs. This will subsequently change our employment and the way we work as evident in the technological changes throughout previous industrial revolutions. This overview aims at charting out the universal societal changes, particularly changes in work aspects, corresponding to industrialisation; and how IR4.0 may alter current social and occupational landscapes in the near future. These universals are then used to contextualise the social and occupational changes during Malaysian industrialisation. The challenges and some suggestions for the direction of future research on work/occupation as Malaysia ventures into IR4.0 are presented at the end of this overview.*

**Keywords:** Industrialisation, IR4.0, social change, sociology of work, sustainable development

## **INTRODUCTION**

As we observe the ruptures in the socioeconomic fabrics of the world unfold during the COVID-19 pandemic; we also see the accelerated incorporation and consolidation of the Fourth Industrial Revolution (IR4.0 or Industry 4.0) technologies in organisational operations, work settings, product/service deliveries and our everyday life. Pandemic control measures have demanded more extensive use of the internet, digitisation, automation and interoperability. The use of these interoperable technologies for COVID-19 contact tracing, working from home, online learning and online shopping is becoming a norm. While some of the pandemic control measures may be passing in the short run as more people are vaccinated; in the long run, the evidence of the workability and cost-effectiveness of IR4.0 technologies will motivate companies to enhance their incorporation into respective organisational and operational designs and making a shift towards people-less organisations (Lee 2020).

In view of this impending shift, we cannot help but wonder what would become of Malaysian society if most workers were replaced by automation or artificial intelligence (AI). This shift may yet become a norm in Malaysia, but it is beneficial to take stock of the social and occupational changes induced by industrialisation and current technological development to map out the probable challenges and path for future research in the field of sociology of work.

The overview from Grant and Booth (2009) aims to outline the literature concerning industrialisation and social changes, particularly occupational changes as society becomes industrialised; and how IR4.0 may alter the social and occupational landscapes in the not-too-distant future. Drawing from the knowledge in developed societies, this overview also attempts to contextualise the occupational changes within broader social changes during Malaysian industrialisation and to identify crucial challenges and potential research opportunities as Malaysia ventures into IR4.0. In keeping with the aims of this overview, backward and forward reference searching was used, and similar studies are excluded. However, relevant grey literature such as commentaries, reports and bulletins are included, especially those concerning the recent and future development of IR4.0. Initial literature search on Scopus and Google Scholar resulted in duplications; therefore, only Google Scholar was used for this overview as it includes more relevant grey literature.

This manuscript is divided into four main sections. The first section provides a succinct theoretical perspective of the nature of industrialisation to contextualise the social changes that have taken place during industrialisation and the probable changes during IR4.0. The second section maps out the universal occupational

changes caused by industrialisation and IR4.0 in three main work aspects—workforce structure, education and skill requirements to work and wages. The third section outlines the trajectory of Malaysian industrialisation and corresponding social and occupational restructurings that ensued. The last section identifies the crucial challenges and future research direction on work/occupation as Malaysian society ventures into IR4.0.

## **INDUSTRIALISATION AND SOCIAL CHANGES**

Industrialisation is commonly known as the socioeconomic transition from an agrarian society into an industrial society by promoting manufacturing as the main mode of production to restructure the economy (O’Sullivan and Sheffrin 2003). Besides restructuring the economy; industrialisation also alters other macro structures such as social stratification (Treiman 1970) and changes micro-level variables such as personal values (Inglehart and Baker 2000). Despite the connotation of Marx’s material determinism, its controversy cannot rule out the tangible social changes brought about by industrialisation.

Although industrialisation is often cited as an agent of social change in social studies (Blumer 1990), the extent and the manner of its influences on society remain controversial in the literature. The controversies are mainly due to the loose definitions of industrialisation in the literature (*ibid.*). As a complex macro social event, when its meaning is not clearly defined, it can easily be mistaken for other interrelated macro social events like urbanisation and modernisation. Therefore, the renowned scholar on industrialisation and social change, Herbert Blumer (1990) proposed, only when a social change is caused by the characteristics of industrialisation, it can then be considered as the effect of industrialisation.

### **The Characteristics of Industrialisation and Social Changes**

Blumer (1990) identified three main characteristics of industrialisation that can lead to social changes. They are “a nucleus of mechanical production, an attached network of procurement and distribution, and an attendant service structure” (*ibid.*, 32). A nucleus of mechanical production is a clustering of power-driven machines in the form of mill, factory, or industrial enterprise that produces economic goods. For the nucleus of production to consistently manufacture economic goods, the procurement and distribution services are required to constantly supply the materials and to deliver the finished goods to the market. Nevertheless, the first two characteristics can only function effectively when an attendant service structure—banking, credit and financial services—is established.

Owing to the emergence of these fundamental characteristics of industrialisation, Kerr et al. (1969) suggest, industrialisation will bring similar changes or universals of industrialisation to every industrial society. The three universals are a change in workforce structure, a larger scale of society and an emergence of consensus in society (ibid.). According to Kerr et al. (1969), in any industrial society, the workforce structure will be diversified and stratified because many different types of occupation are created to satisfy the three characteristics of industrialisation. In the supply of workers, industrialisation changes the purposes of two crucial social institutions—family and educational institutions. In an industrial society, the formal education system has taken over the responsibility of providing vocational training from the family. This shift has also contributed to workforce stratification determined by educational attainment. Furthermore, the scale of an industrial society grows larger because the industrial production and labour specialisation need to operate in large-scale organisations. These large-scale organisations will demand the creation of an elaborate “government” (ibid., 24) to formulate rules to govern the industry. Although different cultures may formulate and promulgate different rules, Kerr et al. (1969) proposed that the contents of the rules will certainly involve professionalism, internationalisation and globalisation, and these rules will inevitably shape social consensus or values. Therefore, to put it in a nutshell, they suggest all industrial societies will hold similar high valuation to science and technology, education and modernity because they serve industrial growth.

### **The Characteristics of Industrialisation in IR4.0 and Social Changes**

IR4.0 is an epochal shift from IR3.0 technologies and its characteristics of industrialisation. In IR3.0, most production, logistic and attendant services had become automated by using digitalisation for higher productivity. In IR4.0, similar digital technologies are being enhanced and synergised to develop the more advanced nucleus of mechanical production. The industrial internet of things (IoT), the cloud computing, the AI and the cyber-physical system (CPS) will enhance and optimise the automated production introduced during IR3.0. Likewise, the attached network of procurement and distribution is no longer a matter of digital logistics; the integration of the IoT, the CPS and the big data is allowing a company to integrate its internal value chain and external supply chain to enable a new level of customer value creation (Nagy et al. 2018). This customer-centric innovation not only increases profit and reduces cost, but also enhances customer experience and loyalty (i-Scoop n.d.). Similarly, financial technology (FinTech) and Blockchain technology are also transforming digital financial services, making corporate and retail financing more effective, efficient and safe (Machkour and Abriane 2020).

Furthermore, in the age of IR4.0, new companies or start-ups of any size can seek crowdfunding to fund a project without relying on highly regulated governmental or financial institutions.

Clearly IR4.0 technologies are revolutionising the means of production, the economic structure and the characteristics of industrialisation from IR3.0; undoubtedly, they will also bring direct disruptions to the three universals of industrialisation.

With reference to the universals identified by Kerr et al. (1969), the workforce structure is expected to become more polarised as a new division of labour between human, machines and algorithms become prevalent (World Economic Forum 2020). Undeniably, job displacement due to digitalisation and automation has already been observed for decades during IR3.0. (cf. Kletzer 1998). Nevertheless, these structural changes to the workforce also need to be contextualised within the framework of the international division of labour or the global production networks (GPNs) (Cui and Liu 2019).

Meanwhile, the convergence of IR4.0 technologies will bring the already globalised world closer than ever. The scale of society not only expands horizontally, but it also penetrates our private lives through the sharing and tracking of consumer data while making manufacturing and marketing processes more responsive to customers' expectations (Morrar, Arman and Mousa 2017). However, this new level of connectivity will force society to redefine the moral and ethical boundaries concerning IR4.0 technologies, and how they should be used and governed (Solomon 2016). These ethical considerations are not only concerned with normative ethical issues such as privacy, security and equity of access, but with fundamental ethical questions such as should the technology even be developed in the first place. For what ends should it be serving? And how should it be monitored? These questions are especially relevant if the technology has bioethical and/or military-ethical implications (ibid.).

Nevertheless, the rate of technological development in IR4.0 is exponential and difficult to forecast (Morrar, Arman and Mousa 2017). There may be other unforeseen technological breakthroughs that may bring about new changes soon. These unforeseeable developments will certainly threaten the sense of security and stability, and test the adaptivity of institutions and individuals.

## **THE INFLUENCES OF INDUSTRIALISATION AND IR4.0 ON WORK ASPECTS**

As alluded to previously, work is decidedly influenced by the characteristics of industrialisation. There are three major aspects of work found in the extant literature that have been significantly altered by industrialisation and will be altered during IR4.0. They are the workforce structure, education and skill requirements to work, and wages.

### **The Changes in Workforce Structure**

The impact of industrialisation on workforce structure is tremendous. The most important change in the workforce structure caused by industrialisation is the division of labour in production. According to Smith (1811), the ultimate reason for the division of labour in manufacturing is to increase productivity. However, the division of labour is not an exclusive product of industrialisation, it has been practiced since the proto-industrial era. It is just that industrialisation has changed the division of labour from the social division of labour to the technical division of labour, which means from the division of tasks between occupations to the division of tasks within occupations (Watson 2011).

The technical division of labour has resulted in many changes to work. The most significant changes are the separation of home and work, the changes in work process and work management. In the pre-industrial period, a family unit was almost equivalent to a work unit. They became separated when the technical division of labour occurred, particularly when the workforce shifted from the agriculture sector to the manufacturing sector (Volti 2011). The introduction of the assembly line during the early industrial revolution also changed the work process and work management. Due to the high sequential task interdependence of the assembly line, the work process flow and workers must be arranged and managed in a more efficient and restrictive manner to ensure the designated productivity (ibid.).

In addition to the technical division of labour, Treiman (1970) identifies further three interrelated factors contributing to the change of workforce structure during industrialisation; increased productivity of labour, technological advancement and increased scale of economic activity. The increased productivity of labour changes the demand of labour market. With the mechanisation of production during industrialisation, less labour is required in the agriculture sector (Kemp 2013). Due to the decrease in demand for agricultural labour, more labour shifted

to manufacturing and service sectors (*ibid.*). Meanwhile, technology advances also cause many pre-industrial and manual workers to become redundant. Keynes (1963, 360) called this job displacement, “technological unemployment”. Nevertheless, many new occupations have also been created during industrialisation. To meet these labour, productivity and technological demands, capital requirement needs to be increased, forcing the increase in the scale of economic activity (Treiman 1970). Such development creates not only more factory jobs but also more administrative and marketing positions (Kemp 2013). Hence, industrialisation and technological advancement during previous industrial revolutions did, in the short run, result in job displacement, but they also created a virtuous circle of employment in the long run.

As mentioned previously, during the last few decades of IR3.0, we did observe technological unemployment due to digitalisation and automation in the manufacturing sector in developed countries (*cf.* Kletzer 1998), during which, job displacement for production workers was higher than managerial, professional, technical, and service workers (*ibid.*). Although technological change was accounted for this job displacement, it also must be understood within the context of GPNs, where most of the labour-intensive manufacturing jobs were relocated to developing countries with lower labour costs. This suggests the technological change during IR3.0 and the shift within the GPNs have disrupted the virtuous circle of employment observed during previous industrial revolutions in developed economies.

In IR4.0, many authors envisage more labour will be substituted by capital/technology in manufacturing and service sectors as new divisions of labour between humans, machines and algorithms emerge. During IR3.0, technologies were only capable of substituting labour in repetitive and codifiable tasks. With the introduction of machine learning in IR4.0, algorithms are becoming more capable of substituting labour in complex cognitive tasks, including data collection, data processing, and even planning and decision-making (Chui, Manyika and Miremadi 2016). This means, technological unemployment will be affecting managerial, professional, technical and service positions. Up to now, immaterial labour such as analytic, creative and affective labours is the only form of labour that cannot be perfected by algorithms; and the two service sectors which have the least capital-labour substitution potential are healthcare and social assistance, and educational services (Chui, Manyika and Miremadi 2016).

From another angle, technological unemployment is making labour markets in advanced economies more polarised. Analysts are observing a decline in employment in middle-skilled occupations (Jerbashian 2019), while employment in



the two extremes is on the rise (Marengo 2019). High-skilled and high-paying jobs that are in demand are those associated with the design, creation and management of the new technologies; whereas the growing low-skilled and low-paying jobs are those in which human labour cannot be substituted or are not economical to be substituted with capital/technology (ibid.).

It seems more workers, except those in the two extremes, will suffer technological unemployment in the coming decades. Will this technological unemployment be permanent or a passing phase? Can we expect another virtuous circle of employment? According to a review by Marengo (2019), there are both optimistic and pessimistic views about reemployment during IR4.0. The optimists foresee compensation effects and labour market adjustment will eventually occur, where new complementing jobs will be created and the demand for immaterial labour jobs will increase. Nevertheless, the optimists also acknowledge these effects and adjustment will take longer and require more institutional interventions. Yet, Marengo (2019) admitted that the pessimistic view is more persuasive. With reference to the structural change and technological unemployment discussed above, Marengo (2019) agreed the labour substituting IR4.0 technologies will alter the production cost and production service structures so much so it will impede the compensation effects. Unlike the innovations in previous IRs, IR4.0 technologies allow an increase in quantity produced with little labour input. Furthermore, these technologies also de-link production and consumption in many services by allowing the services to agglomerate, go online and offshore, and serve larger markets. Therefore, if IR4.0 innovations continue down the path to substitute labour instead of creating new jobs, there will be a remote possibility of a virtuous circle of employment. Hence Manyika et al. (2017) estimated, by 2030, between 400 million and 800 million workers around the world may be displaced and forced to switch occupations or reskill themselves.

### **The Changes in Education and Skill Requirements to Work**

No doubt industrialisation improves accessibility to basic education via a free mass education system, which is made possible with the economic surplus generated by industrialisation (Carl 2009). Nevertheless, Coxhead and Shrestha (2017) discovered this correlation is subject to the type of industrialisation a country gets involved in—low-skill industries do not encourage higher educational attainment, but high-skill industries demand higher qualifications.

Regardless, the changes in the workforce structure due to industrialisation and technological advancement have heightened the demand for digitally competent personnel as well as entrepreneurs. Digitally competent entrepreneurs and



personnel are now becoming more critical as businesses and workers are increasingly associated with ever-smarter machines and algorithms. In addition, trained personnel with affective and high-order cognitive skills, which are harder to be substituted by algorithms, are also becoming more important in the new millennia. According to Bughin et al. (2018), the demand for technological, affective and high-order cognitive skills will accelerate in the 2016 to 2030 period; by contrast, there will be a decline in the demand for cognitive and manual skills substitutable by technologies. Among the technological skills that are expected to be in higher demand in IR4.0, basic digital skill is found to be one of the fastest-growing categories. This is because having sufficient digital competency is a must to either understand or handle most of the core IR4.0 technologies.

The real challenge now is not only training digitally competent entrepreneurs and workers, but also ensuring the displaced workers are given the reskilling support for them to transition into new jobs, and to avoid rising unemployment and depressed wages (ibid.).

### **The Changes in Wages**

In any industrialised society, wage labour is the dominant form of work as compared to independent labour (Charoenloet 2015). The changes in work structure and education as well as skill requirements have allowed more trained workers to work as wage labour in the secondary and tertiary sectors, and it increases their average income (Kuznets 1957).

Although the growth rate of average income varies across different industrialised countries, the correlation between the extent of industrialisation and the average income is significant (ibid.). The correlation can be explained by the increased productivity of labour during industrialisation. When the share of labour force engaged in manufacturing sector goes up, the growth rate of the national product per capita will grow much higher than that of the agriculture sector (ibid.). Furthermore, unlike agricultural products, industrial products can stimulate higher income elasticities of demand (Sutcliffe 1971). That is, the rise in income will increase the demand for industrial products, which leads to a rise in production, and consequently the production growth will increase the income of the workers involved. Eventually, a virtuous cycle will be formed.

However, with the advancement of IR4.0 technologies, Manyika et al. (2017) argued the wage gap will widen due to job displacement and job polarisation as discussed previously. Wages may stagnate or drop in declining occupations and vice versa. Many middle-skilled and low-skilled workers working in predictable

environments will be required to find new jobs, provided IR4.0 technologies have not already taken their jobs and put them at risk of unemployment and depressed wages.

## **INDUSTRIALISATION, SOCIAL AND OCCUPATIONAL CHANGES IN MALAYSIA**

### **Proto-industrialisation and Industrialisation in Malaysia**

Proto-industrialisation in Malaysia can be traced back to the late 19th-century handloom textile industry in Terengganu, Kelantan and Pahang, where the division of labour in the form of wage or piece-rate work already existed in the textile production process (Maznah 2021). Nevertheless, the handloom industry was faced with a downtrend when cheaper chemical dyes were introduced and displaced workers from participating in the ancillary stages of the industry. This could have been the earliest form of technological unemployment in Malaya. Even the colonial interventions were unable to arrest the decline of this industry (*ibid.*).

Expectedly, British colonial rule had a great impact on Malaya's industrialisation. Rasiah (2021) argued that the colonial government had helped modernise Malaya through four developmental restructurings. First, to establish and maintain order, regulations and security. Second, to embark on a massive development and maintenance of infrastructure. Third, to introduce capital-intensive and power-driven technologies to mine tin and cultivate rubber effectively. Fourth, to encourage and administer the import of labour from India and China. These developmental restructurings had accelerated particularly the production and export of tin and rubber. The growing export of tin and rubber also attracted the branches of foreign banks and encouraged the establishment of local banks by independent traders (Muhamad 1996). Unquestionably, these restructurings helped the development of the three basic characteristics of industrialisation required for the industrialisation of Malaya.

Indeed, the development of the characteristics of industrialisation did power the emergence of modern manufacturing among small and medium enterprises (SMEs) to produce intermediate and capital goods such as processed food, textiles, furniture, rubber products, etc. (*cf.* Rasiah 2021). Regardless of this new development, tin and rubber were still contributing over 90% of the British colonial government's tax revenue prior to Malaya's independence (*ibid.*). According to Ariff (1973), however, this export sector had very little spillover effect on the domestic economy

due to the absence of forward and backward production linkages. Moreover, the income-remitting and import-consuming also undercut the growth of the domestic economy.

After independence, the Malaysian government immediately restructured the industrial policies to solve the aforementioned issues, in addition to poverty, income inequality and unemployment (*ibid.*). Post-independence Malaysian industrialisation can be broadly organised into two phases: Phase 1 (1958–1990) and Phase 2 (1991–present) (Rasiah and Krishnan 2020, 704–714). During Phase 1, the agglomeration effects of industrial activities with employment under the first import-substituting industrialisation (1958–1970) contributed to the reduction of poverty. Subsequently, export-oriented industrialisation (1970–1981) was introduced to stimulate investments and employment. The second import-substituting industrialisation (1981–1986) was then launched to establish heavy industries and to stimulate technological upgrading. However, little effort was given to the latter. Phase 2 industrialisation is characterised by high-tech and high value-added industrial policy from 1991 until the present. Strategies to spearhead the two phases of industrialisation such as industrial zones, export processing zones, technology parks and regional corridors (Rasiah and Krishnan 2020) have encouraged the agglomeration of industrial activities and foreign direct investment (FDI), especially in the electrical and electronic industry. The success of Phase 2 has generated countless employment opportunities, knowledge transfer and the emergence of local technopreneurs and technology firms (Chin 2019). Through these strategic industrial policies, Malaysia transitioned successfully from an agricultural to an industrial economy and set up an example for many developing countries.

Despite the successes of Phase 2, several downsides have also been identified, these include “low level of technology and modernisation, lack of inter- and intra-industry linkages, low level of local content, sluggish domestic investment, limited access to the global market, excess capacity, low value-added activities and lack of research and development” (Firdaos 2013, 23). In addition, within the context of GPNs, Henderson (2009) critiqued that the improvident transition from Phase 1 to Phase 2 has missed out on the “windows of opportunity” to move up the value chain provided by the shifting GPNs, which has also trapped domestic firms within established modes of operation. Using the gross domestic product as a measure, the contribution of the manufacturing sector saw consistent growth from 10.26% in 1960 and reached its peak at 30.94% in 1999, after which its contribution declined steadily to 21.44% in 2019 (Macrotrends 2021). This downward trend suggests Malaysia became deindustrialised at the turn of the millennium.

According to Rasiah, Crinis and Lee (2015) and Tengku et al. (2019), however, this deindustrialisation is premature due mainly to the lack of technological upgrading and structural change to move up the value chain in the GPNs. We shall return to the challenges faced by Malaysian industrialisation momentarily.

### **Industrialisation and Social and Occupational Changes in Malaysia**

Extant literature on Malaysian industrialisation is dominated by the subjects of industrial policy, human resources and economics. This is understandable as these three aspects of industrial development are crucial for the newly industrialised nation as it progresses through the phases of industrialisation. Despite the downsides, the strategic restructuring of national industrial policies has certainly changed the industrial profile, workforce and economic structure of Malaysia. It has also engendered the three universals of industrialisation, as proposed by Kerr et al. (1969).

One of the earliest studies on the impact of industrialisation on workforce structure was perhaps Hazelrigg and Garnier's (1976) comparison of intergenerational occupational mobility in 17 industrialised and industrialising nations. Based on Malaysian data in 1966, they noted intergenerational occupational mobility in Malaysia was not significant, probably due to the early stage of industrialisation. Nevertheless, the industrial policies introduced during Phase 1 created a great number of job opportunities in the emerging industrial towns (Abdul Rahman 1996). Because of the job availability, these new townships attracted a massive number of rural–urban migrants, especially the Malay peasant youths (Jamilah 1979), the non-Malay interurban migrants (Chitose 2003), and subsequently, the influx of immigrant workers from Southeast and South Asian countries (Mashitah 2016), which in turn contributed to rapid urbanisation (Abdul Rahman 1996).

In tandem with the effort to attract more technology-based investment for Phase 2 industrialisation, education sector was liberalised (Kuruvilla 1996). This resulted in a considerable increase in the number of private colleges and student enrolment in these colleges had risen by 45% between 1985 and 1992 (Young and Ng 1992). The expansion of job and education opportunities not only stratified the workforce, but also spurred further internal migration and urbanisation, increased income per capita and expanded the middle class in Malaysia (Abdul Rahman 1996).

Amidst the workforce and educational restructurings above was the social restructuring unique to Malaysia. As aspired in the New Economic Policy, Malaysian industrialisation was also meant to reduce the identification of ethnicity with occupation and to increase bumiputera's participation in the non-agricultural

economy. By 1990, the share of Malays in the manufacturing sector had increased from 28.9% in 1970 to 49.1% (Andaya and Andaya 2001). The social implications of this occupational shift among the Malays caught the attention of many prominent scholars in Malaysian studies. For example, Abdul Rahman (2002) and many others wrote extensively about the state-led creation of the new Malay middle class or the *Melayu Baru*. Jamilah (1979) and Stivens (1987; 1998) also highlighted the social implications of the migration and proletarianisation of rural young Malay women who were once the main workforce at the assembly lines prior to the arrival of migrant workers.

By Phase 2 of industrialisation, the FDI and technology transfers through multinational corporations have brought in “Western” work values and cultures that emphasise individualism and professionalism. However, the inculcation of such values and cultures, along with the occupational shift did take root but not without resistance. Unlike the Luddites, the resistance was against cultural change rather than technological change. The most prominent studies on such resistance include Jamilah’s (1979) and Stivens’s (1987; 1998) investigations of the changes and conflicts in traditional gender roles and power balance in Malay families posed by the proletarianisation of Malay women. Amidst these gendered changes and challenges, Ackerman (1991) and Ong (1988) examined the cultural and ideological conflicts within the Malay Muslim society, and between Malay and multinational corporate cultures. Subsequently, authors like Chong (2005), Kahn (1996), and Shamsul (1999) investigated further the new social consensus/dissensus of Malayness due to the occupational shift, upward social mobility and shifting values brought forth by industrialisation. Abdul Rahman (2002) and Shamsul (1997) also took this social consensus/dissensus of Malayness further to map out the political economy of Malaysian ethnic nationalism.

Social changes driven by Malaysian industrialisation clearly do not differ much from the propositions of Blumer (1990) and Kerr et al. (1969). Malaysian industrialisation has changed the workforce structure; encouraged the expansion of education opportunities; and increased the income per capita. However, the bulk of these macroscopic social studies were published up to the early 2000s and henceforth almost no macroscopic social studies on the influences of industrialisation have been published. This could be the direct result of premature deindustrialisation since then. Moreover, the socio-political implications of Anwar Ibrahim’s dismissal and the *reformasi* movement at that time had also diverted the intellectual curiosity of most social scientists from industrialisation (Gomez 2004). Not much has changed until the question of “Are we ready for IR4.0?” was raised a decade later.

## **MALAYSIA INTO IR4.0: CHALLENGES AND FUTURE RESEARCH DIRECTIONS**

### **Is Malaysia Ready for IR4.0? The Challenges Ahead**

Like many other countries, Malaysia is on the verge of IR4.0. At present, the Ministry of International Trade and Industry is preparing the New Industrial Master Plan to prepare the country for IR4.0 (American Malaysian Chamber of Commerce 2020). Meanwhile, no apparent effort has been made in predicting the social changes during IR4.0. Nevertheless, many scholars in the technical fields are exploring the potential of AI (Soh et al. 2018), the IoT (Kang et al. 2020), and the big data (Chan and Miyazaki 2015) in various industries, while some others are anticipating the challenges ahead. The most pressing concern is whether Malaysian industry is ready for IR4.0? Based on the literature and the factors contributing to the deindustrialisation raised earlier, we can sort these challenges into five interrelated dimensions: Technological infrastructure and investment, industrial activities, organisational structure and operations, global competition and human capital planning.

Since 98% of manufacturing establishments in Malaysia are SMEs (Department of Statistics Malaysia 2017), the readiness of manufacturing SMEs and the attached logistic industry naturally become the foci. Studies on manufacturing SMEs (Teh and Kee 2019) and logistics industry (Jeevan et al. 2018) have consistently pointed to the unreadiness of the two industries to invest and transform their technological infrastructure and organisational structure to meet the requirements of IR4.0. However, the unreadiness of these industries to upgrade their technologies and structures is also associated with their tendency to stick to cost-efficient and low value-adding activities reflected in the low- and mid-skilled jobs they create (Dian Hikmah and Mohd Zaidi 2017). Following Henderson (2009), the predicaments faced by the manufacturing SMEs above are due to the fact that Malaysia has missed out on the opportunity to move up the value chain and has since been trapped within the established GPNs mentioned earlier.

Nevertheless, the Malaysian government's intention to increase the number of high-skilled labour by increasing the enrolment in tertiary education under the above predicaments also has its drawback. The most apparent drawback is the disparity between the number of graduates and the number of high-skilled jobs available in the market. Ang, Murugasu and Chai (2018) noted, between 2015 and 2016 the number of local graduates increased by approximately 880,000 persons

while the number of high-skilled job available then was only around 650,000. Meanwhile 73% of net jobs created then went to foreigners! Consequently, more local graduates must work in semi-skilled jobs or risk unemployment.

From another perspective, however, extant studies show technical and vocational education, training and higher learning institutions are currently not having adequate capability to produce IR4.0-competent human capital (Hutkemri, Suzieleez and Umi 2020; Jowati 2019). According to Norizan, Faizuniah and Md Lazim (2021), the key issues hindering Malaysian human capital development are brain drain, affirmative policy and a dated education system which is too exam-oriented, discouraging creativity and depreciating critical thinking among students. What is more disconcerting when facing the human capital challenges in IR4.0 is that even Malaysia's Generation Z or the so-called true digital natives' mean score in digital literacy is only medium in most of the domains (Pandian, Baboo and Lim 2020). Furthermore, Md. Hafizi, Nurjeehan and Nur Shahirah (2021) discovered that digital literacy studies in Malaysia were mainly conducted in academic settings which often exclude the rural and general working populations. This suggests the existence of the digital divide and it also means the average digital literacy in Malaysia should be lower than what we observe in the literature.

Given the predicaments discussed above, the Malaysian industry and job market will be at a higher risk of decline when IR4.0 technologies are implemented globally, for it may lead to two interrelated consequences—the reshoring of manufacturing activities and the transformation of GPNs (Khazanah Research Institute 2017). Both consequences can impact Malaysian industry and the job market heavily by unplugging Malaysia from the transformed GPNs and reducing job opportunities (*ibid.*). Moreover, Khazanah Research Institute (2017) noted, middle-skilled jobs are now at higher risk of technological unemployment, and 90% of them are held by Malaysians. In 2020, middle-skilled jobs accounted for 60% of the total employment (Department of Statistics Malaysia 2021). This means Malaysian society will be facing very tough employment challenges when a large scale of reshoring and technological unemployment occurs. Therefore, it is critical for Malaysia not to miss out on yet another “window of opportunity” to move up the value chain during the IR4.0 technological transition.

### **Future Research Directions**

Despite the decline in macroscopic social studies on industrialisation since the early 2000s, there has been a growing literature on microscopic changes in various work/occupational dimensions in Malaysia including work ethics/values,



occupational decision-making, work motivation, job satisfaction, job performance, organisational commitment, work-life balance/conflict, among others. Most of these recent studies are cross-sectional studies set in industrial, healthcare, business, education and public service organisations aiming at addressing organisational and workers' psychological issues. Therefore, these studies take work in its current state for granted without taking into account the process of industrialisation and social changes discussed above. This trend is probably one of the reasons why there are very limited recent studies investigating the influences of industrialisation (including industrialisation during IR3.0 and IR4.0) on contemporary Malaysian society.

These microscopic studies have undeniably shed light on how workers experience work in contemporary Malaysian society and they can serve as basis for future studies during the IR4.0 occupational transition. However, to better prepare and guide the country's technological upgrading, human capital development, and organisational planning as Malaysia enters the age of IR4.0, macroscopic industrial, social and occupational studies need to be done as soon as possible. First and foremost, we need to analyse the current state of technology infrastructure, industrial activities and organisational structure and operations within the three characteristics of Malaysia's industry to guide policies and the reprogramming of these characteristics to meet the IR4.0 technological and corresponding social changes discussed in the first section. However, as demonstrated in the challenges discussed above, these analyses cannot be done in silos, they need to take into consideration the dynamic interactions between respective policies and reprogramming, and the shifting workforce structure and GPNs.

Within the scope of this overview, several potential work/occupation-related research questions that stand out are:

1. What kind of workforce, skills and training/retraining are required for technological upgrading, and how to affect these workforce changes?
2. How to settle the excess low-skilled migrant workers when the industry moves up the value chain?
3. How to sustain the employment opportunities of middle-skilled workers amidst technological unemployment and workforce polarisation?
4. What kind of occupational and retraining programmes are required to ensure the reemployment of displaced middle-skilled workers to avoid depressed wages and risk losing the middle class?

5. How to improve workers' digital competency and bridge the digital divide?
6. How to ensure a virtuous circle of employment or at least make up for those that will be lost during the technological change?

However, the research questions above share a common ethical assumption that we shall continue down the path to substitute labour with capital/technology. As cautioned by Marengo's (2019) review, there will be a remote possibility of a virtuous circle of employment if we continue to rely on labour-substituting technologies in production.

## CONCLUSION

Therefore, as a concluding remark, a fundamental ethical question we need to ask about IR4.0 technologies is: Should the labour substituting technology continue to be pursued? We are not Luddites, but neither do we believe in an unbridled technology that has little concern for its impacts on the very foundation of people's livelihoods. Therefore, a sustainable and balanced development framework must be formulated to ensure social and occupational equalities in the face of IR4.0 technological leaps.

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