Research Office
Legislative Council Secretariat

Information Note

Measures to promote re-industrialization in selected places

IN15/19-20

1. Introduction

1.1 In recent years, there has been a global trend to revitalize and modernize ageing industries and encourage development of new ones. This process of re-industrialization usually involves structural transformation within the manufacturing sector to bring about an increase in the share of manufacturing industries in value-added or employment.[1] After the outbreak of the global financial crisis in the late 2000s, many economies have taken re-industrialization as a means to revive the economy and enhance their international competitiveness. In many places, re-industrialization is driven by the Fourth Industrial Revolution (referred to as Industry 4.0 below). Its concept involves various elements of the industrial value chain and is based on a range of advanced technologies such as big data and Internet of Things.

1.2 Like many other places, Hong Kong sees re-industrialization a potential new area of economic growth. The Government first highlighted this idea in the 2016 Policy Address and has been supporting the development with various initiatives. Despite the efforts, there is yet a remarkable progress on this and some stakeholders have urged the Government to accelerate the efforts amid growing competition around the globe. At the request of Hon Jimmy NG Wing-ka, the Research Office has prepared this information note to examine the approaches adopted in overseas places in promoting re-industrialization, with a particular focus on the provision of tax incentives to stimulate investment. Japan and the United States ("US") are selected for the study as they are among the top players in global smart manufacturing. Both have formulated their national re-industrialization strategy in the 2010s, alongside the reform of their tax system to incentivize investment in advanced technologies.

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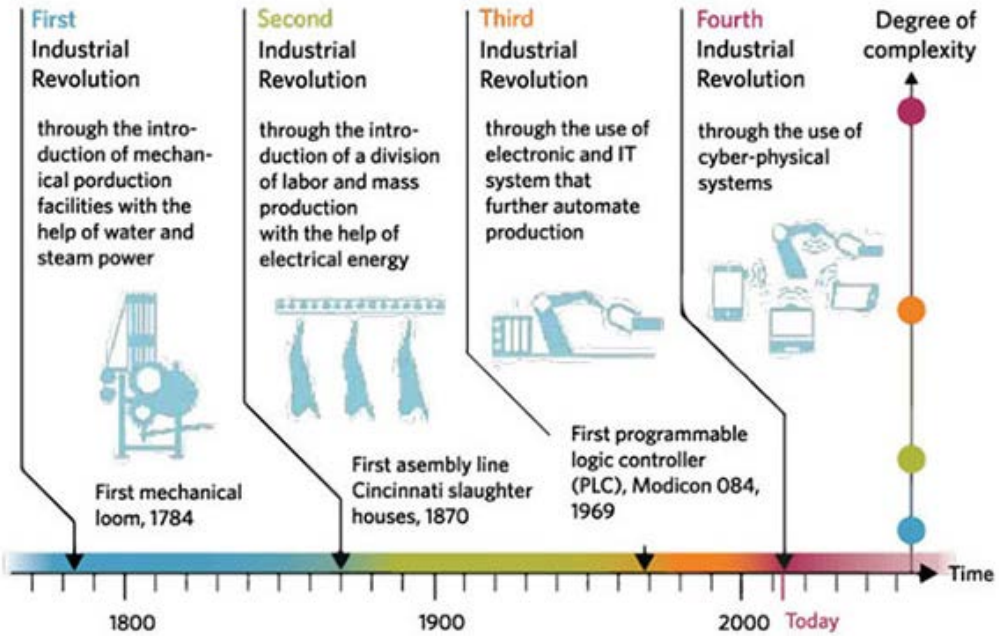
[1] See Rowthorn, R. & Coutts, K. (2013).

1.3 This information note will begin with (a) an overview on the concept of Industry 4.0, followed by (b) a review of the situation of Hong Kong, (c) a discussion on global trend on promoting re-industrialization, and (d) the approaches adopted in Japan and the US.

2. Concept of Industry 4.0

2.1 First introduced by Germany in the early 2010s, Industry 4.0 is a term applied to the rapid transformation in the design, manufacture, operation and service of manufacturing systems and products. The designation of Industry 4.0 signifies that this is the world's Fourth Industrial Revolution, the successor to three earlier Industrial Revolutions (**Figure 1**) that caused quantum leaps in productivity and changed the lives of people throughout the world.[2] In short, everything in and around a manufacturing operation, including suppliers, plant, distributors, even the product itself, is digitally connected, providing a highly integrated value chain.

Figure 1 – Different stages of industrial revolution



Source: RESTART.eu (2020).

[2] See European Parliament (2015).

2.2 Under Industry 4.0, the manufacturing process will be evolved to a higher level of automation where the physical world of industrial production merges with the digital world of information technology, forming cyber-physical systems.[3] Under these cyber-physical systems, resources (e.g. raw materials and machines) coming from different sources of the physical world could be brought together and utilized along the use of computers and networks. With the continuous exchange of data within computers and networks, cost-effective production of customized products could be achieved and new business models could be developed in an autonomous way.

2.3 There are several specific technologies that contribute to the successful development of such automation, which include: (a) artificial intelligence – the ability of a machine-based system to perform tasks requiring skills and abilities associated with human intelligence; (b) big data and analytics – large sets of structured or unstructured data which can be analysed to reveal patterns and trends; (c) blockchain technology – distributed databases and ledgers made of blocks stored on a large number of machines to support traceability and data robustness; (d) Internet of Things – connections between physical objects like sensors or machines and the Internet, resulting in the ability to respond to the environment, process data and engage in machine-to-machine communication; and (e) rapid prototyping – a group of complementary technologies such as computer-aided design and additive-layers manufacturing (also known as 3D printing) used to produce parts and prototypes, as opposed to the traditional material forming and removal technique. As technologies play a major role in Industry 4.0, investing in research and development ("R&D") becomes crucial.

2.4 At the macro level, many developed economies have **taken the concept of Industry 4.0** to map the development of re-industrialization in their states although they may label the concept and development as smart factories, Industrial Internet of Things, smart industry, or advanced manufacturing.[4] One notable feature of Industry 4.0 is that it is not only a high-level strategy for various developed economies, but is also a top priority for many companies, research institutions and universities.

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[3] See United Nations Industrial Development Organization (2017).

[4] See European Parliament (2015).

3. Hong Kong

3.1 Industrialization was the driving force of Hong Kong's economic development in the 1960s and 1970s. At that time, the industries were mainly labour intensive and export-oriented. Hong Kong was the leading exporter of products such as textiles, garments, plastics, wigs, toys, clocks and watches.[5] "**Made in Hong Kong**" was an internationally recognized brand which was generally perceived as a guarantee of confidence and quality of the products.[6] Nevertheless, facing the growing challenges such as soaring land prices and shortage of labour in the 1980s, many industries relocated their production processes to the Mainland and retained their factory spaces in Hong Kong as administrative offices to handle orders, export and financial matters (i.e. working as "front shop, back factory" (前店後廠)).[7, 8]

3.2 As the manufacturing industry continued to lose significance in the 1990s, particularly the segment of textile and wearing apparel, (**Figure 2** and **Figure 3**), Hong Kong's economic development had increasingly been relying on service industries. Under the free market principle, the Government had at that time assumed the role of a **basic service provider** and **facilitator** in implementing the **industrial support policy**.[9] This included providing land at the three Industrial Estates[10] to industries with new or improved technology and processes, and financing innovative projects under the Innovation and Technology Fund.

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5 See Antiquities and Monuments Office (2016).

6 See Labour Department (2017).

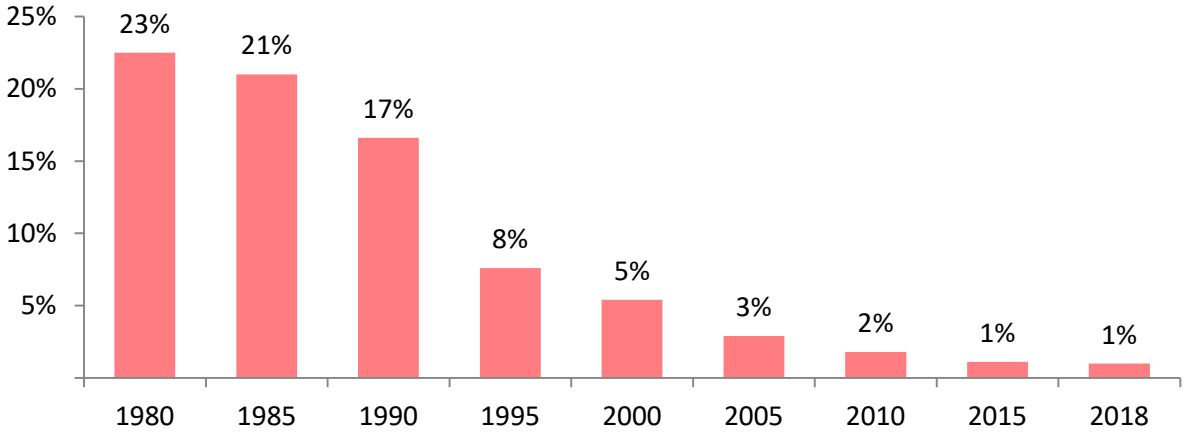
7 See Antiquities and Monuments Office (2016).

8 Since the activities of the firms no longer involved any physical or chemical transformation of raw materials into tangible products, the economic contribution of these Hong Kong-based enterprises came to be re-categorized statistically as contribution by "services". See Trade and Industry Department (Undated).

9 See Commerce and Industry Bureau (2000).

10 They are Tai Po Industrial Estate, Yuen Long Industrial Estate and Tseung Kwan O Industrial Estate.

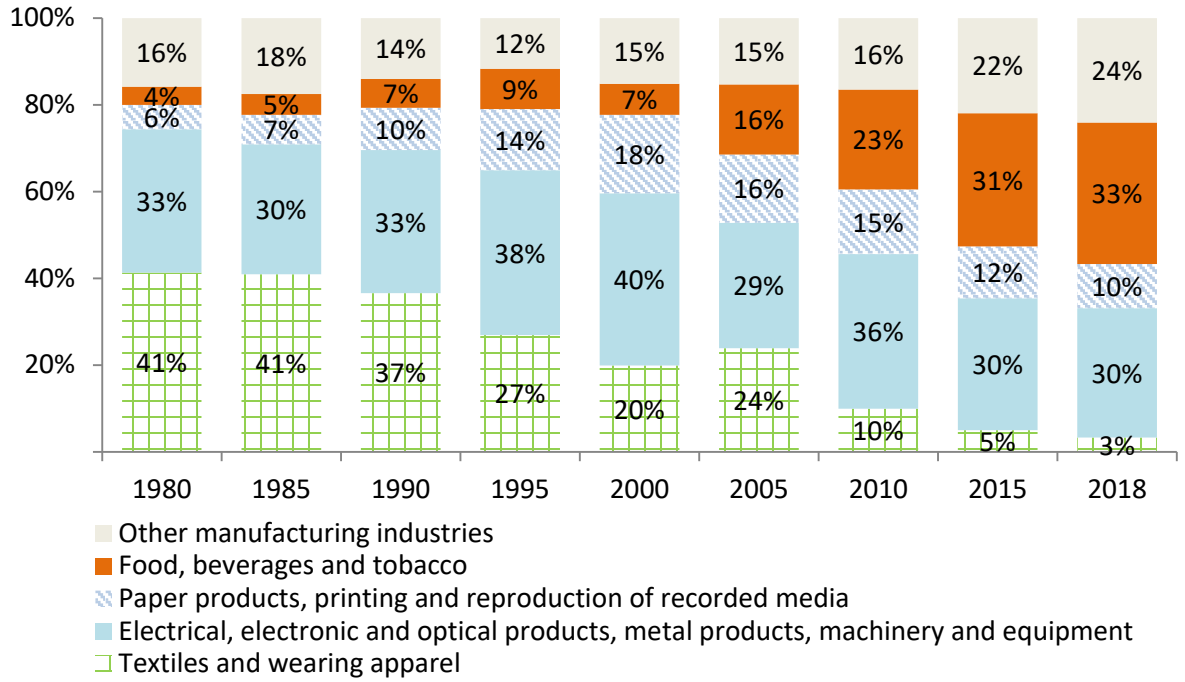
Figure 2 — Percentage contribution of manufacturing to GDP at basic prices[(1)]



Note: (1) According to the Census and Statistics Department, to follow international standards, the figures since 2000 have been compiled based on Hong Kong Standard Industrial Classification ("HSIC") Version 2.0 while those before 2000 are compiled based on HSIC Version 1.1. They are not strictly comparable.

Source: Census and Statistics Department (2020).

Figure 3 — Economic activities in manufacturing (based on value added)[(1), (2)]



Notes: (1) According to the Census and Statistics Department, the figures for the industry groups since 2005 have been compiled based on HSIC Version 2.0 while those before 2005 are compiled based on HSIC Version 1.1 having different classification of industry groups. To provide a proxy indicator, the Research Office regroups relevant industry groups for the figures before 2005 to match with those since 2005.

(2) Figures may not add up to 100% due to rounding.

Source: Census and Statistics Department (2019).

3.3 To encourage private investment in manufacturing facilities, the Government has since 1998 introduced an incentive under the Inland Revenue Ordinance (Cap. 112) to allow businesses to immediately write off capital expenditure instead of claiming depreciation allowance for prescribed fixed assets. These include machinery and plant for manufacturing, and computer software and computer systems, except those under a lease arrangement.[11] According to the Government, the industrial support policy aimed to create a favourable environment for industry development. It was not meant to determine the pace or specific direction like setting a minimum level of contribution from the manufacturing industry to GDP, nor picking "winners" or "pillar" industries.[12]

Re-industrialization initiative emerged in the 2010s

3.4 Following the emergence of Industry 4.0 across the globe, the Government first revealed the re-industrialization initiative in the 2016 Policy Address, highlighting that it would be a potential new area of economic growth for Hong Kong. It has subsequently established a cross-bureau Committee on Innovation, Technology and Re-industrialisation[13], an advisory committee chaired by the Financial Secretary and tasked to collect views from stakeholders and advise the Government on the strategies and measures on promotion of innovation and technology development and re-industrialization in Hong Kong. Relevant issues discussed included supporting the development of start-ups in Hong Kong and enhancing tax deduction for R&D expenditure. According to the Government, it has made reference to members' views in devising and implementing relevant policies.[14]

3.5 Given the constraints in land resources and labour, the Government aimed to develop high value-added and less land-intensive manufacturing industries based on **new technologies** and **smart production**.[15] Examples of these industries include pharmaceutical, healthcare, biomedical and advanced machinery. The Government would maintain the role as an **active promoter**

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11 See section 16G of the Inland Revenue Ordinance.

12 See Commerce and Industry Bureau (2000).

13 Chaired by the Financial Secretary, it is a committee with more than 30 members including official members (e.g. Secretary for Commerce and Economic Development and Secretary for Education) and non-official members from different backgrounds (e.g. academics, stakeholders from the Innovation and Technology and industrial sectors).

14 The Government has not released details about the recommendations put forward by the Committee and whether it has adopted the recommendations. See GovHK (2019).

15 See Legislative Council Secretariat (2019).

and facilitator by providing continued policy support,[16] such as developing different technology centres at Industrial Estates which currently have an occupancy rate of over 90%,[17] and providing funding support for local enterprises to train their staff in advanced technologies under the "Re-industrialisation and Technology Training Programme".[18]

Stakeholders' views and concerns

3.6 In fact, Hong Kong's technology advancement has seen some improvement. For example, there has been a marginal growth of the economic contribution of the innovation and technology industry, from the static rate of 0.7% in the previous nine years to 0.8% of GDP in 2018. R&D expenditure ratio has increased mildly to 0.86% of GDP in 2018 from 0.72% in 2008.[19] However, the progress is still considered far from satisfactory. Recently, the Government has strengthened the efforts by launching a HK$2 billion Re-industrialisation Funding Scheme to subsidize manufacturers to set up new smart production lines locally,[20] and allocating an additional HK$2 billion for the Hong Kong Science and Technology Parks Corporation to develop a Microelectronics Centre.[21] Nevertheless, some have maintained that Hong Kong still lacks **an overarching industrial policy and direction** as well as long and short term goals to guide the development.[22] There have been suggestions that instead of merely acting as a facilitator, the Government should be more proactive by at least drawing up some benchmark indicators to set out the expected benefits brought by re-industrialization (e.g. increase in value added of the manufacturing industry).[23, 24]

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16 See Legislative Council Secretariat (2018).

17 See Innovation and Technology Bureau (2020b).

18 As at end of April 2020, 452 training grant applications have been approved for registering public courses under the Programme to subsidize about 2 400 trainees to receive training in advanced technologies, with a total funding amount of around HK$15 million. See Innovation and Technology Bureau (2020a).

19 The Government has set a goal to increase the R&D expenditure ratio to 1.5% by the end of the current Government's five-year term of office.

20 Funding is proposed to be provided on a matching basis at a government to enterprise ratio of 1 : 2 , with the Government covering a maximum of one-third of the total approved project expenditure or HK$15 million per project, whichever is lower.

21 See Innovation and Technology Bureau (2019).

22 See 香港 01(2018).

23 See 浸大新聞系新聞網(2019) and 香港城市大學(2020).

24 In replying to a Legislative Council Question on whether the Government has drawn up any indicators for evaluation of the effectiveness of the measures relating to re-industrialization, the Government stated that it would evaluate the effectiveness and benefits of the new initiatives when taking forward the proposals. See GovHK (2019).

3.7 Although Hong Kong has strong upstream R&D capabilities, it is considered lacking the capability to commercialize the R&D results.[25] Some people have attributed this to **inadequate collaboration** between the commercial and academic sectors, and lack of local demand which makes commercialization not economically viable. Against this, some stakeholders have considered that re-industrialization could be promoted at the regional level under the overarching initiative of the Greater Bay Area whereby manufacturers retain their production lines on the Mainland. For example, Hong Kong could work with Guangzhou and Shenzhen to form an ecosystem as "**front research, back production**" (**前研後產**), with Hong Kong focusing on **R&D and global distribution of final products**.[26] However, an obstacle faced by the industry is that under the current tax policy, the Government will not grant depreciation allowance for the machinery and plant which are provided by Hong Kong enterprises but solely used in the Mainland manufacturing activities by other parties. The industry has expressed that this had increased their operating cost and hindered their development in re-industrialization. According to the Government, it has communicated with the industry and is re-examining the issue in the light of possible economic integration that may be brought about by the Greater Bay Area development.[27]

3.8 While the above tax matter remains to be resolved, recently, amid the outbreak of the coronavirus pandemic worldwide, the public demand for masks in Hong Kong has surged significantly. In particular, production of reusable masks with advanced technology has prompted renewed discussion on how Hong Kong could actualize re-industrialization.[28] Some have

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[25] See Minutes of Meeting of the Panel on Commerce and Industry of the Legislative Council (2018).

[26] There are views that Hong Kong has first-rate institutions and universities, and is excellent in basic research. At the same time, Shenzhen is strong in applied scientific research and good at nurturing start-ups while Guangzhou is a distribution hub for products nationwide and good at manufacturing. The three places can make use of their advantages to complement each other in manufacturing. See Chinese General Chamber of Commerce (2019).

[27] The manufacturers had been appealing that Hong Kong enterprises should be allowed under section 39E of the Inland Revenue Ordinance to claim depreciation allowance in Hong Kong for their machinery and plant provided for use by Mainland enterprises on a rent-free basis under the "import processing" arrangement. Besides, there are appeals that section 16EC of the Ordinance should be amended to enable the manufacturers to claim tax allowances in respect of the intellectual property rights used in their production procedures located outside Hong Kong. However, according to the Government, it had conducted an in-depth review in 2010 and concluded that there were no justifiable grounds to relax the restrictions as the tax treatments under section 39E and section 16EC were based on the "tax symmetry" principle and "territorial source principle". See GovHK (2018).

[28] See 香港電台網站 (2020).

maintained that the Government should encourage enterprises to **relocate their production lines back** to Hong Kong to take advantage of the "Made in Hong Kong" reputation. In view of shortage of land, some have urged faster **redevelopment and wholesale conversion** of old industrial buildings with the necessary standards to cater for re-industrialization (e.g. equipped with modern logistic centres).[29] Besides, some have proposed adjusting the tax regime by increasing the **depreciation allowances** on construction of industrial buildings and structures (currently, the initial allowance is 20% of capital expenditure on construction and annual allowance is 4%), given that tax incentives play an important role in improving the business climate.[30]

3.9 Other than the above, some on the other hand have called on the Government to provide **preferential tax treatment for specific industries or business sectors** to promote re-industrialization,[31] similar to the tax relief currently provided to aircraft leasing businesses to promote the development of international aviation hub.[32] There have also been views that the Government should take note of the re-industrialization trend by exploring and deploying more **smart solutions** in different sectors like elderly services, logistics and food industry, in view of the imminent challenges arising from population ageing in Hong Kong.[33]

3.10 To encourage more R&D or innovation activities, there have also been suggestions of introducing a **patent box tax regime** seen in some overseas places where a lower corporate tax rate is provided for income earned from commercialization of local IP rights (e.g. licensing).[34, 35] Moreover, some people have suggested expanding the **scope** of qualifying R&D activities under the **enhanced tax deduction regime**. Since April 2018, expenditures on qualifying R&D activities can be deducted at 300% for the first

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[29] See 團結香港基金 (2020).

[30] In particular, the stakeholders suggested the initial allowance on the cost of construction of the premises be increased from 20% to 30% and the annual allowance to be increased from 4% to 10%. See 香港工業總會 (2019).

[31] See 香港中華廠商聯合會 (2019).

[32] The profits derived by qualifying aircraft lessors and qualifying aircraft leasing managers from qualifying activities are charged at one-half of the ordinary profits tax rate (i.e. 8.25%).

[33] See GS1 Hong Kong (2018).

[34] See Ernst & Young Global Limited (2020).

[35] However, the patent box regime has been regarded by Organisation for Economic Co-operation and Development as a harmful tax practice under the base erosion and profit shifting context, as international enterprises may exploit them for international tax planning purposes. More safeguards will therefore need to be adopted in order to ease the harmful tax concern, for instance, ensuring that the company holding the IP has incurred expenditure itself on relevant R&D or has subcontracted the activity to an unconnected third party.

HK$2 million and 200% for the remaining amount, instead of the ordinary 100% tax deduction.[36] However, qualifying R&D activities covers only related payments made to designated local research institutions and those incurred in-house locally. There have been calls to **extend** the eligible sub-contracted R&D service providers to beyond designated local research institutions, so as to help encourage more R&D activities and in turn create more opportunities for turning results into high value-added products locally or regionally.[37]

4. Global trend on promoting re-industrialization

4.1 Around the globe, **Germany** was the first place introducing Industry 4.0 as early as in 2011. The theme was subsequently developed into a national strategy for reindustrialization, aimed primarily at driving forward digital manufacturing by increasing digitization and the interconnection of products, value chains and business models. The national strategy spans over 10-15 years and is based on the German government's High-Tech 2020 Strategy.[38]

4.2 Besides Germany, many other places have also developed their own national strategies or introduced similar initiatives. For example, the **United Kingdom** and **Italy** have formulated the "High Value Manufacturing Catapult" and "Factory of the Future" (Fabbrica del Futuro) plans respectively. The **US** has introduced the Advanced Manufacturing Partnership; **Japan** has devised the "Revitalization Strategy" and the 5th Science and Technology Basic Plan; **South Korea** the "Manufacturing Innovation 3.0" and later "I-Korea 4.0"; and **the Mainland** "Made in China 2025".[39] In **Singapore**, it has not

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[36] R&D activities qualified for enhanced tax deduction are (a) those in the fields of natural or applied science to extend knowledge, (b) original and planned investigation carried on with the prospect of gaining new scientific or technical knowledge and understanding, and (c) the application of research findings or other knowledge to a plan or design for producing or introducing new or substantially improved materials, devices, products, processes, systems or services before they are commercially produced or used. For those R&D activities not qualifying for enhanced tax deduction but fall under the definition of "R&D activity" and "Type A expenditure" in the Inland Revenue Ordinance (Cap. 112), they are entitled to 100% tax deduction.

[37] See 香港經濟日報 (2019).

[38] See European Commission (2017).

[39] In addition, a number of other European countries have also introduced similar initiatives, such as "New Industrial France" (Nouvelle France Industrielle) in France, "Smart Factory" in the Netherlands, "Connected Industry 4.0" (Industria Conectada 4.0) in Spain. In Asia, Malaysia introduced the "National Industry 4.0 Policy Framework" and Thailand implemented the "Thailand 4.0" development plan.

specifically formulated a dedicated blueprint but "Advanced Manufacturing and Engineering" has been listed as one of the technology domains under its Research, Innovation and Enterprise 2020 Plan, with eight key industries identified for development.[40]

4.3 Along with the above national initiatives, many have in place a host of tax measures to incentivize investment. These measures commonly take the form of (a) expense deduction against taxable income, (b) tax credit to reduce tax liability, (c) tax rate reduction, and/or (d) tax deferral. Taking **Singapore** as an example, there is a Land Intensification Allowance to promote industrial land use towards more land-efficient and higher value-added activities. Under the incentive, manufacturing and logistics businesses may enjoy a first-year depreciation allowance at 25% and subsequent annual allowances at 5%[41] of qualifying capital expenditures (e.g. renovation/ extension costs and design fees) for increasing the gross plot ratio (**Table 1**).

Table 1 — Examples of tax incentives conducive to re-industrialization

	Singapore	South Korea	Mainland	Italy
Purpose	• Promote intensification of industrial land use	• Encourage technology transfer by small businesses	• Encourage technological innovation	• Encourage acquisition of Industry 4.0 assets
Scope	• Depreciation allowance at 25% of qualifying capital expenditure, and 5% thereafter	• Exemption of 50% of tax on gains from the technology transfer; and 25% of tax on income from patent lease	• Lower tax rate (15%) than ordinary rate of 25% for technology enterprises	• Tax credit for purchase of new high-tech assets and software relating to industry 4.0 plan, ranging from 15%-40% of purchase cost
Form of deduction	• Expense deducted from taxable income	• Tax credit deducted from tax liability	• Tax rate deduction	• Tax credit deducted from tax liability
Specific sector	• Manufacturing and logistics sectors	• Small- and Medium-sized Enterprises	• Qualified technology Enterprises	• All industries

Sources: Inland Revenue Authority of Singapore (2020), PwC (2015), KPMG (2018), China Innovation Funding (2019) and Deloitte (2020).

[40] The eight industries are (a) aerospace, (b) electronics, (c) chemicals, (d) machinery and systems, (e) marine and offshore, (f) precision modules and components, (g) biologics and pharmaceutical manufacturing, and (h) medical technology manufacturing.

[41] Annual allowances of 5% are granted until total allowance amounts to 100% of qualifying capital expenditure.

4.4 In **South Korea**, to promote transfer of technology, small and medium enterprises ("SMEs") may be eligible for a 50% tax credit on gains arising from technology transfer (e.g. patents), and a 25% tax credit on income derived from leasing patents during the incentive period.[42] As regards the **Mainland**, tax policies are also in place to support the "Made in China 2025" initiative. For instance, companies granted the "High- and New-Technology Enterprise" status[43] will be taxed at a lower corporate rate (15%) instead of the standard 25% rate.[44] In Europe, **Italy** has also introduced in its 2020 budget a new tax credit for acquiring the so-called "Industry 4.0 assets" (i.e. plant, equipment and machinery whose operation is controlled by computer systems and/or operated by smart sensors and drives interconnected to a factory's computer systems). The tax credit amounts to 15%-40% of acquisition cost.[45]

5. Re-industrialization initiative in Japan

5.1 In the 1970s and 1980s, Japan had achieved rapid economic growth by taking advantage of its advanced technologies particularly in the machinery sector. However, since the 1990s, Japan has lost its competitive edge to its global counterparts such as South Korea. Customer needs have become diversified due to globalization and market maturity but Japanese companies have not been able to respond properly to market changes for innovation or acquire new customer value.

5.2 In the face of growing global threat, the Japanese government began in the 2010s to push forward the reform of its industrial sector. In 2013, it introduced its first Industry Revitalization Plan, attempting to eliminate the local market distortion problems such as under-investment, and excessive competition.[46] A more ambitious strategy, known as **Society 5.0**,[47] was later

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42 See PwC (2015) and KPMG (2018).

43 Companies are required to meet a number of requirements in order to obtain the status. For example, they must utilize key technologies for the production of their main products. See China Innovation Funding (2019).

44 See Fiducia (2017) and China Innovation Funding (2019).

45 See Deloitte (2020).

46 This was done through enactment of the Industrial Competitiveness Enactment Act. See Prime Minister of Japan and His Cabinet (2013b).

47 It follows the hunting society (Society 1.0), agricultural society (Society 2.0), industrial society (Society 3.0), and information society (Society 4.0).

introduced under the 5th Science and Technology Basic Plan[48]. Also called "super-smart society", Society 5.0 envisions a sustainable society by incorporating Industry 4.0 technologies into every industry and social life. In particular, "**cyber-physical system**" is featured as a pervasive technological mode supporting Society 5.0. Meanwhile, a policy known as "**Future Vision towards 2030s**" ("Vision Plan 2030s") was introduced, outlining the future steps and directions for achieving toward "Society 5.0".

Vision Plan 2030s

5.3 Since 2016, the Ministry of Economy, Trade and Industry ("METI") has been working to formulate the Vision Plan 2030s. Released in May 2017, the final report identified advanced technologies – **Internet of Things, big data, robots, and artificial intelligence** – as the key technologies driving a new phase of growth. Most notably, a new concept of "**Connected Industries**" was introduced, featuring the connection of people, industries, machines, technologies, etc. for creating new value and products/services. Examples cited by the Japanese government are to tear down the boundaries between the manufacturing and the medical and nursing care industry, and by fusing artificial intelligence with the bio industry.[49]

5.4 Under the framework of Connected Industries, there are **five priority fields** identified for development, namely (a) automated driving and mobility service; (b) biotechnologies and materials; (c) manufacturing and robotics; (d) plant/infrastructure safety management; and (e) smart life. For each priority field, the government has charted future directions after reviewing the past efforts and current situation. In the manufacturing and robotics field, for example, it has the vision to develop non-stop factories using the **smart manufacturing concept**. To facilitate the development, the government has supported various areas of groundwork, such as strengthening **data collaboration** between industry players[50], and developing guidelines for cyber-security and data utilization rights.

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[48] The Science and Technology Basic Plan is a five-year plan aiming to comprehensively and systematically advance science and technology policy of Japan. The first Science and Technology Basic Plan was developed in 1996.

[49] See Ministry of Economy, Trade and Industry (2019a).

[50] This included formulating new data profiling standards, and establishing a common dictionary system for cross-company use.

5.5 In the field of smart life, the Japanese government has committed to **creating a smart home market** to address the labour shortage and other social issues, as well as boosting the consumer demand. Given that promotion of smart home will necessarily touch on data sharing with a variety of businesses (e.g. home appliance manufacturers, electricity utilities, and retailers), METI has collaborated with the industry to develop a recommended standard interface for smart home equipment.[51] This helps improve their interconnectivity, and thereby contributing to the expansion of smart home market. Besides introducing various initiatives under Connected Industries, Japan has also made available tax break programmes to support investment in advanced technologies.

Tax policies to encourage investment

5.6 Japan's corporate income tax is rather high, with its effective rate staying at about 30%. Despite this, the Japanese government has in recent years introduced/reformed its tax incentives to promote use of advanced technologies arising from Industry 4.0 in order to strengthen business competitiveness. The tax incentives are usually provided in the form of tax credit deducted from the corporate tax.[52] Major schemes are as follows:

(a) "**Connected Industries Tax System**" (コネクテッド・インダストリーズ税制, or "IoT 税制"): following the release of the Vision Plan 2030s and the Connected Industries initiative, the Japanese government has introduced a time-limited tax policy called "Connected Industries Tax System" in June 2018.[53] It aimed to boost business productivity by capitalizing on advanced technologies such as Internet of Things and artificial intelligence.[54] Businesses acquiring or constructing qualifying assets with a minimum investment of ¥50 million (HK$3.6 million) and put them into use during the specified period (June 2018 to March 2021) will be entitled to **additional depreciation** or **tax credit** (**Table 2**);

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51 See Echonet (2020).

52 Tax credit amount is calculated by multiplying the tax credit rate by the relevant expenditures.

53 The application ended on 31 March 2020.

54 The tax system comes under the Act on Special Measures for Productivity Improvement. See PwC (2018) and Ministry of Economy, Trade and Industry (2018).

(b) **R&D expenditure tax credit**: to encourage research activities, certain items related to product manufacture, technology improvement, or invention may claim tax credit. Since 2017, the scope has been expanded to include R&D activities using Industry 4.0 technologies, such as Internet of Things and big data.[55] R&D expenditure tax credit has two features: (i) the tax credit rate is generally higher for SMEs, which is currently in the range of 12%-17%, contrary to large corporations' 6%-14%, considering that the former are usually less able to achieve product innovation; and (ii) the tax credit is incremental, depending on the increase/decrease in R&D expenditures with reference to the previous three-year average period and gross sales; and

(c) **Collaborative or outsourced R&D with a higher tax credit rate**: to promote "open innovation",[56] collaborative or outsourced R&D projects have since 2015 been counted as **special R&D expenditures** earning a higher tax credit at 20%-30% of relevant R&D expenditures. The scheme not only includes basic and applied research projects commissioned to public research institutes and universities, but also projects in collaboration with venture corporations and research contracted to large enterprises.

[55] R&D should involve the performance of (a) automatic data-gathering with sensors; (b) analysis using relevant software by specialists to identify the rules; and (c) new service development based on the rules. See EU-Japan Centre (2017) and National Tax Agency (2019).

[56] It refers to "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively". See Chesbrough, H. et al. (2005).

Table 2 — Features of selected tax incentives in Japan conducive to re-industrialization

	Connected Industries Tax System	Tax incentives for R&D	
		A. R&D expenditure tax credit	**B. Collaborative or outsourced R&D with a higher tax credit rate**
Objective	• Boost productivity by capitalizing on advanced technologies	• Promote R&D investment	• Promote "open innovation"
Scope	• Acquisition cost of assets (e.g. data sensors, robot machines and cyber-security systems) which are placed in use during June 2018 to March 2021 (with a minimum investment of ¥50 million (HK$3.6 million))	• General R&D expenditures related to product manufacture, technology improvement, or invention	• Special R&D expenditures for joint or contract research with national research institutes, universities or companies
Deduction amount	• Option 1: Additional depreciation of 30% of the cost • Option 2: Tax credit at 3% of the cost (up to a limit of 15% of corporate tax liabilities)(1)	• Under an incremental approach, 12%-17% of qualified R&D expenditures for SMEs ; 6%-14% for large corporations(2), (3) • Up to a limit of 25% of corporate tax liabilities(4)	• 30% of qualified R&D expenditures for joint or contract research with national research institutes and universities (20% for joint research between companies) • Up to a limit of 10% of corporate tax liabilities
Form of deduction	• Option 1: Deducted from taxable income • Option 2: Tax credit deducted from tax liability	• Tax credit deducted from tax liability(5)	• Tax credit deducted from tax liability(5)
Ability to carry forward tax credit to later years	• No	• No	• No
Major changes or enhancements in recent years	• A time-limited measure introduced in June 2018 and ended in March 2020. However, businesses which have obtained METI approval for putting relevant assets into use before March 2021 will remain eligible for tax credit	Enhancements since 2017 include: • Increased the maximum credit rate from 12% to 17% for SMEs (10% to 14% for large corporations) • Expanded the scope to cover R&D expenditures of specific technologies of Industry 4.0	Enhancements since 2015 include: • Increased the credit rates from 8%-12% to 20%-30% • Expanded the scope to include IP royalties paid to SMEs

Notes: (1) For companies which have increased the salary of existing employees by 3% or above from the previous year, the tax credit will be increased to 5% of asset acquisition cost, capped at 20% of corporate tax liabilities.

(2) For example, for a large corporation, if the percentage increase in R&D expenditures relative to the previous period is above 8%, the tax credit rate formula is: 9.9% + (percentage increase in R&D expenditures relative to the previous period - 8%) × 0.3 × α (where α= ratio of R&D expenditure to average gross sales).

(3) Larger corporations and SMEs with R&D expenditures being more than 10% of the average turnover may be eligible for additional tax credit.

(4) On the other hand, for eligible R&D venture corporations, the limit is capped at 40%.

(5) R&D expenditures are also deducted from taxable income as expenses or amortized over a period of time.

Sources: PwC (2018), EU-Japan Centre (2017) and National Tax Agency (2019).

Observed outcomes

5.7 According to METI, the time-limited **Connected Industries Tax System** has attracted a total of 210 successful applications in less than two years.[57] Manufacturing accounted for 51% of the total, followed by the finance and insurance sector (16%), and the wholesale and retail sector (13%). Over one-third of the companies invested ¥100 million (HK$7.2 million) to ¥500 million (HK$36 million) in technology assets, followed by a quarter of them investing between ¥1 billion (HK$72 million) and ¥5 billion (HK$360 million). As for the **R&D tax incentives**, METI commissioned a survey in 2018 on the utilization status to better understand the attitudes and experiences of the companies investing in R&D.[58] According to the survey results, the expected proportion of these companies utilizing the tax incentives would reach 81% in 2019, up from the adoption rate of 73% in 2015. Among those who have claimed the tax incentives, almost all of them responded that they would continue to utilize the R&D expenditure tax credit. In addition, one-fifth of them specifically indicated that they plan to undergo collaborative or outsourced R&D to earn tax credit. In 2015, the adoption rate of such a tax credit was just 11%.

National promotion strategy

5.8 Apart from the above high-level strategic initiative and tax policies, the Japanese government has also made concerted efforts on the soft side to promote its products and services in the international arena. Specifically, it has introduced a national promotion strategy, known as "**Cool Japan Strategy**", to promote Japanese products to the world. Target goods range from games and Japanese cuisine to eco-friendly technologies and other high-tech industrial products. A core part of the Strategy was the setting up of a "**Cool Japan Promotion Council**" and the **Cool Japan Fund** under METI. The latter provides risk money to the private sector, with a hope of bringing attractive Japanese goods and services on a worldwide scale and making it a driving force for Japan's economic growth.[59] For example, the Fund has invested in a game

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[57] See Ministry of Economy, Trade and Industry (2020).

[58] Commissioned by METI, the survey was conducted periodically. In 2018, it was sent to about 700 companies that had responded to the survey previously, and to about 1 300 companies which significantly increased their R&D expenses (i.e. more than a double in the past three years). Among the 819 responses received, over 70% came from the manufacturing sector. See Ministry of Economy, Trade and Industry (2019c).

[59] The Cool Japan Fund's capital amounted to over ¥101.3 billion (HK$7.3 billion) as at July 2020. See Cool Japan Fund (2020).

and toy company for its online distribution of animation products; and invested in a Japanese Food Town in Singapore offering authentic Japanese food. By supporting overseas promotion, it is expected that **Japanese cultural products, food and services will reach new customers across international boundaries**, creating a greater global demand which helps contribute positively to the development of every industry in Japan.

6. Re-industrialization initiative in the United States

6.1 Different from Hong Kong, the US used to be focusing on heavy industries such as automobiles, machinery and steels. However, low-wages and heavy investment of the manufacturing sector in other developing economies have posed challenges to the US too in securing the leading production in both low-tech and high-tech industries.[60] With the onset of the recession since the 2000s, especially in the aftermath of the global financial crisis, the US saw a pressing need to strengthen the competitiveness of the manufacturing sector as a means to boost the economy. Despite constituting less than one-fifth of GDP, manufacturing was a major source of US exports, and was responsible for a majority of private R&D activities.[61]

6.2 Recognizing the importance of the manufacturing sector, the then Obama administration of the US had sought to revitalize it since taking office in 2009. Specifically, it released the **Framework for Revitalizing American Manufacturing** in December 2009. The Framework highlighted a need for the government to be more **active**, considering that the laissez-faire approach adopted in the manufacturing sector had resulted in steep job losses and threatened to lose the potential for greater innovation in future. Building on the recommendations of the advisory body, namely President's Council of Advisors on Science and Technology[62], the Obama administration had set out the strategic direction with the launch of various initiatives over the subsequent years. These were seen to be the moves leveraging on the re-industrialization trend, and were broadly grouped as follows:

[60] See Executive Office of the President (2011).
[61] See National Economic Council (2016).
[62] Ibid.

(a) **A focus on advanced manufacturing**: developing advanced manufacturing through the use of innovative technologies[63] was identified as a strategic way to revitalize the manufacturing sector in the US. The federal government has clearly outlined the existing technology priorities and potential future technology areas[64]. To kickstart the investment, an initial budget of over US$500 million (HK$3.9 billion) was committed, with objectives to help US manufacturers reduce costs, improve quality, accelerate product development, and create new jobs;

(b) **Whole-of-government effort complemented by industry and academic support**: the US government has adopted a whole-of-government approach based on the recommendations of the above President's Council. Specifically, it established a dedicated office (**National Program Office for the Advanced Manufacturing Partnership**) in 2011 to support inter-agency coordination of advanced manufacturing programmes; and formed the **Advanced Manufacturing Partnership** ("**AMP**") **Steering Committee** comprising representatives from different government departments, industry and universities. The AMP Steering Committee 2.0 formed two years later even included the labour representatives as well, and functioned as a working group to support the implementation of the related initiatives;

(c) **Enhanced public-private collaboration**: one of the most significant actions taken was the establishment of a number of **manufacturing innovation institutes**[65] across the US. They were formed under a public-private partnership of companies, academia, state and local governments, as well as federal agencies. Focusing on **specific technology areas** (e.g. 3D printing, integrated photonics and smart sensors),[66] they provide resources and facilities to allow industry and academia to cooperate to solve industry-relevant problems and bridge the gap between basic research and production.[67] These resources included manufacturing technology demonstrations and

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63 Examples are production activities that depend on information, automation, computation, software, sensing and networking.

64 Examples are advanced materials manufacturing, biomanufacturing for regenerative medicine and advanced bioproducts manufacturing.

65 See Executive Office of the President (2016).

66 See National Economic Council (2016).

67 See Executive Office of the President (2016).

fee-based facilities, which have enabled SMEs to access expensive equipment and help reduce their cost of R&D experimentation.

Furthermore, the US has formed the **National Network for Manufacturing Innovation** (now known as Manufacturing USA) linking the manufacturing innovation institutes together.[68] Within the network, they work together to **share best practices**, identify common interests, and exchange information about newly developed technologies and processes. As at 2018, there were a total of 14 institutes established comprising 1 937 member organizations;[69] and

(d) **Workforce training**: "securing the talent pipeline" is also one of the key focuses under its advanced manufacturing development. The then US President has created the **Community College to Career Fund** to help forge new partnerships between community colleges and businesses to train about two million workers in **high-growth and high-demand industries** (i.e. including advanced manufacturing).[70] Furthermore, the manufacturing innovation institutes mentioned above also provide workforce education and training in advanced manufacturing. So far, over 200 000 workers, students, and educators have trained through participating in various workforce activities (e.g. institute projects and internship programme).[71]

6.3 Within a few years, the US manufacturing sector had added more than 700 000 jobs.[72] In 2014, the advisory body President's Council of Advisors on Science and Technology further issued a report "Accelerating U.S. Advanced Manufacturing", recommending the government to continue the efforts in (a) enabling innovation, (b) securing the talent pipeline, and

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[68] This is done through the enactment of the Revitalize American Manufacturing and Innovation Act. See Advanced Manufacturing National Program Office (Undated) Glossary: National Network for Manufacturing Innovation.

[69] Of the member organizations, a majority of them (63%) were manufacturers. This was followed by the academia (e.g. universities and technical training schools) (24%) and other relevant organizations (e.g. government laboratories and not-for-profit organizations) (13%). See Manufacturing USA (2019).

[70] See the White House (2012).

[71] See Manufacturing USA (2019).

[72] See the White House (2014).

(c) improving the business climate. To keep the momentum, the federal government has committed an additional US$300 million (HK$2.3 billion) in investing in emerging manufacturing technologies, and improving the business climate.

Improving the business climate using tax incentives

6.4 Along with the strategic initiatives, the US government has introduced a series of changes to the tax system with a view to increasing the global competitiveness of the industrial sector. For example, the R&D tax incentive was refined under the "Protecting Americans from Tax Hikes Act of 2015". Following the change of government in 2017, a more comprehensive tax reform was taken place under the "Tax Cuts and Jobs Act of 2017". A significant change was the reduction of corporate tax rate from a maximum of 35% under the graduated rate structure[73] to a flat rate of 21%. Other strengthened tax reliefs to support more R&D and capital investment are discussed in ensuing paragraphs and summarized in **Table 3**.

(a) **Research and Experimentation Tax Credit**: also known as federal R&D tax credit, it is a major incentive to encourage innovation and covers in-house research and contract research (Table 3). In the case of contract research, R&D activities may be contracted to eligible small businesses, higher education institutes and research consortia.[74] The scope appears broader than that of Hong Kong[75], probably because of stronger R&D capability in the US private sector. To encourage increasing research activities, since 2016, start-ups with no federal tax liability may deduct their R&D tax credit from the employer contribution of social security tax.[76] The R&D tax credit is calculated at 20% of a firm's qualified R&D expenses beyond a base amount. The incremental nature is meant to encourage businesses to increase R&D spending. Unused credit can be carried forward to future years; and

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[73] Corporations' annual federal income tax liabilities were computed according to a progressive rate structure that started at 15% for the first US$50,000 (HK$391,800) of taxable income and increased to 35% for income above US$10 million (HK$78.4 million).

[74] See Section 41(3)(d) of the US Internal Revenue Code.

[75] In Hong Kong, the scope covers designated local research institutes only.

[76] Under the Federal Insurance Contributions Act, employers are required to pay the social security tax for their employees.

(b) **Upfront tax break on capital investment**: to encourage greater capital investment, businesses may, instead of through normal depreciation, immediately deduct the cost of certain business assets. There are two ways of doing this under the Inland Revenue Code, which are "Election to expense certain depreciable business assets" (Section 179) and "bonus" depreciation (Section 168(k)) (see Table 3). The former is subject to a deduction cap which has been increased by 100% to US$1 million (HK$7.8 million) since 2018. Corporations which purchase and lease the machinery to other entities may also claim the deduction. Bonus depreciation has no deduction cap, but will start to phase out beginning in 2022. Since 2018, eligible properties have also included second-hand properties acquired from an unrelated party.

6.5 Different states reportedly have largely followed the tax changes made at the federal level.[77] Moreover, they may introduce their own initiatives to promote the development. In **New York**, for instance, it has rolled out an "Excelsior Jobs Program" to provide tax credits in certain industries which they consider important, including financial services, life sciences and manufacturing. Under the scheme, businesses in those industries will be granted a tax credit at 6.85% of wages per net new job, 2% of qualified investments, and additional tax credit for R&D activities.[78]

[77] See Tax Foundation (2017 and 2019).
[78] See Empire State Development (2020).

Table 3 — Features of selected tax incentives in the US conducive to re-industrialization

	Federal R&D tax credit	Upfront tax break on capital investment	
		A. "Election to expense certain depreciable business assets"[(1)]	B. "Bonus" depreciation[(1)]
Objective	• Encourage private spending on R&D	• Encourage business investment	
Scope	• Qualified research[(2)] expenses relating to: (a) in-house research (relevant wages, supplies and computer lease); and (b) contract research, covers 65%-75% payments made to qualified research consortium, eligible small businesses, higher education institutes, and federal laboratories	• Eligible properties include tangible property (e.g. machinery, equipment, and integral part of manufacturing and related research facility), computer software, and qualified real property	• Generally apply to depreciable business assets with useful life of 20 years or less (e.g. machinery, equipment, and computers) • Assets must be acquired and placed in service between September 2017 and end-2022[(3)]
Deduction amount	• 20% of qualified R&D expenses beyond a base amount. The base amount is determined by multiplying a fixed percentage (capped at 16%) and the average sales over the preceding four years	• Capped at US$1 million (HK$7.8 million) (2018 price, adjusted for inflation annually)[(4)]	• 100% of cost
Form of deduction	• Tax credit deducted from tax liability[(5)]	• Deducted from taxable income	• Deducted from taxable income
Ability to carry forward to later years	• Yes, unused tax credit can be carried forward for up to 20 years	• Yes, relevant cost not deducted due to insufficient income during the year can be carried forward to later years	• Yes, bonus depreciation can be deducted even when there is insufficient income. The net operating loss so resulted can be carried forward to deduct against future income
Major changes or enhancements in recent years	Changes since 2016 include: • Made it a permanent scheme instead of on renewal basis • Allowed start-up businesses with no deferral tax liability to use R&D tax credit to offset the employer contribution of social security tax	Changes since 2018 include: • Increased the cap by 100% to US$1 million • Modified the definition of qualified real property to include certain improvements made to non-residential real property	Changes since 2018 include: • Increased the deduction from 50% to 100% of cost • Expanded the definition of qualified property to include used property (i.e. second-hand)

Notes: (1) Item A and item B are under Section 179 and Section 168(k) of the Inland Revenue Code respectively. Where properties are eligible for deduction under both schemes, scheme A will be taken first before scheme B, provided that a business has opted in to use scheme A.

(2) Definition of qualified research: (a) technological in nature; (b) a process of experimentation; (c) development of a new or improved product or process; and (d) elimination of uncertainty in relation to (c).

(3) Starting in 2023, the rate for bonus depreciation will be reduced to 80% and progressively to 20% in 2026.

(4) However, there is a phase-out threshold at US$2.5 million (HK$19.6 million), meaning that if the business spends more than US$2.5 million on a piece of equipment, the amount eligible for deduction starts to decrease.

(5) R&D expenditures covered by tax credit are also allowable for deduction from taxable income. However, this constitutes double tax benefit. One of the ways to prevent this under the Inland Revenue Code is to reduce the tax credit by the corporate tax rate of 21%. In other words, the business will claim 79% of the tax credit.

Sources: Department of the Treasury (2016), Internal Revenue Service (2018a and 2018b).

Observed outcomes

6.6 Among the various changes made at the federal level, the **bonus depreciation** is considered as the most impactful tax incentive, as it covers 100% of cost and is applicable to used (i.e. second-hand) properties. While it is too early to ascertain the overall impact of the tax reform, a survey of National Association of Manufacturers indicated that 95% of large and small manufacturers considered their **outlook positive** after relaxing the rules in 2018, which was the highest in the survey's 20-year history.[79] Reportedly, another survey also revealed that 83% of the small business owners planned to deduct the cost of eligible business equipment they purchased and put into business use in 2019. The proportion was 10 percentage points higher than that in 2017.[80] Besides, businesses generally welcome the move to allow small businesses with no federal tax liability to use the R&D credit to offset the social security tax liability. Probably reflecting an improved tax environment, annual business investment in R&D in the US has also seen a noticeable growth, from 4.4% in 2014-2015 to 6.8% in 2016-2017.

6.7 Despite a rise of investment with growing manufacturing business activities, economic contribution of the sector had remained on a persistent mild decline.[81] In October 2018, the US government released a visionary plan **Strategy for American Leadership in Advanced Manufacturing**, with goals to continually develop new manufacturing technologies, education and training, and expand the capabilities of the domestic manufacturing supply chain. While its effect has yet been known, a study commissioned by Manufacturing USA viewed that government efforts are necessarily long-term and the results will likely take years to manifest.[82] The study, however, has found that public-private partnership had successfully united and attracted significant participation from academic and industry, resulting in increased joint investments in collaborative R&D and commercialization of advanced manufacturing technologies.

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79 See National Association of Manufacturers (2017).

80 See Equipment Finance Advisor (2017) and Equipment Leasing and Finance Association (2019).

81 It stood at 12% of GDP in 2010, dropping to 11.7% in 2015 and further to 11% in 2019.

82 See Deloitte (2017).

7. Concluding remarks

7.1 Re-industrialization is a global trend. Many developed economies are leveraging on the advanced technologies under Industry 4.0 to reform their industries in their own way. Hong Kong first released the initiative in the 2016 Policy Address, with an aspiration to revitalize traditional industries using new technologies and develop emerging industries. However, the progress is considered far from satisfactory. Recently, it has strengthened the efforts to provide more support measures. Although it will likely take time to see the effect, there are views that the Government should play a more active role to lead the development instead of just being a facilitator, and should explore more tax measures to incentivize re-industrialization activities.

7.2 Contrary to Hong Kong, the economies of Japan and the US have a clear development direction under the re-industrialization concept. Japan has set an ambitious inspiration by introducing the idea of Connected Industries to connect people, industries, machines and technologies together under the overarching Society 5.0 concept. Under the framework of Connected Industries, there are five priority fields identified for development and much work has been put on strengthening data sharing across companies and industries to facilitate automation. At the same time, it has implemented the Cool Japan Strategy and set up a fund to assist the trade in promoting Japanese products to the world.

7.3 Different from Japan, the US's main focus is to revitalize its manufacturing industries. It has placed importance on whole-of-government effort, close collaboration with industry and academia, and workforce training. For instance, it has established the manufacturing innovation institutes to allow industry and academia to cooperate to solve industry-relevant problems and bridge the gap between basic research and production. Its collaborative platform has enabled SMEs to access expensive equipment for experimentation and thereby raising their ability on inventions. In addition, it has also created a career fund to help forge new partnerships between community colleges and businesses to train about two million workers in high-growth and high-demand industries.

7.4 On the other hand, both places have reformed their tax system by providing greater incentives. They are mainly concerned with encouraging R&D and capital investment. Different from Hong Kong, R&D tax incentives in both places are provided by means of tax credit, with its level hinging on changes in R&D expenditures with reference to the previous period as well as their business income/sale receipts. Furthermore, both places are keen to promote collaborative research, by offering a higher tax credit rate for related expenditures, and/or featuring a wider scope of service providers compared with Hong Kong. Moreover, in Japan, SMEs are generally offered a better tax credit rate than large companies, considering that the former are less able to perform R&D innovation. On encouraging capital investment, the US has in place a policy to allow immediate writing off of capital expenditures, which cover not only manufacturing assets but improvement in non-residential properties. Though the tax structure and tax rates in both places are not directly comparable to Hong Kong, their tax incentive design, focus and scope might still offer some reference to Hong Kong.

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