

ISSN Online: 2327-5960 ISSN Print: 2327-5952

# The Impacts of Foreign Direct Investment Flows on the Economic Growth during the Pre-Covid-19 Era

Odette Tougem Tasinda<sup>1</sup>, Ze Tian<sup>1\*</sup>, Sunday Adiyoh Imanche<sup>2</sup>, Bernard Boamah Bekoe<sup>1</sup>, Fomukong Tasinda Raphael<sup>3</sup>

<sup>1</sup>Business School of Hohai University, Nanjing, China

Email: \*tianze21@126.com

How to cite this paper: Tasinda, O. T., Tian, Z., Imanche, S. A., Bekoe, B. B., & Raphael, F. T. (2022). The Impacts of Foreign Direct Investment Flows on the Economic Growth during the Pre-Covid-19 Era. *Open Journal of Social Sciences*, 10, 79-89.

https://doi.org/10.4236/jss.2022.104006

Received: September 16, 2021 Accepted: April 9, 2022 Published: April 12, 2022

Copyright © 2022 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

http://creativecommons.org/licenses/by/4.0/





## **Abstract**

This paper comprehensively discusses whether Foreign Direct Investment and Capital Financing in developing countries are a blessing or a disadvantage. The study shows the different effects of international investment in developing countries. The various disadvantages brought by global investment were also examined to determine their impact in developing countries. The method used was compilation and analysis of credible, peer-reviewed sources. The result indicated both positive and negative effects on international investment. However, it had a more positive impact than a negative impact on the developing countries.

# **Keywords**

Foreign Direct Investment (FDI), Organization for Economic Co-Operation and Development (OECD), Pre-Covid-19 Era, World Bank, International Monetary Fund (IMF), Africa

# 1. Introduction

Literature indicates that the impact of foreign direct investment (FDI) on economic growth is debatable. According to the fundamental Solow development model, foreign direct investment (FDI) enables host nations to attain investment levels that surpass their domestic savings and enhance capital formation. According to this view, the beneficial benefits of foreign direct investment (FDI) on output growth will be transitory. Foreign direct investment (FDI) may have no

<sup>&</sup>lt;sup>2</sup>Department of Economic, Faculty of Humanities Management and social Sciences, Federal University Wukari, Wukari, Nigeria <sup>3</sup>Nanjing Kuaisheng Trade Co. Ltd., Nanjing, China

long-term effect on the recipient country's economy due to declining marginal returns on physical capital.

FDI may benefit growth under endogenous growth models that highlight the necessity of increasing productivity through technical developments and efficiency. Liberalization of commerce and currency rates has propelled globalization to some extent. As a result, global FDI has risen in volume. Foreign direct investment (FDI) has increased dramatically during the last few decades. According to the United Nations Conference on Trade and Development, FDI inflows to developing nations increased from \$8392 million in 1990 to \$246,056 million in 2001.

Unprecedented riches have been produced in numerous regions of the world, most notably in Southeast Asia, due to global FDI (SEA). Several countries in Sub-Saharan Africa (SSA) were troubled by border conflicts and internal political unrest throughout the 1970s and 1980s, resulting in many investments in the SEA (Razin, Sadka, & Yuen, 1999). However, despite several incentives offered to foreign investors, FDI flows to the SSA have grown just a little. Even under favourable political conditions, a lack of foreign investment is partly due to a mismatch between host nations' growth ambitions and international investors.

Host countries and developing countries can have different prospects based on cross-border movement's capital, technology, knowledge, and skills. The worldwide economy of the world is recognized as a significant contributor to FDI. Surplus productivity through distributing ideas to local enterprises is addressed in the literature, which ties foreign direct investment to the development of the host economy (Blomström, Kokko, & Globerman, 2001). Spillover that is useful and does not detract from quality could be everything from inspiring creative expression, enhancing labor mobility, and raising export performance. Other countries speculate that improving the financial situation of the recipient country may have long-term benefits. In the opinion of numerous researchers, foreign direct investment can impede economic development. Reduced competitiveness due to barriers to entry, such as the Dixit approach (1980), results in negative spillovers, like crowding out. The interrelationships among vertically and horizontally related foreign and local companies are essential. The influences on those companies' businesses vary depending on whether they are strategically complementary to their competitors' products (Estrin et al., 2014). This paper seeks to determine whether FDI and Human Capital growth in Africa relating to the pre-Covid-19 era was a blessing or a culprit and how it affected Africa's economic growth.

#### 2. Literature Review

Investment into Africa should preferably concentrate on the primary industries and possibilities that define the short and long-term development of the continent in the next few years. Some of them deserve to be stressed. Inner Mongolia, France, Korea, and Italy have all had a role in developing your smartphone, very

likely. Intricate international cooperation networks were developed through our increasingly global consumption and production system. This is facilitated by foreign direct investment. Although FDI is frequently considered for emerging economies as a driver of prosperity, current research tells another picture.

Foreign direct investment may be described as money a corporation invests beyond its home nation in buildings, industries, machinery, or other infrastructures. A corporation can get the raw materials it wants for its production processes by investing globally. It is lucrative to invest in a developing country because of frequently low prices and flexible regulations. FDI has been extensively examined in developing nations. However, it was not related to the depletion of natural resources until recently.

Michael Long and Paul Stretesky of Newcastle University and Michael Lynch of South Florida explored FDI's influence on the depletion of natural resources in developing nations in an article in the journal Society & Natural Resources (Long, Stretesky, & Lynch, 2017). They hypothesized that FDI leads to an increase in the depletion of natural resources while promoting reliance on incomes from this depletion. The money created via unsustainable forestry techniques would be one example of income generated by a decline in resources. They found both assumptions valid, following an analysis of data from 125 developed countries between 2005 and 2013.

Environmental deterioration is of two kinds: ecological addition and environmental withdrawal. Ecological add-up means pollution from production processes, such as carbon dioxide emissions from industries, added to the environment. Ecological recalls, such as mining or taking down trees, are environmental "retractions". The increasing environmental removal of non-renewable resources contributes to the depletion of natural resources. The paper focuses on the depletion of natural resources, particularly in the energy, forest, and mining sectors, such as coal, gas, and oil.

A new study finds that a yearly rise in foreign direct investment enhances the depletion of energy, forestry, and mineral resources in emerging countries (Bokpin, 2017). Investing in foreign direct investment encourages resource depletion, according to this research. It is also the case that foreign direct investment (FDI) allows supply networks to be expanded, enabling developing countries to "warehouse" supplies. Resource depletion in pollution and waste and depletion of resources also suggests a higher ecological impact. This is connected to the 'production treadmill idea, which proposes that as the world's rising economy depletes resources and pollutes the environment, it furthers economic growth. Rich nations enjoy high consumption levels, while underdeveloped countries suffer from production repercussions.

Low-income developing countries that engage in significant amounts of foreign direct investment (FDI) are shown to increase their dependence on income from forests and minerals. Said, FDI spurs the use of natural resources to sustain an economy. A positive feedback loop describes the authors since authors feed off one another. There is a rise in foreign direct investment, which leads to financial dependence and depletion of resources that stimulates foreign direct investment as the natural resources sectors increase. The developing country will also be expected to follow a sound economic policy to assist the country whose citizens want to invest. If this measure is adopted, the developing country will be unable to make decisions that help the greater global economic prosperity. Therefore, the common belief is that FDI is not the primary growth driver.

The authors believe policymakers should be vigilant about taking actions that enhance their country's reliance on natural resource income and prevent losing its independence in economic decision-making. More research is also needed to grasp the exact dynamics. Examining case studies with historical FDI data, resource depletion, and financial development would better understand FDI's longer-term impact on emerging economies.

# 3. Methodology

The methodology used in obtaining information for the document is qualitative research. The primary goal of qualitative research is to learn more about something. It is utilized to determine what drives people's decisions, attitudes, and motivations. It gives information about the problem of aids in developing concepts or hypotheses for quantitative research (Pathak, Jena, & Kalra, 2013). It was done by collecting data for the study to derive and compile different credible sources on whether FDI and Human Capital growth in Africa relating to the pre-Covid-19 era is a blessing or a culprit. The sources included the Journal of Data Analysis and Information Processing, Domestic Investment, Foreign Direct Investment, and Economic Growth in Sub-Saharan Africa: A Case of Industrial Investment in Cameroon (Tougem et al., 2021). The document is important because empirically, this study analyzes the impact on the economic development of Cameroon from 1990 to 2018 of domestic (DI) and foreign direct investment (FDI). Financial development, institution, infrastructure, and social capital were all four elements evaluated. Evaluating the connection between DI and FDI regarding economic development based on the listed parameters was employed for the dynamic panel estimate, standing panel lapse methodologies, and other peer-reviewed sources. The information from the different sources related to our hypothesis is carefully analyzed and compiled to get the required information for the study (Minayo, 2012).

## 4. Findings

Foreign direct investment denotes the investments made by corporations in one country to grow their businesses and set up long-term stakes in the companies of other countries. There usually are 10% voting rights for a durable investment in the companies of the host nation. In addition, the investing country wields significant influence over enterprises in the host country. Stocks purchased by the investor countries have the capability of achieving this. In addition, the investment country organization may set up a branch or franchise of your company in

the host nation. Research studies have proven that foreign direct investment increases human and infrastructure development in the host country.

With FDI, the goal was usually to draw in new economic policies. FDI has numerous benefits for both the countries where the money is invested, and the investments are made. Foreign direct investment contributes significantly to economic growth and development in the host country. The growth of human capital and developments in technology are vital elements in every country's economic advancement. A general improvement in productivity in a country is predicted to increase overall GDP. The Solow model states that as productivity increases, so does economic growth. In Africa, Chinese investment should bring modern technologies and training. FDI should lead to an increase in human capital, which will result in economic growth and prosperity in Africa (Tasinda et al., 2021).

Nevertheless, politicians and media record FDI levels, mainly from hocus pocus. Political players from the local region are campaigning for their party to have more faith in transnational capital, attract FDI seas, and for arriving jobs to offset the state's social welfare reduction. It has been said that the advantages of FDI are not automatic; policies set the foundation for it. So, what are the policy objectives of FDI, and how will the FDI achieve them? The OECD provides the most constructive framework, which urges States to apply FDI-friendly measures by adopting its thumb rules. These rules include: "respect of the rule of law, quality regulation, transparency, openness and honesty," to no one's surprise.

Furthermore, let us not forget the free transfer of cash; how else can the capitals and creditors expatriate their profits? FDI is valuable, but it is worthwhile for whom and to what end, but questions are frequently presumed instead of being probed for answers. Does FDI have a blessing? Are his supporters' adorers, beneficiaries, helpful idiots, or anything else?

It is simple to see why Third World countries are paradoxically linked to FDI and the investment framework under the weight of a dubious past. The Global South welcomes FDI, but it feels like a ridiculous understatement; they hound FDI, giving up a great deal of sovereignty (and dignity) in the process. Because of the difference between the capital-importers and the exports of capital, the latter feel obliged to do as the latter would say and accommodate their creditors' requests, demands, and impositions. In a world where cash is the king, the IFIs hold the key to salvation (or ruin), the constitutionalizing and commerce of neoclassical and neoliberal ideas. Third World states have difficulty doing otherwise.

However, debates throughout the Third World are marked by condemnations: opposition parties, civil societies, and social movements are united against their governments and accused of selling their populace for a song and a whistle. Even governments sometimes condemn the IFIs and themselves!—to submit to their requests. Remember Michael Manley's experience meeting the IMF, the previous Prime Minister of Jamaica. His administration borrowed money to repay the spiraling cost of fuel-based imports, reeling from the energy crisis of the

1970s. With limited aid provided by commercial banks, the Bank has used the World Bank and IMF to propose a long-term structural investment plan to strengthen infrastructure throughout the island and establish conditions for a prosperous post-colonial society. Its proposal could not accept IFIs insistence on short-term refunds only by enacting massive cutbacks across critical sectors like cation, health, and agriculture. His plan was not acceptable. Jamaica has also reduced safeguards for indigenous industries and agricultural products in line with the structural adaptation plans. He consented despite Manley's knowledge of the effects of the medication. He acknowledges that he did not know what else to do when reflecting on those years later. He chose for the renunciation of the economic sovereignty of Jamaica to international investors or the disintegration of his society as a financial lifeline was broken. This may be a victory of the Pyrrhus, but we have to ask what kind of framework forces the victims of historical exploitation to choose between their left and right arm. We also question if Manley's last joke about what was good enough for England was good enough for him.

#### 5. Discussion

Economists advocate for the free movement of capital across domestic borders to maximize overall financial return. An additional benefit to free capital movements is bringing various benefits. International capital flows first and foremost diminish the risk that capital owners face by making their credit and investment available across borders. Also, the integration of global capital markets helps distribute good governance, accounting laws, and legal traditions around the globe. Also, the third point is that a lack of global capital mobility impairs governments' capacity to institute destructive policies. According to Feldstein (2000), other types of private capital inflows aside, FDI earnings for host states can take on numerous distinct forms (Feldstein, 2000).

The foreign direct investment enables technology transfers in the form of new kinds of capital inputs, such as new sources of capital that cannot be attained through financial investments or by trading in products and services. FDI can also improve a country's competitiveness in the domestic input market. New firms that contribute to human capital development in the host country may only be established with the help of foreign direct investment (FDI). FDI income helps to boost company tax revenue in the host country.

When a country attempts to lure foreign direct investment by lowering corporate taxes, they frequently go ahead and waive certain taxes. Some OECD Member States, for example, are seeing a steep decline in tax revenue because of that competition. This also means that foreign direct investment (FDI) can generally benefit a country's investment and growth.

Other research finds that developing countries should exercise caution while endorsing FDI's benefits, as has occurred in the past. Is a high level of foreign direct investment associated with a deficit? A study done by Hausmann and Fernández-Arias (2000) shows why a high percentage of foreign direct invest-

ment in overall capital inflows indicates a weakness in the country where it is hosted rather than its might (Fernández-Arias & Hausmann, 2000).

FDI flows stand out because they are more heavily involved in the total influx of riskier countries with risk gauged by several country risk factors, including sovereign debt credit ratings and country risk indicators. Quality may be better in places where institutions are weaker. Are these results truly paradoxical, or is there an explanation for them? Additionally, when markets are imperfect or ineffective, FDI is more likely to occur than other kinds of capital flows. In these conditions, foreign investors prefer to interact directly with the firm, suppliers, and law instead of going through local financial markets, suppliers, and the legal system. Razin (2001) explains that one should go with "trusted implementation mechanisms" instead of promoting FDI (Razin, 2001).

Investment, above all, has a developmental path, an ideological and transcendental path that is global by extension. By removing the economic system from the social one and combining market value with human well-being (sometimes human value), investment is equally substantial in the status of religion. In a provincial sea, investment is the goal that can all prostrate.

As in other areas framed by a neo-classical prism, we observe that the FDI discussion is influenced not by data but by preconceptions. The principle is familiar: FDI helps to improve economic performance, fosters jobs and new technologies, and raises living conditions. In exchange, investors naturally deserve appropriate protection and a specialized adjudication system in the name of the public interest. It is a comfortable narration and one which has assumed rather than assumed the quality of the Gospel. Nevertheless, supporters of this narrative Disadvantage precipitating human progress due to missing proof of the changes in the FDI.

Moreover, over 40% of the worldwide FDI is a fantastic investment in corporate shells with little substance and no real connection to the host country's economy. The OECD also recognized this, which has declared fusions and acquisitions to be Wall Street's financial witchcraft and lamented its insignificant influence on local welfare. Netflix is impossible to picture a renewable energy investment program being developed by Greenfield

In the words of Hausmann and Fernández-Arias (2000), the investment climate and market functioning should be improved in the same way (Fernández-Arias & Hausmann, 2000). They will certainly be rewarded since they can raise overall investment efficiency and subsequent inflow of money. Inflows of funds, where local policies and institutions are inadequate, will lead to significant foreign direct investment. They are destitute because of it.

Fire, choice, and influence. Innovative ideas attract customers. Foreign direct investment is an investment technique that empowers foreign investors to control and manage host-nation enterprises. It gives a means for international investors to have complete control of their investments. Under adverse selection or undue leverage, the host country is not guaranteed to benefit from the transfer of control.

In the heart of a crisis, the transfer of control frequently assists foreigners. One wonders if this transfer of control serves the interests of foreigners. Do foreign firms own domestic firms because they have more incredible business abilities and are better able to manage them, or do they own significant funds and not manage local firms? It was a miscalculation. Is it a burden to carry the fire sale and assets of domestic enterprises beyond the price of the crisis itself?

As Razin, Sadka and Yuen (1999) concluded, FDI will not assist the host country outside these fire sales conditions. FDI serves as a critical source of knowledge on the productivity of businesses that a foreign investor controls (Razin, Sadka, & Yuen, 1999). Uninformed savers do not influence their investment decisions in domestic enterprises, which this strategy addresses. When foreign direct investors use this superior intelligence, they tend to keep control and ownership of high-productivity companies and sell low-productivity companies to investors who lack such knowledge. Over-investment by foreign direct investors may be a worry with this process because of other issues of this type.

Additionally, the advantage in FDI could be hindered by excessive leverage. On the whole, a significant portion of FDI investment-generated leverage is generated through domestic credit. While foreign investors may repatriate domestic borrowed funds, FDI profits could be diminished by domestic borrowing by foreign owners. It is possible that this could lead to domestic borrowing.

Disinvestment by foreign investors? More recent research has unveiled the long-term effects of foreign direct investment. Machines are "bolted" to the location, making it difficult for foreign investors to take their money and leave the country in the short term. However, companies have succeeded in reversing foreign direct investment, primarily through financial transactions. The foreign subsidiary, for example, can borrow from collateral locally and then borrow back the money that it has just received in the form of a lease. Because a large percentage of FDI is intercompany debt, the parent can remember this.

Another contributing aspect. When FDI is channel led to markets protected by high tariffs or non-tariffs, the receiving country may not benefit from FDI. While FDI may contribute to the misallocation of resources, it also supports lobbying to keep resources misallocated. In some cases, a loss of domestic competitiveness could be caused by foreign procurement, which would lead to the consolidation of domestic enterprises. Takeovers or company failure are the other possible outcomes.

# 6. Summary

One of the main advantages of cross-border international capital flows is the availability of loans and investments across national borders. As financial markets worldwide become more interconnected, better governance and accounting standards will spread around the world. Because of a lack of global capital mobility, governments cannot enforce detrimental policies. According to Feldstein (2000), host nations' FDI gains can take diverse forms, apart from other types of

private capital inflows (Feldstein, 2000).

Foreign direct investment, for example, opens up fresh sources of capital that can't be accessible through financial transactions or the trade of products and services. FDI can improve a country's competitiveness in the local input market. Only foreign direct investment (FDI) can be utilized to start new firms in the host nation to help build its human capital (FDI). FDI income boosts the host country's corporate tax revenues. To encourage foreign direct investment (FDI), it is usual to decrease or eliminate various taxes. The tax revenue of certain nations, such as those in the OECD, has been significantly decreased due to this competition. Foreign direct investment is expected to positively impact a country's an investment and economy (FDI).

Development nations should be wary of the benefits of foreign direct investment (FDI), as they have done in the past; according to different studies, FDI has been associated with deficits. When foreign direct investment (FDI) accounts for more than 10% of overall capital inflows, it reflects the country's fragility rather than its strength (Fernández-Arias & Hausmann, 2000). There is a distinct difference between FDI and other measures of national risk, like sovereign debt credit ratings and country risk indicators, because FDI flows play a bigger role in the total admittance of riskier states. Possible that the quality is greater in areas where institutions are weaker.

The neoclassical theory holds that the debate over foreign direct investment is swayed more by opinion than fact. Economic growth, job creation, and technical innovation benefit from foreign direct investment (FDI). Furthermore, investors ought to be protected and adjudicated following the law, as they do so for the greater benefit. This anecdote, rather than disputing the Gospel's relevance, provides reassurance. According to the proponents of this theory, the lack of evidence for changes in foreign direct investment (FDI) has slowed human progress.

Globally, a big percentage of the FDI is a great investment in empty shells with no actual connection to the host country's economic growth and development. The OECD also takes notice and laments the lack of effect on local well-being of mergers and acquisitions as Wall Street financial trickery. Greenfield has a hard time seeing a program to invest in renewable energy sources.

This recommendation is supported by Hausmann and Fernández-Arias (2000), who argue that both the investment climate and market functioning should be enhanced (Fernández-Arias & Hausmann, 2000). Those that can increase overall investment efficiency and increase the amount of money coming in will be well-rewarded. There is a good chance that FDI will expand in nations lacking policies and institutions.

#### 7. Conclusion

FDI flow during the pre-covid-19 era has proven to be more of a blessing than a culprit. Most of the economy had been wrecked by the corona pandemic; thus,

the governments had to rely on various sources of finance to keep most of the businesses and industries going. FDI appears to have a positive impact on host developing countries. Recent studies point to certain possible risks: international financial transactions may cause the effect to be reversed; additional liabilities may be acquired because of inefficient portfolio selection and fire sales; in this research study, leverage could limit the efficacy of its results; and an above-average FDI stake in a country's overall capital inflows could reflect the weaknesses, rather than strength, of its institutions. Hence, more research needs to be done to determine the impacts of Foreign Domestic investment on a country's financial trend, focusing on both the strengths of the latter to the financial institution and how the overall trend affects the economic growth of the country to determine if these financial factors are significant as well. Although it needs to be proven that some of these risk sources have a demonstrable impact on the financial system, the dangers highlight that a better understanding of the likely consequences of FDI is present. The development policy proposals should focus on building an improved investment climate for all sorts of domestic and foreign capital.

#### **Conflicts of Interest**

The authors declare no conflicts of interest regarding the publication of this paper.

#### References

Blomström, M., Kokko, A., & Globerman, S. (2001). The Determinants of Host Country Spillovers from foreign Direct Investment: A Review and Synthesis of the Literature. In N. Pain (Ed.), *Inward Investment Technological Change and Growth* (pp. 34-65). Palgrave Macmillan. <a href="https://doi.org/10.1057/9780230598447">https://doi.org/10.1057/9780230598447</a> 2

Bokpin, G. A. (2017). Foreign Direct Investment and Environmental Sustainability in Africa: The Role of Institutions and Governance. *Research in International Business and Finance*, *39*, 239-247. <a href="https://doi.org/10.1016/j.ribaf.2016.07.038">https://doi.org/10.1016/j.ribaf.2016.07.038</a>

Estrin, S., Hülya Danakol, S., Reynolds, P., & Weitzel, U. (2014). *Foreign Direct Investment and Domestic Entrepreneurship: Blessing or Curse?* CEP Discussion Papers No. dp1268, Centre for Economic Performance.

Feldstein, M. S. (2000). Aspects of Global Economic Integration: Outlook for the Future. Working Paper No. w7899, National Bureau of Economic Research. <a href="https://doi.org/10.3386/w7899">https://doi.org/10.3386/w7899</a>

Fernández-Arias, E., & Hausmann, R. (2000). *Is FDI a Safer Form of Financing?* Working Paper No. 347, Inter-American Development Bank. https://doi.org/10.2139/ssrn.1817214

Long, M. A., Stretesky, P. B., & Lynch, M. J. (2017). Foreign Direct Investment, Ecological Withdrawals, and Natural-Resource-Dependent Economies. Society & Natural Resources, 30, 1261-1276. https://doi.org/10.1080/08941920.2017.1331483

Minayo, M. C. D. S. (2012). Qualitative Analysis: Theory, Steps and Reliability. *Ciência & Saúde Coletiva, 17,* 621-626. https://doi.org/10.1590/S1413-81232012000300007

Pathak, V., Jena, B., & Kalra, S. (2013). Qualitative Research. *Perspectives in Clinical Research*, *4*, 192. <a href="https://doi.org/10.4103/2229-3485.115389">https://doi.org/10.4103/2229-3485.115389</a>

- Razin, A. (2001). *FDI Flows: A Critical Look*. Pinhas Sapir Center for Development, Tel-Aviv University.
- Razin, A., Sadka, E., & Yuen, C. W. (1999). Excessive FDI Flows under Asymmetric Information. Working Paper No. w7400, National Bureau of Economic Research. https://doi.org/10.3386/w7400
- Tasinda, O. T., Ze, T., & Imanche, S. A. (2021). A Panel Data Analysis of the Impact of Chinese Foreign Direct Investment (FDI), Remittances and Foreign Aid on Human Capital Growth and Brain Drain in Africa. *Journal of Data Analysis and Information Processing*, 9, 175-188. https://doi.org/10.4236/jdaip.2021.93012
- Tougem, T. O., Ze, T., Amowine, N., & Adiyoh, I. S. (2021). Domestic Investment, Foreign Direct Investment, and Economic Growth in Sub-Saharan Africa: A Case of Industrial Investment in Cameroon. *Journal of Industrial Integration and Management*, Article ID: 2150003. https://doi.org/10.1142/S2424862221500032