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# Occupational Safety in the Age of Artificial Intelligence: Reformation of the Indonesian Work Safety Law

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## Abstract

Artificial intelligence (AI) is undergoing rapid development globally, including in countries such as Taiwan and Indonesia. Taiwan, renowned as a world leader in hardware and semiconductor technologies, holds a significant advantage in AI advancement. This is further bolstered by governmental support through regulatory frameworks, policies, and funding initiatives, enhancing Taiwan's prowess in AI development. In contrast, Indonesia has also embraced the tide of technological progress, with its President declaring the nation's commitment to entering the 4th industrial revolution. Integral to this transition is the adoption of AI, recognized as a pivotal component of the aforementioned revolution. The collective technological advancements across Indonesia, Taiwan, and other nations invariably impact society, particularly the workforce. The integration of these futuristic technologies, predominantly within corporate settings, inherently alters labor dynamics and working conditions.

This study scrutinizes the trajectories of AI development in both Taiwan and Indonesia, probing the compatibility of existing occupational safety and health legislation with the AI era. The findings underscore the perpetual evolution of technology and emphasize the imperative for nations to remain adaptive to emerging innovations. Furthermore, the study advocates for continuous updates to legal frameworks to align with the dynamic landscape of technological advancement.

**KEYWORDS** *Artificial Intelligence, Occupational Safety and Health, Worker Safety*

# Introduction

Science fiction has long envisaged a future where humans would engage in constant interaction with robots and intelligent machines. These imaginative constructs have remained pivotal in science fiction narratives to this day, and remarkably, they are now transitioning into tangible realities.[1] What was once the realm of speculative fiction is increasingly becoming commonplace, as numerous warehouses and manufacturing enterprises incorporate automated machinery to streamline their operations.

The AI domain has potentially assist humans to completing their tasks in accordance with the fields that humans interests. AI can be instructed by humans to manage in certain fields according to deep learning and natural language processing.[2] Furthermore, workers are integrating virtual or augmented reality into their training regimens, leveraging these technologies to enhance job performance or facilitate interactions with clients. Additionally, a significant portion of the workforce finds itself subject to automated surveillance by their employers.[3]

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1 Sophie Wennerscheid, "Posthuman Desire in Robotics and Science Fiction," in *Love and Sex with Robots*, ed. Adrian David Cheok and David Levy, vol. 10715, Lecture Notes in Computer Science (Cham: Springer International Publishing, 2018), 37–50, https://doi.org/10.1007/978-3-319-76369-9_4.

2 Syariful Alam, Mutiara Shaquila Salsabila, and Sholahuddin Al-Fatih, "Artificial Intelligence (AI) In Judiciary Processes," *Indonesian Journal of Law and Society* 5, no. 1 (2024): 43–80, https://doi.org/10.19184/ijls.v5i1.42798.

3 Anna Henschel, Guy Laban, and Emily S. Cross, "What Makes a Robot Social? A Review of Social Robots from Science Fiction to a Home or Hospital Near You," *Current Robotics Reports* 2, no. 1 (March 2021): 9–19, https://doi.org/10.1007/s43154-020-00035-0.

At the core of this technological evolution lies the classic concept of Artificial Intelligence (AI), which has garnered substantial attention in recent years owing to its profound advancements, particularly within the domain of machine learning technology.[4] Presently, a plethora of AI products cater to human needs, encompassing intelligent machines or robots, self-driving vehicles, mobile supercomputing, genome editing, and neuro-technological enhancements for the brain.[5] These transformative innovations are unfolding at an exponential pace, heralding what is termed the Fourth Industrial Revolution, or Industry 4.0. This paradigmatic shift is profoundly reshaping the fabric of human existence, impacting how individuals live, work, and communicate. It is restructuring various sectors, including government, education, healthcare, commerce, and beyond.[6]

Beyond its technological advancement, the impact of AI is prompting discourse not only within the realms of technology and science but also within the domain of law. These developments prompt inquiries into the regulation of AI through legal frameworks, addressing a myriad of legal issues such as legal personhood, intellectual property, and worker protection.[7]

The Indonesian Government's vision for Industry 4.0 necessitates corresponding regulatory measures to ensure legal certainty within society.[8] Workers represent a crucial demographic directly affected by the integration of intelligent machines across Indonesian companies. According to a study by McKinsey, by 2030, automation could displace as many as 23 million jobs, while simultaneously creating between 27 and 46 million new positions. This suggests a potential net gain of up to 23 million jobs, contingent on the pace

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[4] J. Matthew Helm et al., "Machine Learning and Artificial Intelligence: Definitions, Applications, and Future Directions," *Current Reviews in Musculoskeletal Medicine* 13, no. 1 (February 2020): 69–76, https://doi.org/10.1007/s12178-020-09600-8.

[5] Tomina Saveanu et al., "Labour Market in a Time of Crisis. What Do HR Experts Say about the Importance of Digitalization in the Postpandemic Context," *The Annals of the University of Oradea Economic Sciences* 32, no. 2 (December 2023): 85–98, https://doi.org/10.47535/1991AUOES32(2)008.

[6] Georg Spoettl, "AUTO 4.0: Anticipation of Skills for Employees Due to Digitalization - Identification of 'Occupational Profiles,'" in *Industry 4.0 - Current Status and Future Trends*, ed. Jesús Hamilton Ortiz (IntechOpen, 2020), https://doi.org/10.5772/intechopen.90185.

[7] Håkan Hydén, "AI, Norms, Big Data, and the Law," *Asian Journal of Law and Society* 7, no. 3 (October 2020): 409–36, https://doi.org/10.1017/als.2020.36.

[8] Reza Octavia Kusumaningtyas et al., "Reduction of Digitalization Policy in Indonesian MSMEs and Implications for Sharia Economic Development," *JURIS (Jurnal Ilmiah Syariah)* 21, no. 2 (December 30, 2022): 157, https://doi.org/10.31958/juris.v21i2.6855.

of technology adoption. However, the nature of these jobs will shift, with increased demand for advanced skills, especially in sectors like construction, education, healthcare, and digital services.[9]

Moreover, Indonesia's demographic dynamics, such as the anticipated demographic bonus between 2030-2040, will further amplify the need for job creation and skills development. As Indonesia transitions into a more digital and automated economy, young workers will face growing pressures to upskill, particularly in areas that require digital literacy and technical expertise. To harness the benefits of Industry 4.0, the Indonesian government has implemented initiatives like the "Making Indonesia 4.0" roadmap, which targets skills development in key sectors. These efforts are necessary to ensure that the labor force is prepared for technological integration across industries, reducing potential job displacement and optimizing economic growth.[10]

Recognizing that safeguarding workers is enshrined within the Indonesian Constitution as a cornerstone of societal welfare, it is imperative for the state to uphold this responsibility.[11] Hence, the government must deliberate on the adequacy of existing worker protection mechanisms in Indonesia amidst the era of intelligent machines. The pivotal question arises: Does the current framework for worker protection in Indonesia suffice to adequately safeguard workers in the age of advanced development of technology, especially Artificial Intelligence?

The proliferation of intelligent machines within companies has exacerbated concerns regarding worker protection, as these automated systems streamline tasks while simultaneously posing potential risks to workers. While intelligent machines undoubtedly enhance efficiency and productivity for workers, they also introduce the possibility of errors that could result in harm,

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[9] Kaushik Das et al., "How Automation in Indonesia Will Change the Future of Work," *McKinsey & Company*, 2018, https://www.mckinsey.com/featured-insights/asia-pacific/how-automation-in-indonesia-will-change-the-future-of-work.

[10] Bayu Giri Prakosa et al., "Correlation among Components of the Indonesian Industry Readiness Index 4.0 and Its Implementation on Socioeconomic along with the Demographic Aspects," *Digital Transformation and Society* 3, no. 3 (July 4, 2024): 296–309, https://doi.org/10.1108/DTS-08-2023-0063.

[11] Surya Perdana, "Comparison of Government Efforts in Improving the Welfare of Indonesian Workers Based on Law Number 13 of 2003 Concerning Manpower and Draft Law Number 11 of 2020 Concerning Job Creation," *International Journal Reglement & Society (IJRS)* 2, no. 1 (January 30, 2021), https://doi.org/10.55357/ijrs.v2i1.85.

including fatalities.[12]

This conundrum prompts a critical inquiry into whether Indonesia possesses adequate regulations or protections for workers in the event of such accidents. Despite the existence of some worker protection laws in Indonesia, there is a notable absence of specific legislation addressing accidents involving automated machines. Consequently, the ramifications of automated machine usage raise questions regarding liability in the event of workplace accidents. Given that these machines operate autonomously based on predefined algorithms, assigning responsibility becomes a complex dilemma, particularly as the machines themselves lack legal personhood and thus cannot be held accountable under existing laws.

The research is descriptive qualitative, aiming to elucidate the impact of artificial intelligence deployment within companies and the associated legal risks in the event of workplace accidents.[13] Through this descriptive approach, the author seeks to analyze the implementation of pertinent laws across various countries, assessing their efficacy in managing artificial intelligence within corporate settings. The overarching objective is to scrutinize the intersection of occupational safety regulations and the integration of artificial intelligence in the workplace.

By conducting comparative analyses of legal frameworks in different jurisdictions, the research endeavors to evaluate the adequacy of existing laws in addressing the challenges posed by artificial intelligence. Ultimately, the research aims to generate insights into occupational safety practices and worker protection in the era of artificial intelligence. The output of the study is envisioned to be a conceptual framework proposing enhancements to existing regulatory frameworks to better safeguard workers amidst the proliferation of artificial intelligence technologies.

Taiwan is chosen as the comparative country is considering their achievement as a leading tech hub in Asia, with substantial investments in AI and automation. By comparing it with Indonesia, which is still developing its AI infrastructure, we can observe how an economy driven by advanced technologies manages worker protection in contrast to a developing one. Additionally, Taiwan's well-established legal framework for labor protection, particularly in industries affected by automation, provides an opportunity to

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[12] Valerio De Stefano, "Introduction: Automation, Artificial Intelligence, and Labour Protection," *Artificial Intelligence, and Labour Protection (June 13, 2019). Comparative Labor Law & Policy Journal* 41, no. 1 (2019), https://ssrn.com/abstract=3403837.

[13] Lexy J Moleong, *Metodologi Penelitian Kualitatif* (Bandung: PT. Remaja Rosdakarya, 2019).

examine how both countries adapt their labor laws in response to AI-induced changes.[14]

The socioeconomic differences between Taiwan and Indonesia add further value to this comparison. While Taiwan has a smaller but more technologically advanced economy, Indonesia has a much larger and more diverse workforce. This contrast allows for an exploration of how the labor markets in these two countries are affected by AI, particularly in terms of job displacement, reskilling, and labor force transitions.[15]

Another important factor is the government response in both countries. Taiwan has been proactive in introducing policies aimed at mitigating the impact of automation on workers, including reskilling programs and AI ethics guidelines. Studying these initiatives can provide Indonesia with valuable insights into policy measures that may work in its own context. Finally, since both countries are in Asia and share some regional challenges, their comparison offers a relevant cultural and geopolitical perspective on how AI may shape labor markets across the region.[16]

# The Development of Artificial Intelligence in Taiwan and Indonesia

## A. Artificial Intelligence Development in Taiwan

Taiwan stands at the forefront of global innovation, particularly in semiconductors, information and communication technology (ICT), and manufacturing industries. Leveraging these robust foundations, Taiwan possesses a strong foothold to propel advancements in Artificial Intelligence (AI). Recognizing the immense potential inherent in Taiwan's capabilities, the government has embarked on proactive measures to bolster AI development. This commitment is evident through the formulation of ambitious AI policies,

[14] Mohd Akhlak Hussain, "The Impact of Artificial Intelligence on Workforce Automation and Skill Development," *Journal of Artificial Intelligence, Machine Learning and Neural Network*, no. 44 (June 5, 2024): 11–21, https://doi.org/10.55529/jaimlnn.44.11.21.

[15] World Economic Forum, "The Future of Jobs Report 2023," April 30, 2023, https://www.weforum.org/publications/the-future-of-jobs-report-2023/.

[16] McKinsey & Company, "AI, Automation, and the Future of Work," June 1, 2018, https://www.mckinsey.com/featured-insights/future-of-work/ai-automation-and-the-future-of-work-ten-things-to-solve-for.

complemented by strategic investments in infrastructure and the cultivation of AI talent.[17]

# 1. Policy

In early 2018, Taiwan unveiled its AI strategies, signaling a concerted effort to harness the potential of Artificial Intelligence (AI). Substantial financial resources have been allocated to support these initiatives, underscoring the government's commitment to fostering AI innovation. Specifically, the Executive Yuan unveiled a comprehensive 4-year AI Action Plan, accompanied by a substantial budget of 38 billion NTD (approximately 1.1 billion EUR). Additionally, the Ministry of Science and Technology (MoST) released a 5-year AI Strategy, backed by a budget of 16 billion NTD (equivalent to approximately 490 million EUR). These financial commitments reflect Taiwan's proactive stance in advancing AI research, development, and implementation across various sectors.[18]

## General Policy

### a) 5+2 Innovative Industries Plan

The cornerstone policy driving Taiwan's AI agenda is the 5+2 Innovative Industries Plan, an integral component of the Taiwan National Development Plan. This plan is pivotal in catalyzing industrial transformation and fostering sustainable growth within Taiwan's economy.[19] Historically renowned for its manufacturing prowess, particularly in the realm of Information and Communication Technology (ICT), Taiwan aims to pivot from traditional contract manufacturing towards a new paradigm centered on high-value-added business models.[20]

The 5+2 Innovative Industries Plan is designed to spearhead this transition, with a focus on seven key industries: Asia-Silicon Valley (Internet of

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[17] Gee San and Patarapong Intarakumnerd, eds., *Industrial Development of Taiwan: Past Achievement and Future Challenges beyond 2020*, Routledge-GRIPS Development Forum Studies 8 (London: Routledge, 2021), 34–54.

[18] Jui-fen Rachel Lu and Tung-liang Chiang, "Developing an Adequate Supply of Health Services: Taiwan's Path to Universal Health Coverage," *Social Science & Medicine* 198 (February 2018): 7–13, https://doi.org/10.1016/j.socscimed.2017.12.017.

[19] Shiu-Wan Hung, Chao-Liang Chang, and Shu Ming Liu, "Innovation System Assessment Model for Sustainability Planning in Taiwan," *Sustainability* 11, no. 24 (December 9, 2019): 7040, https://doi.org/10.3390/su11247040.

[20] Robert Wade, *Governing the Market: Economic Theory and the Role of Government in East Asian Industrialization* (Princeton, NJ: Princeton University Press, 2018).

Things), Biomedical, Green Energy, Smart Machinery, Defense, Agriculture, and Circular Economy. Initially conceived as a framework encompassing five industries, the plan expanded to include two additional sectors, Digital Economy and Cultural Innovation, with a subsequent incorporation of Semiconductors and IC Design. Despite these expansions, the nomenclature of "5+2" persists.[21]

The overarching objective is to propel Taiwan beyond its manufacturing-centric identity towards a more diversified economy offering comprehensive solutions. Central to this vision is the integration of AI technologies across various sectors, viewed as a catalyst for innovation, enhanced competitiveness, increased profitability, and improved working standards. Consequently, the strategic deployment of AI is envisaged as a transformative force capable of driving progress and prosperity across Taiwan's industrial landscape.[22]

### *b) Forward-Looking Infrastructure Development Program*

The second overarching policy pertinent to AI is the Forward-Looking Infrastructure Development Program, a significant initiative aimed at fortifying Taiwan's infrastructure in anticipation of evolving industries and emerging technologies. Envisioned as a cornerstone for Taiwan's growth over the next three decades, this program encompasses funding across eight key categories:[23]

1) Railway Projects: Enhancing transportation safety and efficiency.
2) Water Environments: Building resilience against climate change.
3) Green Energy Infrastructure: Promoting environmental sustainability.
4) Digital Infrastructure: Fostering a smart and connected nation.
5) Urban and Rural Projects: Balancing regional development.
6) Child Care Facilities: Addressing declining birth rates.
7) Food Safety Infrastructure: Ensuring food safety standards.

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[21] Ying-Ying Lai and Yuh-Ming Lee, "Management Strategy of Plastic Wastes in Taiwan," *Sustainable Environment Research* 32, no. 1 (December 2022): 11, https://doi.org/10.1186/s42834-022-00123-0.

[22] Guo Freeman, Jeffrey Bardzell, and Shaowen Bardzell, "Open Source, Open Vision: The MakerPro Network and the Broadening of Participation in Setting Taiwan's IT Vision Agenda," *Human–Computer Interaction* 34, no. 5–6 (September 2, 2019): 506–40, https://doi.org/10.1080/07370024.2018.1555043.

[23] Jen-Yang Lin, Ying-Chu Chen, and Cherng-Tzong Chang, "Costs and Environmental Benefits of Watershed Conservation and Restoration in Taiwan," *Ecological Engineering* 142 (January 2020): 105633, https://doi.org/10.1016/j.ecoleng.2019.105633.

8) Human Resources Infrastructure: Nurturing talent and boosting employment.

Launched by presidential decree in July 2017 and slated to span four years, the program is anticipated to contribute significantly to Taiwan's real Gross Domestic Product (GDP), with an expected increase of 0.1% annually. With a total budget of 420 billion NTD (approximately 12.7 billion EUR) funded through government-issued debt, the program encompasses various focus areas, among which digital infrastructure assumes paramount importance.[24]

The Digital Infrastructure program within the Forward-Looking Infrastructure Development Program aims to cultivate a smart and connected nation. Its objectives span several domains, including:[25]

1) Cybersecurity Infrastructure: Strengthening information and cybersecurity to safeguard online services.
2) Digital Inclusion: Ensuring universal access to basic broadband and cloud resources, particularly in rural areas.
3) Digital Cultural Creativity Industry: Catalyzing growth in the digital cultural creativity sector through high-definition services and content creation.
4) Smart Urban and Rural Services: Enhancing quality of life through ubiquitous smart services in both urban and rural areas.
5) Research and Smart Learning: Fostering an innovative digital learning environment through advanced technologies such as fiber optic broadband and smart learning tools.

With a budget of 43.1 billion NTD (approximately 1.3 billion EUR) allocated from 2017 to 2020, the Digital Infrastructure program represents a pivotal component of Taiwan's broader infrastructure development efforts, augmented by substantial private sector investments in broadband infrastructure and research and development. Through these initiatives, Taiwan aims to lay the groundwork for a technologically advanced and inclusive society poised to leverage the potential of AI and other emerging technologies.[26]

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[24] Shyi-Min Lu, "Global Outlook for 2018: Economy, Finance, and Monetary, with a Particular Case Study of Taiwan," *International Journal of Economics and Finance* 10, no. 3 (February 20, 2018): 133, https://doi.org/10.5539/ijef.v10n3p133.

[25] Jang-Hwa Leu et al., "Smart City Development in Taiwan," *IET Smart Cities* 3, no. 3 (September 2021): 125–41, https://doi.org/10.1049/smc2.12008.

[26] Lu, "Global Outlook for 2018."

## *Specific AI Policy*

In addition to overarching governmental directives, the Taiwanese administration has formulated specialized policies focused on the advancement of Artificial Intelligence (AI). These include the issuance of an AI Action Plan by the Executive Yuan and the publication of an AI strategy by the Ministry of Science and Technology (MoST), both intended to catalyze and foster the development of AI technologies within Taiwan.

### *a) Taiwan AI Action Plan*

In January 2018, the Executive Yuan of Taiwan unveiled a comprehensive 4-year AI action plan spanning from 2018 to 2021.[27] This initiative is designed to propel the nation's artificial intelligence (AI) industry forward, with a substantial budget allocation of approximately 38 billion NTD over the four-year period. This equates to an annual budget of 9.5 billion NTD, or approximately 280 million EUR, dedicated to fostering AI development. Funding for this budget is drawn from both the general science and technology sector and the Forward-Looking Infrastructure Development program. The AI action plan delineates five primary focus areas aimed at stimulating and expediting AI development within Taiwan.[28]

**TABLE 1.** Taiwan AI Action Plan

| No. | AI Action Plan | Notes |
|---|---|---|
| 1. | AI for industrial innovation | Connect industrial innovation with AI (5+2 industries) and enable AI-driven innovation in SMEs |
| 2. | AI International Innovation Hub | Foster 100 AI start- ups and develop international AI innovation clusters |
| 3. | AI Pilot projects | Launch research projects (like DARPA in US and SIP in Japan) |
| 4. | AI Talent Program | 1.000 advanced AI researchers and 10.000 AI professionals + recruit AI talents |

[27] Weronika Jakubczak and Hon-min Yau, "Trends in Cybersecurity Regulations of Taiwan (Republic of China) – Phases of Pro Motion of Major Cyber Security Plans and Programsin the National Cyber Security Program of Taiwan (2021–2024)," *Zeszyty Naukowe SGSP* 1, no. 80 (December 21, 2021): 199–216, https://doi.org/10.5604/01.3001.0015.6485.

[28] Shin-Cheng Yeh et al., "Public Perception of Artificial Intelligence and Its Connections to the Sustainable Development Goals," *Sustainability* 13, no. 16 (August 16, 2021): 9165, https://doi.org/10.3390/su13169165.

| No. | AI Action Plan | Notes |
|---|---|---|
| 5. | Test field and Regulatory Co-Creation | Open fields and data for testing |

## *b) AI Innovation: Grand Strategy for a Small Country*

The Ministry of Science and Technology (MoST) has devised a comprehensive five-year AI strategy spanning from 2017 to 2021, aimed at catalyzing the advancement of next-generation AI technologies through the cultivation of AI specialists and the creation of a conducive environment for AI scientific research.[29] Termed the "Grand Strategy for a Small Country," this initiative boasts a budget of 16 billion NTD (approximately 490 million EUR) over the designated five-year period. The overarching objective is to foster future fields of innovation within Taiwan's AI landscape while leveraging the nation's existing strengths in sectors such as semiconductors and information and communications technology (ICT).[30]

To realize this vision, the MoST has formulated five master strategies aimed at establishing a robust AI innovation ecosystem:[31]

1) AI Cloud Platform: This strategy entails the development of an AI Research and Development (R&D) platform for cloud services and high-speed computing, facilitating a shared-use environment for large-scale, high-speed computing endeavors.
2) AI Innovation: The establishment of four innovation research centers is proposed to cultivate specialists in AI research and facilitate investments in technological advancements within the field.
3) AI Robot Makerspace: A dedicated AI Robot Makerspace will be established at Taiwan Science Parks, serving as a hub for integrating robotics software and hardware, fostering the development of innovative applications, and providing practical experience to AI talents.

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[29] Jui-Lung Chen, "The Cases Study of 'One Belt and One Road' and 'Made in China 2025' Impact on the Development of Taiwan's Machine Tool Industry," *International Business Research* 11, no. 2 (January 18, 2018): 189, https://doi.org/10.5539/ibr.v11n2p189.

[30] Wan Li Chien, Yu Chia Ko, and Jian Hang Wang, "The Role of Multinational Technology Companies in Facilitating Emerging Enabling Technologies for Industry Transformation: The Case of Artificial Intelligence in Intelligent Manufacturing in Taiwan," *International Journal of Multinational Corporation Strategy* 3, no. 2 (2020): 95, https://doi.org/10.1504/IJMCS.2020.114690.

[31] Christopher Grant Kirwan and Zhiyong Fu, *Smart Cities and Artificial Intelligence: Convergent Systems for Planning, Design, and Operations* (Amsterdam, Netherlands ; Cambridge, MA: Elsevier, 2020).

4) Semiconductor Moonshot: This strategy aims to address bottlenecks hindering AI-powered edge computing within the semiconductor industry. Initiatives include the launch of an AI Semiconductor Moonshot project and the training of AI talents in semiconductor process technologies and chip design.
5) AI Formosa Grand Challenges: The initiation of three technology competitions, known as the Formosa Grand Challenge, will serve to unearth talent and drive technological advancements within the AI domain.

## *2. Infrastructures*

Data stands as the foundational element crucial for initiating AI endeavors. Devoid of accessible datasets, the application of AI remains unattainable. Indeed, the magnitude of available data directly correlates with the efficacy of AI utilization.[32] This reality is exemplified by unicorn startup companies such as Facebook, Amazon, and Google, which have emerged as frontrunners in the AI domain due to their longstanding accumulation of vast datasets. Their privileged access to extensive data repositories furnishes them with a distinct advantage, enabling them to maintain a competitive edge over their counterparts. Notably, the majority of this data remains proprietary, underscoring the significance of data acquisition capabilities.[33]

The procurement of data poses a primary challenge for researchers, necessitating a concerted effort to expand the availability of publicly accessible datasets.[34] Taiwan, in particular, has proactively endeavored to enhance data accessibility, recognizing its pivotal role in fostering innovation and addressing public needs. The government of Taiwan espouses the benefits of open data, citing its potential to enhance policy efficiency, meet public demands, and spur creativity. To this end, Taiwan has outlined a comprehensive strategy for promoting data openness, encompassing the formulation of open data policies and regulations, the provision of open data platforms, the cultivation of a

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[32] Jens Westenberger, Kajetan Schuler, and Dennis Schlegel, "Failure of AI Projects: Understanding the Critical Factors," *Procedia Computer Science* 196 (2022): 69–76, https://doi.org/10.1016/j.procs.2021.11.074.

[33] Teresa Shuk-Ching Poon, Chia-Hsuan Wu, and Meng-Chun Liu, "Developing Entrepreneurial Ecosystem: A Case of Unicorns in China and Its Innovation Policy Implications," *Asian Journal of Technology Innovation* 32, no. 1 (January 2, 2024): 20–36, https://doi.org/10.1080/19761597.2022.2157849.

[34] Martin Hilbert, "Big Data for Development: A Review of Promises and Challenges," *Development Policy Review* 34, no. 1 (January 2016): 135–74, https://doi.org/10.1111/dpr.12142.

governmental culture conducive to data openness, and the empowerment of civil participation and public innovation.[35]

Presently, Taiwan boasts an open data platform housing information spanning over 27,000 categories, including air quality and property registration data, accessible to the public free of charge. These concerted efforts have propelled Taiwan to the forefront of global data openness, culminating in its top-ranking position on the Global Open Data Index (GODI), with an impressive score of 90%. The GODI serves as a benchmark for assessing the openness of government data, underscoring Taiwan's commitment to transparency and accessibility in the realm of data governance.[36]

## *3. Talents*

Annually, Taiwan witnesses a robust influx of talent in the fields of computer science and electrical engineering, with over 10,000 graduates in computer science and more than 25,000 graduates in electrical engineering. Notably, engineering degrees constitute over 25% of all university degrees conferred in Taiwan.[37] Furthermore, Taiwanese students rank fourth globally in Science, Technology, Engineering, and Mathematics (STEM) disciplines according to OECD statistics.[38] Given that engineering and data science serve as the bedrock of AI, this abundant pool of talent possesses foundational knowledge conducive to further upskilling and specialization in AI.

Taiwan's commitment to AI development is underscored by the establishment of the Taiwan AI Academy, which plays a pivotal role in cultivating and implementing AI initiatives within the country. The academy actively conducts training programs targeting industrial AI talent, bridging the gap between academia and industry. Functioning as an open platform for knowledge exchange and cooperation among government, industry, and academia, the Taiwan AI Academy was founded in January 2018 by the Science

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[35] Dennis Linders, Calvin Zhou-Peng Liao, and Cheng-Ming Wang, "Proactive E-Governance: Flipping the Service Delivery Model from Pull to Push in Taiwan," *Government Information Quarterly* 35, no. 4 (October 2018): S68–76, https://doi.org/10.1016/j.giq.2015.08.004.

[36] Sk Tahsin Hossain et al., "Local Government Cybersecurity Landscape: A Systematic Review and Conceptual Framework," 2023, https://doi.org/10.2139/ssrn.4680227.

[37] Dongsoo Kim, "China's Potential and the Power of Human Resources," *SSRN Electronic Journal*, 2020, https://doi.org/10.2139/ssrn.4194335.

[38] Min-Hsien Lee, Chung-Yuan Hsu, and Chun-Yen Chang, "Identifying Taiwanese Teachers' Perceived Self-Efficacy for Science, Technology, Engineering, and Mathematics (STEM) Knowledge," *The Asia-Pacific Education Researcher* 28, no. 1 (February 2019): 15–23, https://doi.org/10.1007/s40299-018-0401-6.

& Technology Ecosystem Development Foundation and the Taiwan Data Science Foundation, and is operated by the Artificial Intelligence Foundation, all of which are non-profit organizations.[39]

Funding for the Taiwan AI Academy was sourced through a non-profit foundation, supplemented by tuition fees from trainees. Notably, the academy received substantial financial support totaling NT$30 million (US$1 million) from six prominent companies, including Chi Mei Industrial, Formosa Plastics, Inventec Group, MediaTek, Elan Electronics, and AU Optronics, shortly after its establishment.[40] Additionally, numerous companies and universities across Taiwan have actively sponsored the academy, facilitating the establishment of branch campuses in Hsinchu, Taichung, and Tainan within a year of its inauguration in Taipei.[41]

Taiwan's status as a global hardware hub has historically been its forte, with a recent shift toward AI leveraging the abundant engineering talent available in the country. This strategic refocus on AI not only capitalizes on existing talent but also reduces dependence on hardware manufacturing, a sector that can be outsourced to lower-cost regions such as China. Multinational tech companies have shown keen interest in tapping into Taiwan's software talent, particularly in the realm of AI, signaling a promising trajectory for Taiwan's AI ecosystem.[42]

## B. Artificial Intelligence Development in Indonesia

Artificial intelligence (AI) has garnered widespread adoption across various industries in Indonesia, spanning education, healthcare, manufacturing, services, and product sectors. Beyond its application in manufacturing

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[39] Tsai-Min Chen et al., "SRECG: ECG Signal Super-Resolution Framework for Portable/Wearable Devices in Cardiac Arrhythmias Classification," *IEEE Transactions on Consumer Electronics* 69, no. 3 (August 2023): 250–60, https://doi.org/10.1109/TCE.2023.3237715.

[40] Sarah O'Meara, "From Plastic Toys to Industry 4.0: How Taiwan Is Using Science to Upgrade Its Manufacturing," *Nature* 577, no. 7790 (January 16, 2020): S1–3, https://doi.org/10.1038/d41586-020-00060-1.

[41] Chu-Chen Rosa Yeh et al., "Will Robots Take My Job? Exploring the Effect of Artificial Intelligence in Taiwan's Labor Market," in *Knowledge Management in Organizations*, ed. Lorna Uden, I-Hsien Ting, and Kai Wang, vol. 1438, Communications in Computer and Information Science (Cham: Springer International Publishing, 2021), 444–56, https://doi.org/10.1007/978-3-030-81635-3_36.

[42] Thomas J. Shattuck, "Stuck in the Middle: Taiwan's Semiconductor Industry, the U.S.-China Tech Fight, and Cross-Strait Stability," *Orbis* 65, no. 1 (2021): 101–17, https://doi.org/10.1016/j.orbis.2020.11.005.

production, AI is utilized in educational institutions through learning outcome systems, while government agencies leverage it for regulatory functions.[43] The implementation of AI has notably yielded positive outcomes, including reduced waiting times and enhanced service quality. However, in developing countries like Indonesia, AI adoption is accompanied by challenges, such as diminished labor absorption and substantial investment requirements.

Key actors in Indonesia's AI landscape encompass multinational corporations like Google – Alphabet and Facebook, telecommunications firms such as PT. Telkom Tbk., PT. Telkom Sigma, and PT. XL Axiata Tbk., as well as a burgeoning array of startups like Snapcart, Kata.ai, BJtech, Sonar, Nodeflux, Bahasa.ai, AiSensum, and Deligence.ai. Additionally, government entities play a role in fostering AI innovation through initiatives like incubator programs. Startups, in particular, play a strategic role in expediting AI technology adoption across Indonesia. Their growth trajectory not only accelerates the uptake of AI but also serves as a magnet for domestic and international talent, thereby fostering a dynamic AI industry ecosystem.[44]

## *1. Policy*

Under the administration of President Joko Widodo, Indonesia is tasked with embracing the Fourth Industrial Revolution (4IR), which encompasses cutting-edge technologies such as artificial intelligence (AI), the Internet of Things (IoT), wearables, advanced robotics, and 3D printing. As Indonesia strives to embrace the 4IR, it faces significant technological disparities and must undertake extensive preparations.[45]

The Ministry of Industry has devised the "Making Indonesia 4.0" initiative to implement the 4IR strategy and roadmap within the nation. This roadmap engages various stakeholders, including governmental bodies, industry associations, businesses, technology providers, and research and educational

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[43] Eko Eddya Supriyanto, Hardi Warsono, and Augusin Rina Herawati, "Literature Study on the Use of Big Data and Artificial Intelligence in Policy Making in Indonesia," *Administratio: Jurnal Ilmiah Administrasi Publik Dan Pembangunan* 12, no. 2 (December 7, 2021): 139–53, https://doi.org/10.23960/administratio.v12i2.235.

[44] Roberto Akyuwen, Marthin Nanere, and Vanessa Ratten, "Technology Entrepreneurship: Fintech Lending in Indonesia," in *Entrepreneurial Innovation*, ed. Vanessa Ratten, Studies on Entrepreneurship, Structural Change and Industrial Dynamics (Singapore: Springer Nature Singapore, 2022), 151–76, https://doi.org/10.1007/978-981-16-4795-6_14.

[45] Try Hardyanthi, Falah Al Ghozali, and Muhammad Arizka Wahyu, "Facing the Industrial Revolution 4.0: Taiwanese and Indonesian Perspective," *Indonesian Comparative Law Review* 1, no. 2 (2019), https://doi.org/10.18196/iclr.1209.

institutions. Designed to chart Indonesia's industrial trajectory, the Making Indonesia 4.0 roadmap outlines specific sectors and national priorities aimed at bolstering the country's industrial framework.[46]

The primary sectors earmarked for initial technology integration include food and beverage, textiles and clothing, automotive, chemistry, and electronics. Additionally, ten national priorities have been identified to fortify Indonesia's industrial fabric, including enhancing goods and material flow, revamping industrial zones, adhering to sustainability standards, empowering micro, small, and medium-sized enterprises (MSMEs), fostering a national digital infrastructure, attracting foreign investment, enhancing human resource quality, nurturing an innovation ecosystem, incentivizing technology investment, and harmonizing regulatory frameworks.[47]

Among these priorities, three are particularly pertinent to the advancement and implementation of AI in Indonesia: accommodating sustainability standards, establishing a national digital infrastructure, and enhancing human resource quality.

## *2. Infrastructures*

Indonesia's technological infrastructure, particularly in the realm of artificial intelligence, lags behind global standards. The establishment of a national digital framework as a new priority underscores Indonesia's nascent focus on technology infrastructure development.[48] This indicates that Indonesia is only now beginning to prioritize and invest in technology infrastructure.

The digitalization of government operations in Indonesia commenced with the issuance of Presidential Instruction No. 3 in 2003, outlining the National E-Government Development Policy and Strategy. This directive prompted government institutions at all levels to transition from manual,

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[46] Hasbullah Hasbullah, Salleh Ahmad Bareduan, and Sawarni Hasibuan, "Developing I4.0 Readiness Index for Factory Operation in Indonesia to Enhance INDI 4.0," *International Journal on Advanced Science, Engineering and Information Technology* 11, no. 4 (August 30, 2021): 1668, https://doi.org/10.18517/ijaseit.11.4.14280.

[47] Chunguang Bai et al., "Industry 4.0 Technologies Assessment: A Sustainability Perspective," *International Journal of Production Economics* 229 (November 2020): 107776, https://doi.org/10.1016/j.ijpe.2020.107776.

[48] Mochammad Tanzil Multazam and Aan Eko Widiarto, "Digitalization of the Legal System: Opportunities and Challenges for Indonesia," *Rechtsidee* 11, no. 2 (December 25, 2023), https://doi.org/10.21070/jihr.v12i2.1014.

paper-based processes to digital systems.[49] However, this digitization effort lacked structure and integration, resulting in disparate data collection and storage practices across agencies. Consequently, duplicative data entries in various formats and the proliferation of over 2700 decentralized data centers became commonplace, leading to inefficiencies and data inconsistencies. Similarly, within the national industry sector, customer data collection lacked uniformity, further complicating data management.[50]

Recognizing the need for data standardization, the government introduced Presidential Decree No. 39 in 2019, known as One Data Indonesia, aimed at harmonizing data quality and format. Despite this initiative, challenges persist in aggregating data from diverse sources and formats, impeding comprehensive data availability and utilization for national interests.[51]

## *3. Talents*

Indonesia's population has embraced digital technology at an impressive rate, with individuals spending an average of 5 hours per day on their smartphones, surpassing the usage in countries like Japan.[52] A substantial portion of Indonesia's population, approximately 193 million out of 264 million, owns smartphones. However, despite this widespread digitalization, only half of mobile phone users in Indonesia utilize their devices for mobile transactions.[53]

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[49] Widhi Handoko and Ricco Survival Yubaidi, "Information Technology in Electronic Land Registration System as the Standard of Government Performance in the Industry 4.0 Revolution," *Lex Publica* 7, no. 1 (2020): 82–94.

[50] Yusuf Rizky Aditya, "Application of E-Government in Immigration Management Information System (SIMKIM) at Directorate General of Immigration," *TEMATICS: Technology ManagemenT and Informatics Research Journals* 2, no. 2 (April 27, 2020): 93–113, https://doi.org/10.52617/tematics.v2i2.107.

[51] Maulia Jayantina Islami, "Implementasi Satu Data Indonesia: Tantangan Dan Critical Success Factors (CSFs)," *Jurnal Komunika: Jurnal Komunikasi, Media Dan Informatika* 10, no. 1 (September 3, 2021): 13, https://doi.org/10.31504/komunika.v10i1.3750. *See also* Junaidi Junaidi, Pujiono Pujiono, and Rozlinda Mohamed Fadzil. "Legal Reform of Artificial Intelligence's Liability to Personal Data Perspectives of Progressive Legal Theory." *Journal of Law and Legal Reform* 5, no. 2 (2024): 587-612.

[52] Lia Puspitasari and Kenichi Ishii, "Digital Divides and Mobile Internet in Indonesia: Impact of Smartphones," *Telematics and Informatics* 33, no. 2 (May 2016): 472–83, https://doi.org/10.1016/j.tele.2015.11.001.

[53] Kathleen Azali, "Cashless in Indonesia: Gelling Mobile E-Frictions?," *Southeast Asian Economies* 33, no. 3 (December 30, 2016): 364–86, https://doi.org/10.1355/ae33-3e.

In the context of Industry 4.0, which heavily relies on advanced technologies like artificial intelligence (AI), the demand for AI talent has surged across various Indonesian industries. AI serves as a cornerstone of Industry 4.0 initiatives, amplifying the need for skilled professionals to facilitate its integration. These AI talents may emerge from formal educational institutions or non-formal training centers. Nevertheless, Indonesia faces challenges in meeting the escalating demand for AI talent, both in terms of quality and quantity. A notable gap exists between industry requirements and the available talent pool.[54]

Former Coordinating Minister for Economic Affairs, Darmin Nasution, highlighted the inadequacies of the Indonesian education system in cultivating top-tier technology professionals. In the era of Industry 4.0 and Society 5.0, which hinge on technological advancements, Indonesia must prioritize the development of skilled human resources. This entails nurturing individuals capable of leveraging technology effectively while also honing soft skills that complement the capabilities of AI.[55]

# The Occupational Safety and Health (OSH) Legal Framework

The implementation of Occupational Safety and Health (OSH) programs within companies constitutes a crucial factor in enhancing work productivity. OSH initiatives not only fulfill regulatory requirements but also safeguard the fundamental rights of workers.[56] Health and safety insurance engenders a sense of security among workers, enabling them to perform their duties without succumbing to anxiety or distress caused by workplace

[54] Jamal Maulana Hudin et al., "Audit Sistem Informasi Sumber Daya Manusia Pada PT. Intercon Terminal Indonesia Menggunakan Framework Cobit 4.1," *Swabumi* 9, no. 1 (April 7, 2021): 48–56, https://doi.org/10.31294/swabumi.v9i1.10310.

[55] Yudo Devianto and Saruni Dwiasnati, "Kerangka Kerja Sistem Kecerdasan Buatan Dalam Meningkatkan Kompetensi Sumber Daya Manusia Indonesia," *Jurnal Telekomunikasi Dan Komputer* 10, no. 1 (April 8, 2020): 19, https://doi.org/10.22441/incomtech.v10i1.7460.

[56] Kassu Jilcha Sileyew, "Systematic Industrial OSH Advancement Factors Identification for Manufacturing Industries: A Case of Ethiopia," *Safety Science* 132 (December 2020): 104989, https://doi.org/10.1016/j.ssci.2020.104989.

conditions or circumstances.[57] These programs serve as proactive measures to mitigate potential hazards arising from the operational activities of the company, thereby ensuring the protection and well-being of employees.

# A. The OSH Legal Framework in Taiwan

## 1. Taiwan Constitution

The Taiwanese Constitution contains several provisions pertaining to working conditions and Occupational Safety and Health (OSH).[58] Article 15 guarantees the protection of the right to life, employment, and property, aligning with the fundamental rights outlined in the Universal Declaration of Human Rights (UDHR). Additionally, Article 153, Section 1 emphasizes the state's responsibility to enhance the skills and quality of life of workers and farmers through legislation and policy implementation, with special protections afforded to women and children in Section 2. Article 154 emphasizes the need for harmony between capital and labor in business development, with dispute resolution regulated by law.

Among these articles, Article 153 is particularly relevant to OSH. National OSH policies aim to ensure safety, health, and welfare for all workers, including those employed in companies, self-employed individuals, and those under workplace supervision. These policies delineate responsibilities for employers, importers, manufacturers, and suppliers, while promoting collaboration among government, workers, and employers. Additionally, they aim to enhance OSH management for machinery, chemicals, and equipment, establish comprehensive occupational disease prevention and health service systems, and reinforce protections for workers' physical and psychosocial health.[59]

Furthermore, OSH policies prioritize the protection of vulnerable

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[57] N. Jamilatul Izyati et al., "The Urgency of Health Insurance Systems as Safety Education Efforts for Informal Sector Workers in Garage," *Journal of Safety Education* 1, no. 2 (December 25, 2023): 49–52, https://doi.org/10.15294/jse.v1i2.76200.

[58] Yeun-wen Ku, "To Be or Not To Be a Taiwanese Welfare State: Lessons from Recent Experience," in *Comparing the Social Policy Experience of Britain and Taiwan*, ed. Catherine Jones Finer (Abingdon, Oxon: Routledge, 2018), 27–48.

[59] Xinglin Chen et al., "Occupational Health and Safety in China: A Systematic Analysis of Research Trends and Future Perspectives," *Sustainability* 15, no. 19 (September 22, 2023): 14061, https://doi.org/10.3390/su151914061.

demographics such as pregnant, elderly, and young workers, alongside increased labor inspection capacities, penalties for violations, and research on emerging risks.[60] They advocate for systematic risk management, OSH training, and the promotion of an OSH culture among citizens. Support for small and medium enterprises in improving working environments and assistance and rehabilitation for workers involved in occupational accidents are also integral components of these policies.[61]

## *a) Taiwan OSH Act*

The Taiwan Occupational Safety and Health (OSH) Act was enacted on April 16, 1974, and underwent comprehensive amendment in 2013. This legislation applies to all laborers, self-employed individuals, and others engaged in work under the direction or supervision of responsible persons in workplaces. It delineates the responsibilities of employers and their obligations regarding safety, alongside manufacturers, importers, and related parties. In addition to these general responsibilities, the Act addresses various aspects of occupational safety, including occupational health protection, safety management, accident statistics, severe accident notifications, maternity and youth worker protections, among others.[62]

Article 5, Taiwanese OSH Act mandated employers to assign work to laborers within reasonable and feasible parameters and to provide necessary preventive measures and tools to mitigate occupational accidents. They are required to furnish appropriate safety and health equipment compliant with relevant laws, regulations, and policies to prevent injuries. Those involved in the design, manufacture, or import of machinery, materials, tools, equipment, and engineering projects must conduct risk assessments and take measures to prevent occupational accidents during usage or construction.[63]

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[60] *Caring for Those Who Care: Guide for the Development of Occupational Health and Safety Programmes for Health Workers* (Geneva, Switzerland: World Health Organization and the International Labour Organization, 2022).

[61] Hui-Ting Huang, Chung-Hung Tsai, and Chia-Fen Wang, "A Model for Promoting Occupational Safety and Health in Taiwan's Hospitals: An Integrative Approach," *International Journal of Environmental Research and Public Health* 16, no. 5 (March 11, 2019): 882, https://doi.org/10.3390/ijerph16050882.

[62] Ting-Ya Hsieh, Mu-Chun Liao, and Hsing-Wei Tai, "Comparison of Legal System of Occupational Safety and Health between Mainland China and Taiwan," *Open Journal of Safety Science and Technology* 09, no. 04 (2019): 113–36, https://doi.org/10.4236/ojsst.2019.94008.

[63] Wei Tong Chen et al., "Construction Safety Success Factors: A Taiwanese Case Study," *Sustainability* 12, no. 16 (August 6, 2020): 6326, https://doi.org/10.3390/su12166326.

As mentioned in Article 7 Taiwanese OSH Act, manufacturers or transporters of machinery, equipment, or tools specified by the central competent authority must adhere to safety standards. Those that meet safety standards must be registered and affixed with safety labels. Dangerous machinery products and equipment must be handled by qualified individuals who regularly conduct risk assessments for chemical processes with potentially severe consequences.

Employers are required to provide clear information on occupational safety and health through education or training to enable workers to fulfill their duties and prevent occupational accidents. When a business entity outsources work to contractors, the liability for the specific work rests with the contractors, but both the business entity and the contractor share responsibility for occupational accidents, including subcontractors, if any.[64]

Regarding chemical substances, the OSH Act, Article 13 & 14 stipulates authorization, assessment, and future-reference management mechanisms for new chemical compounds, regulated chemicals, and chemicals for priority management. Importers, manufacturers, employers, or suppliers are obligated to prepare or disclose safety data sheets, provide inventory lists, and implement training and education for workers involved in hazardous chemical operations. Business entities must assess worker exposure risks and implement appropriate control measures based on intrinsic hazards, quantity of utilization, and degree of dispersion.[65]

In article 19 of Taiwanese OSH Act, it was mentioned that employers should prevent labor fatigue, musculoskeletal disorders, and mental stress, and refrain from subjecting workers to high-temperature work environments for more than six hours per day. Abnormal working conditions require reduced hours and appropriate rest periods.[66] Employers with over 50 workers must hire or contract a medical worker to carry out worker health management, occupational disease prevention, and other worker health protection programs.

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[64] Elizabeth Bluff, "How SMEs Respond to Legal Requirements to Provide Information, Training, Instruction and Supervision to Workers about Work Health and Safety Matters," *Safety Science* 116 (July 2019): 45–57, https://doi.org/10.1016/j.ssci.2019.02.036.

[65] Keng-Wen Lien et al., "Inspections of Imported Foods to Taiwan: An Overview," *Journal of Consumer Protection and Food Safety* 14, no. 2 (June 2019): 183–91, https://doi.org/10.1007/s00003-018-1204-7.

[66] Heng-Hao Chang and Ro-Ting Lin, "Policy Changes for Preventing and Recognizing Overwork-Related Cardiovascular Diseases in Taiwan: An Overview," *Journal of Occupational Health* 61, no. 4 (July 2019): 278–87, https://doi.org/10.1002/1348-9585.12046.

Specific hazardous tasks prohibit the employment of workers under 18, women, pregnant women, and those who have given birth within a year. Designated entities must assess and control hazards related to maternity health, making work adjustments for pregnant or postpartum women.[67]

Employers and labor unions or worker representatives collaborate to establish appropriate OSH codes of practice.[68] Workers who observe violations of the OSH Act or other regulations may file complaints with the employer, competent authority, or labor inspection agency. Employers are prohibited from retaliating against such workers. In case of occupational accidents, employers must provide first aid, emergency rescue, and conduct investigations, notifying the labor inspection agency within eight hours.[69]

The Ministry of Labor and labor inspection agencies conduct worksite inspections, informing non-compliant entities of violations and providing a limited time for improvements. Entities failing to improve within the given time frame, experiencing occupational accidents, or posing potential hazards may be subject to suspension of operations, in whole or in part.[70]

## *b) Labor Inspection Act*

The enactment of this act aims to facilitate labor inspection, enforce labor laws and regulations, and safeguard the rights and interests of both labor and employers.[71] Based on article 4 of Taiwan Labour Inspection Act, the scope of labor inspection encompasses various laws and regulations, including the Occupational Safety and Health Act, the Labor Standards Act, and other pertinent labor legislation, covering aspects such as process safety management, inspection of hazardous machinery and equipment, designated inspection

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[67] Lin Che Huei et al., "Occupational Health and Safety Hazards Faced by Healthcare Professionals in Taiwan: A Systematic Review of Risk Factors and Control Strategies," *SAGE Open Medicine* 8 (January 2020): 205031212091899, https://doi.org/10.1177/2050312120918999.

[68] Yibee Huang et al., "Contextualization of UN Human Rights Indicators: Modifying 'Right to Work' Indicators for Application in Taiwan," *Journal of Human Rights* 17, no. 3 (May 27, 2018): 340–56, https://doi.org/10.1080/14754835.2018.1432341.

[69] Peter Vandergeest and Melissa Marschke, "Beyond Slavery Scandals: Explaining Working Conditions Among Fish Workers in Taiwan and Thailand," *Marine Policy* 132 (October 2021): 104685, https://doi.org/10.1016/j.marpol.2021.104685.

[70] Hsieh, Liao, and Tai, "Comparison of Legal System of Occupational Safety and Health between Mainland China and Taiwan."

[71] Abdul Kadir Jaelani et al., "Legal Protection of Employee Wage Rights in Bankrupt Companies: Evidence from China," *Legality: Jurnal Ilmiah Hukum* 31, no. 2 (August 22, 2023): 202–23, https://doi.org/10.22219/ljih.v31i2.25874.

agency management, and inspection procedures.

Labor inspection is conducted by the labor inspection agency, established either by the Central Competent Authority or by delegation of inspection authority to municipal competent authorities. Joint inspections with county/city competent authorities may be conducted when deemed necessary. In cases requiring immediate action to prevent further fatalities or injuries, workplace shutdowns are permitted, provided the labor inspector(s) inform the business entity in writing and provide instructions for partial or complete shutdown.[72]

Upon receipt of a labor complaint, labor unions review and verify the complaints, suggesting improvements to the employer and forwarding a copy to the labor inspection agency and the complainant(s). If the employer rejects the suggestions, the union may request inspection by the labor inspection agency.[73] When a violation remains unaddressed past the compliance deadline, posing a risk of occupational fatalities or injuries, the labor inspector reports to the relevant labor inspection agency. If necessary, the agency instructs the business entity to partially or completely shut down the workplace [74].

## *c) Labor Insurance Act*

The Labor Insurance Act aims to safeguard the livelihood of laborers and foster social security. It encompasses two main categories of benefits:[75]

1) Ordinary Insurance: This category includes five benefits: Maternity benefits, Disability benefits, Injury or sickness benefits, Old age benefits, and Survivors' benefits

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[72] Huang, Tsai, and Wang, "A Model for Promoting Occupational Safety and Health in Taiwan's Hospitals."

[73] Chyi-Herng Chang, "Severance Payment System in Taiwan: A Historical Perspective," in *Severance Payment and Labor Mobility: A Comparative Study of Taiwan and Japan*, ed. Tatsuo Hatta and Shinya Ouchi, Economics, Law, and Institutions in Asia Pacific (Singapore: Springer Singapore, 2018), 93–121, https://doi.org/10.1007/978-981-13-2149-8_4.

[74] Sheng-Wen Wang, Chia-Wei Hsu, and Allen H. Hu, "An Analytical Framework for Social Life Cycle Impact Assessment—Part 2: Case Study of Labor Impacts in An IC Packaging Company," *The International Journal of Life Cycle Assessment* 22, no. 5 (May 2017): 784–97, https://doi.org/10.1007/s11367-016-1185-7.

[75] Yih-Jiunn Lee and Yeun-Wen Ku, "The Taiwanese Welfare State System: With Special Reference to Its Universal Health Insurance System," in *The Routledge International Handbook to Welfare State Systems*, ed. Christian Aspalter, Routledge International Handbooks (Abingdon New York (N.Y.): Routledge, an imprint of the Taylor & Francis group, 2017), 465–82.

2) Occupational Accident Insurance: This category comprises four benefits: Survivors' benefits, Disability benefits, Medical care benefits, and Injury and sickness benefits

All laborers aged over 15 and under 65 are required to be insured under this program, with their employers or the organizations/institutes they belong to considered as the insured units. The calculation of insurance premiums for laborers is based on their monthly salary and the applicable insurance premium rates, which encompass both general insurance premium rates and occupational accident insurance premium rates (OAR). The OAR, reviewed every three years, includes premiums for business category accidents and on-off duty accidents.[76]

## *d) Labor Standards Act*

Article 1 of Labor Standards Act was clearly stated that this Act is introduced with the objective of establishing baseline standards for working conditions. Its primary aim is to ensure the safety and welfare of workers by mitigating occupational risks, establishing suitable working environments, and providing welfare facilities. It mandates that original business entities oversee contractors and subcontractors to ensure compliance with the Act's provisions regarding labor conditions.

This legislation encompasses various aspects, including wages, working hours, protection for children and female workers, gender equality, apprentice protection, establishment of work regulations, retirement and associated benefits, compensation for occupational accidents, and the order of receiving survivor compensation, among others. The Act stipulates that regular working hours are limited to 8 hours per day and 84 hours over a two-week period, with laborers prohibited from exceeding these limits. However, under agreements reached with labor unions or, in their absence, through individual arrangements, working hours may be extended to a maximum of 12 hours per day or 46 hours per month for overtime work. Laborers are provided the option to choose between compensatory rest hours or overtime pay for overtime work.[77]

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[76] Yih-Jiunn Lee and Yeun-Wen Ku, "The Taiwanese Welfare State System A Special Focus on the Universal Health Insurance System," in *The Routledge International Handbook to Welfare State Systems: Towards Global Social Policy Science*, ed. Christian Aspalter, Second edition, Routledge International Handbooks (Abingdon, Oxon ; New York, NY: Routledge, 2024).

[77] Chang and Lin, "Policy Changes for Preventing and Recognizing Overwork-related Cardiovascular Diseases in Taiwan."

Special provisions within the Act pertain to the rights of women, including maternity leave with payment, totaling 8 weeks before and after childbirth.[78] Employers are obligated to allow female workers to breastfeed their infants under one year of age twice a day for thirty minutes each time, with this breastfeeding period considered as working time. Additionally, workers have the right to parental leave when their child is under three years old, with those taking such leave eligible to receive allowances from the labor insurance fund if they have been insured for over a year.[79]

# B. The OSH legal framework in Indonesia

## *1. Indonesian 1945 Constitution*

At least two articles within the Indonesian 1945 Constitution address aspects of working conditions in Indonesia. Article 27 (2) affirms that every citizen possesses the entitlement to employment and the ability to earn a dignified livelihood. Similarly, Article 28D (2) asserts the right of every individual to engage in work and to receive equitable and just compensation and treatment within employment settings.

While these articles do not explicitly delineate provisions related to occupational safety and health in Indonesia, their focus lies on safeguarding individuals' rights to work, ensuring fair treatment, and promoting equality before the law. Through Articles 27 (2) and 28D (2) of the Indonesian 1945 Constitution, the state endeavors to ensure that every individual is afforded protection and convenience in pursuing employment opportunities. This protection entails equitable treatment devoid of discrimination on any grounds, alongside the entitlement to receive appropriate compensation and treatment in the workplace.[80]

## *2. Specific OSHA in Indonesia*

In addition to the 1945 Constitution, Indonesia has established a legal

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[78] Sam Wai Kam Yu et al., "Defamilisation/Familisation Measures and Pensions in Hong Kong and Taiwan," *Journal of Aging & Social Policy* 33, no. 2 (March 4, 2021): 161–76, https://doi.org/10.1080/08959420.2020.1851348.

[79] Sherri S. Yeh et al., "Occupational Hazard Exposures and Depressive Symptoms of Pregnant Workers," *Journal of Occupational & Environmental Medicine* 60, no. 3 (March 2018): e134–38, https://doi.org/10.1097/JOM.0000000000001255.

[80] Lidia Febrianti et al., "Perlindungan Hukum Terhadap Upah Pekerja Kontrak Ditinjau Dari Undang-Undang Ketenagakerjaan Indonesia Dan Hukum Islam," *Journal of Economic, Bussines and Accounting (COSTING)* 5, no. 2 (June 29, 2022): 1755–64, https://doi.org/10.31539/costing.v6i1.4120.

framework for Occupational Safety and Health (OSH) since 1930 with the enactment of the 1930 Steam Law.[81] However, a more comprehensive national OSH legal framework was initiated in 1970 with the introduction of Law No. 1 of 1970 concerning Work Safety. This marked the beginning of various regulations, standards, and guidelines governing aspects of engineering, occupational health, and the work environment.[82]

Law No. 1 of 1970 underscores preventive measures encompassing all workplaces, whether on land, underground, underwater, or in the air. Since 2003, Indonesia has pursued the development of comprehensive OSH regulations with a systematic approach, particularly through the implementation of an Occupational Safety and Health management system following the enactment of Law No. 13 of 2003 concerning Manpower. Article 87 of this law mandates that every company must adopt an occupational safety and health management system.[83]

The formulation of the national OSH legal framework is primarily conducted under the auspices of the Ministry of Manpower, which serves as the lead sector for OSH matters in Indonesia. Additionally, various other ministries and sectors have issued laws or regulations containing provisions related to sectoral OSH. These include the Ministry of Public Works, Ministry of Energy and Mineral Resources, Ministry of Trade, Ministry of Industry, Ministry of Health, and Regional Regulations.[84]

Furthermore, several ministries have issued Regulations and Decrees specifically addressing OSH concerns within certain sectors such as the cutting, timber, transportation, and construction sectors. These concerted efforts from multiple sectors contribute to the establishment of a comprehensive national OSH legal framework in Indonesia.

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[81] Theresia Avila Bria et al., "Analysis of Fatal Construction Accidents in Indonesia—A Case Study," *Buildings* 14, no. 4 (April 5, 2024): 1010, https://doi.org/10.3390/buildings14041010.

[82] Florentin Blanc and Margarita Maria Escobar Pereira, "Risks, Circumstances and Regulation – Historical Development, Diversity of Structures and Practices in Occupational Safety and Health Inspections," *Safety Science* 130 (October 2020): 104850, https://doi.org/10.1016/j.ssci.2020.104850.

[83] Hamonangan Albariansyah, Topo Santoso, and Eva Achjani Zulfa, "Legal Protection of Work Safety Crimes Victims in Indonesia," *Sriwijaya Law Review* 6, no. 1 (January 31, 2022): 24, https://doi.org/10.28946/slrev.Vol6.Iss1.1363.pp24-40.

[84] Kuok Ho Daniel Tang, "A Comparative Overview of the Primary Southeast Asian Safety and Health Laws," *International Journal of Workplace Health Management* 13, no. 6 (July 28, 2020): 601–32, https://doi.org/10.1108/IJWHM-10-2019-0132.

## 3. *Law No. 1 of 1970 on Work Safety Act*

The legislation concerning Work Safety encompasses various aspects such as terms, scope, safety requirements, supervision, committee establishment, accident protocols, labor rights and obligations, and management duties. Notably, this law emphasizes a shift towards preventive measures rather than a repressive approach. Compared to its predecessor, the law has undergone significant changes in both content and structure.[85]

Key revisions and expansions include the broadening of scope, transitioning from repressive to preventive supervision, stricter technical formulations, administrative adjustments to facilitate implementation, additional safety guidance for management and employees, establishment of an Occupational Safety and Health Advisory Committee, and provisions for collecting annual fees.[86]

Currently, Law No. 1 of 1970 on Work Safety Act serves as the primary reference for occupational safety in Indonesia. Recognizing the right of every worker to safety in the workplace, regulations have been established to ensure safety standards for workers, employers, and visitors. Through this law, the government aims to provide protection and foster a sense of security and comfort for all stakeholders in the workplace.[87] The Work Safety Act applies to all workplaces within the jurisdiction of the Republic of Indonesia, regardless of location—whether on land, underground, on the water surface, underwater, or in the air. In terms of implementation, company directors are responsible for overall compliance with the law, while supervisory staff and safety experts oversee adherence and aid in implementation.[88]

Furthermore, management is mandated to assess the physical health, mental condition, and physical abilities of prospective and current employees, tailored to the requirements of assigned tasks. Regular health checks by

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[85] David A. Hofmann, Michael J. Burke, and Dov Zohar, "100 Years of Occupational Safety Research: From Basic Protections and Work Analysis to A Multilevel View of Workplace Safety and Risk.," *Journal of Applied Psychology* 102, no. 3 (2017): 375–88, https://doi.org/10.1037/apl0000114.

[86] Hofmann, Burke, and Zohar.

[87] Verri Octavian and Pandi Septiawan, "Perlindungan Keselamatan Dan Kesehatan Kerja Bagi Pekerja Proyek Konstruksi Menurut Undang-Undang Nomor 13 Tahun 2003 Tentang Ketenagakerjaan Di PT. Cipta Mutu Konstruksi Kota Depok," *Pamulang Law Review* 4, no. 2 (January 22, 2022): 243, https://doi.org/10.32493/palrev.v4i2.17760.

[88] Sunny Ummul Firdaus, Jamal Wiwoho, and Muhamad Alief Hidayat, "The Effectiveness of the Implementation of Occupational Health and Safety (OHS) in Indonesian Medical Personnel During the Covid-19," *UNIFIKASI: Jurnal Ilmu Hukum* 10, no. 2 (October 7, 2023): 74–87, https://doi.org/10.25134/unifikasi.v10i2.7938.

designated physicians are also required for all workers under management's purview. In the event of a workplace accident, management is obligated to report the incident to an official appointed by the Minister of Manpower.[89]

## 4. Law No. 13 of 2003 on Manpower Act

The primary legislation governing employment matters in Indonesia is Law No. 13 of 2003 on Employment, commonly referred to as the Employment Law. This law serves as the foundation for employment regulations in the country and is supplemented by various government regulations, presidential decrees, ministerial regulations, circulars, and instructions.[90]

Within the framework of the Employment Law, provisions concerning wages, working hours, holidays, and occupational safety and health are discussed comprehensively. Specifically, the issue of occupational safety and health is addressed in Chapter X, which focuses on Protection, Wages, and Welfare.

Under this law, workers are entitled to protection ensuring their health and safety in the workplace. Article 86 stipulates the following:

1) Every worker or laborer has the right to protection in terms of occupational safety and health, morality and decency, and treatment that upholds human dignity and religious values.
2) To ensure the safety of workers and optimize productivity, an occupational health and safety scheme must be implemented.
3) The protection outlined in subsections (1) and (2) must adhere to existing laws and regulations.

Furthermore, Article 87 mandates that every enterprise must establish an occupational safety and health management system integrated into its overall management system. The detailed provisions regarding the implementation of this system are subject to government regulation.

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[89] Bambang Suhardi et al., "Analysis of the Potential Hazard Identification and Risk Assessment (HIRA) and Hazard Operability Study (HAZOP): Case Study," *International Journal of Engineering & Technology* 7, no. 3.24 (August 10, 2018): 1, https://doi.org/10.14419/ijet.v7i3.24.17290.

[90] Adnan Hamid, "The Application of The Rights and Obligations of Workers During The Covid-19 Outbreak In Indonesia: Labor Law Perspective," *International Journal of Business Ecosystem & Strategy (2687-2293)* 3, no. 3 (December 10, 2021): 26–37, https://doi.org/10.36096/ijbes.v3i3.269.

## 5. *Law No. 40 of 2004 on National Social Security System*

Article 3 of Law No. 40 of 2004 on the National Social Security System (hereafter referred to as the National Social Security System Law) explicitly states the primary objective of the legislation, which is to ensure the adequate fulfillment of basic life necessities for each participant and their respective family members.

## 6. *Law No. 36 of 2009 on Health*

Health encompasses physical, mental, spiritual, and social well-being, allowing individuals to lead productive lives, engage in work and social activities, and fulfill their needs.[91] Conversely, health issues within a community can lead to significant economic losses for the country. Hence, safeguarding public health becomes a crucial responsibility for the government. Through legislation such as the Health Law, the aim is to establish societal health standards that foster awareness, willingness, and capability for a healthy lifestyle, ultimately contributing to the development of productive human resources both socially and economically.[92]

Every individual possesses the right to health, including access to quality and affordable healthcare services, as well as the autonomy to make informed decisions regarding their health needs. Furthermore, individuals have the right to a healthy environment conducive to achieving optimal health standards.[93] Similarly, within the workplace, the government assumes an active role in establishing health standards to protect workers from occupational hazards and adverse health effects. Employers are mandated to ensure the health of their employees through preventive measures, healthcare provision, and rehabilitation efforts, with the associated costs borne by the employer. This

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[91] Asha Binu Raj, "Employee Well-Being through Internal Branding: An Integrated Approach for Achieving Employee-Based Brand Outcomes," *Global Business Review* 21, no. 4 (August 2020): 1065–86, https://doi.org/10.1177/0972150918779161.

[92] Manfred Lenzen et al., "Global Socio-Economic Losses and Environmental Gains from the Coronavirus Pandemic," ed. Bing Xue, *PLOS ONE* 15, no. 7 (July 9, 2020): e0235654, https://doi.org/10.1371/journal.pone.0235654.

[93] Endang Kusuma Astuti, "Peran BPJS Kesehatan Dalam Mewujudkan Hak Atas Pelayanan Kesehatan Bagi Warga Negara Indonesia," *JPeHI (Jurnal Penelitian Hukum Indonesia)* 1, no. 02 (2024), https://doi.org/10.61689/jpehi.v1i02.149.

obligation extends to covering healthcare expenses resulting from work-related health issues, as stipulated by regulations.[94]

Despite the comprehensive legislative framework addressing occupational safety and health (OSH) in Indonesia, the prevalence of occupational accidents indicates gaps in enforcement and implementation.[95] Data from the Ministry of Manpower and Transmigration of Indonesia reveals that only a small percentage (2.1% of 15,000) of large-scale enterprises in the country have adopted OSH Management Systems. Among the reasons cited for non-compliance is a misconception among employers regarding the perceived financial burden of OSH implementation. However, this belief overlooks the potential cost savings, as failure to ensure workplace safety can result in compensation payments to affected workers in the event of accidents. Thus, dispelling such misconceptions is essential to foster a culture of workplace safety and prevent adverse consequences for employers and employees alike.[96]

# Conclusion

The rapid evolution of technology, particularly in artificial intelligence, has spurred global competition among nations to enhance their technological capabilities. Taiwan has emerged as a frontrunner in semiconductors, information and communication technology (ICT), and manufacturing, leveraging its robust pool of skilled human resources dedicated to technological innovation. The Taiwanese government actively supports the advancement of the ICT sector through regulatory frameworks and policy initiatives, underscoring its commitment to technological progress. In contrast, Indonesia, as a developing nation, has expressed aspirations to embrace the fourth industrial revolution and artificial intelligence but encounters challenges in keeping pace with other nations. The effective implementation of occupational

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[94] Sisca Phuspa et al., "Implications of Indonesian Occupational Safety and Health Management System Award to the Safety Culture," in *Proceedings of the Proceedings of the 1st International Conference on Business, Law And Pedagogy, ICBLP 2019, 13-15 February 2019, Sidoarjo, Indonesia* (Proceedings of the 1st International Conference on Business, Law And Pedagogy, ICBLP 2019, 13-15 February 2019, Sidoarjo, Indonesia, Sidoarjo, Indonesia: EAI, 2019), https://doi.org/10.4108/eai.13-2-2019.2286198.

[95] Phuspa et al.

[96] Andi Tenri Sapada and Muhammad Ikbal, "Optimasi Penggunaan Media Sosial Instagram Dalam Peningkatan Pelayanan Balai Besar Pengembangan Keselamatan Dan Kesehatan Kerja Makassar," *Jurnal Administrasi Publik* 16, no. 1 (September 28, 2020): 14, https://doi.org/10.52316/jap.v16i1.44.

safety and health (OSH) measures is imperative in addressing the risks and challenges posed by technological advancements. While Taiwan has successfully implemented comprehensive OSH programs, Indonesia faces obstacles in law enforcement, resulting in widespread non-compliance with safety standards across many companies. To enhance its technological development, Indonesia should identify specific areas of focus, akin to Taiwan's long-standing emphasis on ICT and manufacturing. It is essential for Indonesia to advocate for the significance of information and technology development within society, thereby fostering greater interest in IT-related fields and nurturing a skilled IT workforce. In addressing OSH concerns, the Indonesian government must prioritize enforcing existing safety standards rigorously and imposing stringent penalties on companies found to be in violation.

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