



APEC Study Centre

Policy for Promoting MSMEs
Modernization
towards Industry 4.0
in Hong Kong, China

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CUHK-APEC Study Centre
2018-04 Working Paper Series - 02
www.cuhk.edu.hk/hkiaps/apecsc

Introduction

The first three industrial revolutions developed as a result of mechanization, electricity invention and applications of information technology (IT). The 3rd industrial revolution started with the first programmable control system automating production in 1969. Since then, a continuous technological breakthrough in engineering, computer and IT led to the 4th industrial revolution which was termed “Industry 4.0” in 2011. Industry 4.0 is characterized by a combination of the usage of robots, drones, sensors, data analytics and flow of digital information throughout the production value chain, creating a network of services, data and people through a Cyber-Physical System (CPS). In manufacturing, these CPSs include smart machines, storage capacity and production arrangements capable of autonomously exchanging information, initiating operations and controlling each other independently. The future-oriented project was part of the German government’s high-tech

strategy. This has now become widely adopted by other economies, which is mainly about the technical integration of CPSs in production and logistics, as well as internet of things.¹

The core capability of Industry 4.0 is the innovation and integration of data and its analytics, which consists of three levels of digitalisation:

- (i) Digitalisation and integration of vertical and horizontal value chain;
- (ii) Digitalisation of product and service offering; and
- (iii) Digital business models and customer access.

By the above three levels of digitalization, the future landscape of business operations will be altered dramatically. The first element suggests seamless coordination and cooperation between business partners. The second and third elements improve customers-manufac-

FUNCTIONALITIES OF INDUSTRY 4.0

Functionalities	Components
Information and Communication	Mobile devices, Internet of Things (IoT) platform, and cloud computing
Data Management	Big data analytics and advanced algorithms
Customer Management	Multilevel customer interaction and customer profiling, smart sensors, location detection technologies and human-machine interface
Marketing and Sales	3D product printing and augmented reality and wearables
Production Process	Smart sensors, location detection technologies, advanced human-machine interface
Security and Personalization	Authentication and fraud detection

Source: PWC (2016a), p. 6

turers (or service providers) relationship by means of personalisation of product designs. With the advances in information and computing technologies, a collection and network of already available and accessible products are making the three digitalization processes possible. The key elements are categorised according to their functionalities in the above Table.

It is noteworthy that although the development and adaptation of Industry 4.0 are mainly found among big companies that enjoy considerable economies to scale and financial capability, the application of Industry 4.0 is undoubtedly also relevant to micro, small and medium enterprises (MSMEs) that may consist of a few dozen up to a few hundred persons in employment.

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A Study of Industry 4.0 by PriceWaterhouseCoopers

IMPLEMENTATION AND BENEFITS

According to the Global Industry 4.0 Survey with over 2000 participants from 9 major industrial sectors and 26 countries in 2016 undertaken by PriceWaterhouseCoopers (PwC), the adaptation of Industry 4.0 undoubtedly has potential to realise substantial benefits (PwC, 2016a). The coverage of the survey spanned from Aerospace, defence and security (2%) to Industrial manufacturing (21%), covering transportation and logistics, electronics, chemicals and others. Among which, 33% of the companies considered having a high level of digitization today, but the proportion would be increasing to 72% by 2020. Among the first movers into Industry 4.0, they expected to generate an increase in revenue and reduction of costs simultaneously by more than 30%. Overall, the surveyed participants expected to reduce operational cost by 3.6% and increase efficiency by 4.1% an-

nually until 2020. These companies also expected additional revenue of 2.9% annually until 2020.

Furthermore, in the PwC's 2016/17 Survey of APEC CEOs (PwC, 2016b) from companies of industrial, financial services, consumer and technology products, it is also revealed that the biggest benefit would be an improvement of operational efficiency or cost reduction, improved supply chain responsiveness, and customer experiences and relationship. The report concluded that a new wave of adoptees would push the Internet of Things (IoT) in Asia-Pacific Economic Cooperation (APEC) economies. In particular, nearly all CEOs being surveyed (a total of 1,040 participants) expected to deploy connected devices in at least one- or up to three-parts of their businesses. Over next years, 23% of the participants would adopt devices for tracking consumer preferences, shopping behaviour and geolocation. As

IoT systems become intra-connected effectively to sustain “system of systems” networks, benefits are likely to multiply. The second phase of IoT is expected to evolve over the next 15 years.

In fact, most APEC economies are well on their way to build IoT infrastructures, from the number of connected devices, to mobile penetration, to internet usage. Korea has a Master Plan for building the Internet of Things. Singapore aspires to be the first “Smart Nation”. China is building out machine-to-machine (M2M) ecosystems. Hong Kong SAR Government has announced the development of “Smart City” in its 2016 Policy Address.²

KEY ELEMENTS OF SUCCESS

The PwC global survey identified that firms would receive additional revenues from:

- (i) Digitising products and services within the existing portfolio;
- (ii) New digital products, services and solutions;
- (iii) Offering big data and analytics as a service;
- (iv) Modular, flexible and customer-tailored production concepts;
- (v) Personalised products and mass customisation;
- (vi) Capturing high-margin businesses through improved customer insight from data analytics; and
- (vii) Increasing scale of operation and market share of core products.

Also, the lower cost and greater efficiency would be generated from:

- (i) Real-time inline quality control based on Big Data Analytics;
- (ii) Real-time visibility into process and product variance;
- (iii) Maintenance on key assets using predictive algorithms to optimise repair and maintenance schedules and improve asset uptime;
- (iv) Vertical integration to real-time production planning for better capital (e.g. machines) utilisation and faster throughput times;
- (v) Horizontal integration, as well as track-and-trace of products for better inventory performance and reduced logistics;
- (vi) Digitisation and automation of processes for a smarter use of human resources and higher operations speed; and
- (vii) System based, real-time end-to-end planning and horizontal collaboration using cloud based planning platforms for execution optimisation.

DIFFICULTIES OF ADOPTING INDUSTRY 4.0 BY MSMEs

Industry 4.0 began in Germany as a government-backed digital revolutionary industrial policy and many large companies already introduced innovation. However, small and medium-sized enterprises (SMEs) are facing great uncertainties, as pointed out by Schroder (2017). In Germany, about 95% of all

companies are part of the Mittelstand and 690,000 SMEs are involved in production alone. Only 5% of Mittelstand manufacturing companies have networked their machinery, plants and systems across the board. The key reasons for such low penetration can be traced back to the following issues most of which are unsolvable by a SME by its own:

- (i) Lacking of Big Data and the Cloud for SMEs;
- (ii) No comprehensive strategy;
- (iii) Serious security concerns ;
- (iv) Fear of job losses; and
- (v) Shortage of skilled workers.

Objectives of this Study

This paper attempts to provide an overview of the government policy and programmes in Hong Kong that may play a direct and indirect role for the adaptation of Industry 4.0 by the MSMEs. Industry 4.0 is mainly about the full integration of digitalization with robotic production in manufacturing, facing the rapid changes in demand and the globalization of the supply chain. However, as every economy is having its own characteristics and at different stages of development, the zealous and sustainable attempt for local adaptation of the core value of Industry 4.0 is the essence of the issue.

The manufacturing sector in Hong Kong only accounts for less than 2% of GDP. However, many industrialists originated from Hong Kong are successfully operating in the Pearl River Delta (PRD) in the Mainland China for a long time, in various scales of operation. In terms of technology, many large firms (particu-

larly those operating in the PRD) are operating between Industry 2.0 and Industry 3.0, while the technology level of SMEs could be lower. The promotion of Industry 4.0 in MSMEs in Hong Kong would have positive demonstration and filtering effect into the PRD as well, thus affecting the entire global supply chain.

Hong Kong is mainly a service economy, with service sectors accounting for over 90% of GDP. The concept of Industry 4.0 could have a broader application to the upgrading and restructuring of various service sectors as well. It is mainly manifested as the application of IT (i.e. Internet of Things and Services) through the entire supply chain of the services provided, with enhancing efficiency of the firm and quality of services to customers as objectives. It is no doubt that the application of IT in large firms in Hong Kong has been very much entrenched and sophisticated, e.g. in commercial banks, logistics- and transport-related

companies including shipping and airlines, telecommunications, public utilities, departmental and grocery stores, public services, etc. However, there have also been comments that Hong Kong has been lacking behind the Mainland China (e.g. in financial services) and Singapore (e.g. in public services).

Needless to say, the full integration of Industry 4.0 and IT applications in Hong Kong for MSMEs in manufacturing and service sectors is still at its preliminary stage. There are several major issues to be addressed in this study:

- (i) How and to what extent has the Hong Kong SAR Government been promoting Industry 4.0 to MSMEs in Hong Kong?
- (ii) In particular, through what channels, the concept and best practices of Industry 4.0 have filtered through MSMEs in Hong Kong?
- (iii) How much and in what aspects have MSMEs in Hong Kong appreciated such technological and market development?

Although there has been no major official policy document in Hong Kong making direct policy reference to Industry 4.0, the policy of “reindustrialization” as highlighted in the 2017 Policy Address by the Chief Executive of Hong Kong SAR Government has pointed to the same direction. In paragraph 55 of the 2017 Policy Address (Hong Kong Government, 2017), it was highlighted that “the Government has also made a substantial investment of hk\$18b to enhance

Hong Kong’s innovation and technology ecosystem.³ These measures include promoting reindustrialization, funding universities to conduct mid-stream and applied research projects, subsidizing industry adoption of technology to upgrade and transform, and supporting start-ups”.

Reindustrialization in Hong Kong aims at a rapid growth of a new generation of high-value added manufacturing in Hong Kong and facilitating the transformation of Hong Kong industries to smart production. In terms of hardware, the Government is constructing an Advanced Manufacturing Centre and a Data Technology Hub in the Tseung Kwan O Industrial Estate, at a total cost of about HK\$8.2b. Through other public funding programmes and infrastructure such as the Hong Kong Science Park, the Government is promoting R&D in robotics, healthy ageing and smart city.

Moreover, many existing official programmes and the efforts of some semi-government organizations, and trade and professional associations are having similar effects. Indeed, the Hong Kong Productivity Council has pioneered the promotion and implementation of Industry 4.0 since 2013.⁴ Overall, it can be considered that the Hong Kong SAR Government adopts a multi-dimensional approach to promote Industry 4.0 and advanced IT applications to MSMEs in Hong Kong, including:

- (i) Setting up facilities to support MSMEs’ operations;
- (ii) Providing direct financial support

for MSMEs to upgrade their technology and restructure operations;

(iii) Providing demonstration and consultancy through semi-government organizations, (e.g. Hong Kong Productivity Centre);

(iv) Encouraging trade associations and professional bodies to enhance efficiency and quality of services (mainly through digitalization) which is the core value of industry 4.0; and

(v) Promoting awareness and relevant training.

In the following, we first introduce the overall MSME policies in Hong Kong. This is followed by highlighting the pioneer effort by the Hong Kong Productivity Council in promoting Industry 4.0 in the manufacturing industry. Subsequently, several relevant policies and schemes implemented by the Hong Kong SAR Government to promote innovation and IT applications would be reviewed. Again, the “Quality Award” Scheme organized by the Hong Kong Management Association is a very good example of public-private partnership to promote quality of services among MSMEs, mainly through enhancing leadership and IT applications. Lastly, the difficulties encountered by MSMEs in the Hong Kong logistics industry in adopting IT and other relevant technologies would be assessed, which could be illustrative and applicable to every sector in Hong Kong.

Overall MSME Policies in Hong Kong

SMEs accounted for about 98% of firms and 50% of the employment in Hong Kong.⁵ Hong Kong SAR Government had a long history to provide supports to SMEs, despite their business nature. MSME policies could be divided in two broad categories: general and specific. There are many types of general industrial policy adopted by the Hong Kong SAR Government over the years, including market liberalization, protection of intellectual property, strengthening the rule of law, promoting international trade and investment, deepening capital market development, providing vocational education, etc. They aim at enhancing the economic environment within which firms are operating.

In 1960, Hong Kong Government established the Hong Kong Export Credits Insurance Corporation, and then the Trade Development Council and Hong Kong Productivity Council in 1967. These are important semi-government

organizations providing financial, market information, technology and management services to SMEs.

Since 1997, the Government established many specific Funds and Schemes to support the development of SMEs in Hong Kong. Each of the schemes is designated to meet different business needs, such as guarantee for bank loans, sponsorship for export marketing activities, acquiring new technology and funding for SMEs' development projects (Law and Leung, 2017). In 2000, the Hong Kong SAR Government set up a high-level Small and Medium Enterprises (SME) Committee to advise on SME-related subjects. The Terms of Reference is "To advise the Chief Executive on issues affecting the development of small and medium enterprises in Hong Kong and to suggest measures to support and facilitate their development and growth."⁶ The SME Committee identified the following major issues

hindering the development of SMEs in Hong Kong.

(i) While encouraging SMEs to help themselves through self-enhancement, it would be necessary for the SME Committee to take serious look at the current support services and market opportunities available as well as the needs of SMEs identify the gaps left unfilled, including information gaps and mismatch of resources, and then come up with solutions.

(ii) The financial problems encountered by SMEs are to a considerable extent, attributable to the fact that many enterprises did not normally maintain an acceptable degree of transparency with their financial accounts and are therefore unable to provide the documentary proof required by financial institutions for loans.

(iii) The problems encountered by SMEs in human resources development and information technology applications are also partly due to a lack of interest or understanding about the importance of training on the part of the SME owners and their staff and the potential benefits from adopting information technology.

The (iii) point is particularly relevant for the promotion of Industry 4.0 among MSMEs. As most manufacturing factories are no longer located in Hong Kong, the relevancy to the adaptation of Industry 4.0 by MSMEs could be questionable. However, many industrialists originated from Hong Kong are successfully operating in the PRD. The promotion of Industry 4.0 in Hong Kong would have

positive spillover effects into PRD as well. Furthermore, the core value and concept of Industry 4.0, are also applicable to MSMEs in the service sectors in Hong Kong.

Hong Kong Productivity Council — Pioneering Industry 4.0 in Hong Kong

HKPC (established in 1967) is having the statutory responsibility to support and enhance the development of manufacturing industry and other economic activities in Hong Kong. This is a semi-government organization established by law. Since the inception of Industry 4.0 in Germany, HKPC has been working closely with Fraunhofer Institute of Germany to introduce Industry 4.0 in Hong Kong.

INDUSTRY 4.0 FOR THE MANUFACTURING

In the last few years, HKPC has been preparing to spearhead Industry 4.0 in Hong Kong.⁷ The major strategies adopted by HKPC to promote Industry 4.0 in Hong Kong are the following:

Establishing the Intelligent Manufacturing Technology Demonstration Centre

In order to promote Industry 4.0 in Hong Kong, HKPC has set up the Intelligent Manufacturing Technology Demonstra-

tion Centre, “3D Printing One” and “Robotics One” support centres to demonstrate some of the Industry 4.0 enabling technologies. HKPC is also planning to set up a similar Centre in Shenzhen of the Mainland China. The facility includes the following technologies:

- Flexible manufacturing, 3D printing, virtualization and human-machine interfacing;
- Wireless “Smart Meter” to monitor energy consumption of different devices;
- “Intelligent Planning and Scheduling System” to achieve automated optimal resource management in future factories;
- A “Digital Factory” with enabling sensors, systems and data analytics; and
- Partnering with software companies (e.g. with Epicor Software Corporation as a solution partner for its enterprise resource planning (ERP) and manufac-

turing execution system (MES) technology) to promote Industry 4.0.

Developing and Training Experts

A pool of certified trainers and experts (trained by Fraunhofer Institute for Production Technology, Germany) has been assembled to support local manufacturers in training and transition to the smart regime. Workshops, conferences, consultancy have been and will be organized to promote the awareness of Industry 4.0.

Providing Consultancy Services

HKPC will actively promote consultancy to the industry for transition into Industry 4.0. Consultancy would include training, technology assessment, planning strategy, launching pilot scheme, standard certification, etc. A certification scheme would be established together with Fraunhofer. HKPC and Fraunhofer have recently launched a new consultancy study, under the support of the SME Development Fund of the Government, to establish pilot schemes for toys, electronics, metal products and plastic products industries to attain Industry 4.0. Other industrial sectors would be included in subsequent studies.

Enhancing IT Support to Industry and Other Economic Sectors

Industry 4.0 would create new IT applications, implementation and protection requirement. HKPC would provide the necessary supporting services for firms to achieve Industry 4.0.

IT APPLICATIONS BY THE RETAIL SECTOR -- RETAIL TECHNOLOGY ADOPTION ASSISTANCE SCHEME

As for the retail sector, the Hong Kong SAR Government has also introduced policies to upgrade its operation by adopting IT applications. For example, the Task Force on Manpower Development of the Retail Industry was established by the government in 2013 and recommended an industry support scheme to address the manpower tightening problem faced by the retail industry. Approved in 2014, the government set aside HK\$50m for The Retail Technology Adoption Assistance Scheme (ReTAAS) to adopt relevant information and communications technology, and other technologies. The funding would enhance productivity and efficiency. HKPC is designated as the implementation partner of ReTAAS and served as the Secretariat.

Funding will be provided on a matching basis, i.e. the Government will cover a maximum of 50% of the total approved project cost. Up to two projects from a single applicant may be approved, subject to the cumulative ceiling of funding support of HK\$50,000. Any expenses directly related to the project can be funded. However, daily operating costs (e.g. the salary for employee, office rent, general administrative and office expenses, etc.) are not eligible for funding. A list of typical technologies for manpower management would include the following:

- (i) POS (point-of-sales) system;
- (ii) Inventory system;

- (iii) Electronic payment system; and
- (iv) Radio-frequency identification (RFID) system.

HKPC will handle enquiries, process applications, support a Vetting Committee, monitor project implementation, effect payments and evaluate overall effectiveness of ReTAAS. As at the end of November 2016, there were about 200 applications, involving HK\$7.3m funding.⁸

The HKSAR Government — Multi-Dimensional Approach to Promote Industry 4.0 and IT Applications

Overall, it can be considered that the Hong Kong SAR Government adopts a multi-dimensional approach to promote Industry 4.0 and advanced IT applications to MSMEs in Hong Kong.

THE TRADE AND INDUSTRY DEPARTMENT - MANY SCHEMES PROVIDING FUNDING SUPPORT TO MSMEs FOR TECHNOLOGY ENHANCEMENT

The Hong Kong SAR Government, under the Trade and Industry Department in particular, introduced the following major MSME schemes to promote upgrading of technology and restructuring of operation since 1997:

(i) In the early 2000s, the SME Development Fund was set up to provide financial support to non-profit organizations to implement projects which aimed to enhance the competitiveness of Hong Kong's SMEs. Projects could include seminars, workshops, conferences, exhibitions, research studies, award

schemes, codes of best practices, databases, service centres, support facilities and technology demonstration, etc. The maximum amount of funding support for each approved project is HK\$5m, or 90% of the approved project expenditure.⁹ The applicant has to contribute the remaining 10% of the project expenditure, which may be in cash, in kind or in the form of sponsorship.

(ii) A SME Loan Guarantee Scheme was set up in 2001 and aimed at helping SMEs securing loans from banks for acquiring business installations and equipment, and meeting working capital needs of general business used. The amount of guarantee for an SME is 50% of the approved loan, subject to a maximum amount of HK\$6m. The Scheme has been extended and expanded several times. The total amount of guarantee committed by the Hong Kong SAR Government was about HK\$24b in 2016.¹⁰

(iii) In recent years, a “Small Entrepreneurs Research Assistance Programme” was established, providing dollar-to-dollar matching grants up to HK\$2m per project to help small start-ups to turn innovation and technology ideas into commercially viable products, processes or services. The funding ceiling increased to HK\$6m in 2012. From 1999 to 2014, the number of approved projects under the Programme was 416 and HK\$508.2m was granted.¹¹

(iv) The Government also set up a “Dedicated Fund on Branding, Upgrading and Domestic Sales” of HK\$1b in June 2012. The Fund aims to provide funding support to assist firms in exploring and developing the Mainland market through developing brands, upgrading and restructuring operations, and promoting domestic sales in the Mainland. Funding will be provided on a matching basis, i.e. the Government will cover a maximum of 50% of the total amount approved. The maximum funding for each firm is HK\$500,000 and each funded project is required to be completed within 24 months.¹²

The SME Development Fund is particularly important mainly because of its flexibility. Any projects that could enhance the competitiveness and quality of services of SMEs of a certain sector or as a whole (not for the benefit of an individual firm) can apply. These enhancement projects for SMEs could draw on the expertise and collaboration from semi-government organizations, tertiary institutions, NGOs, trade and business associations, think tanks, etc. In the fol-

lowing, we provide a selected number of recent projects which are relevant for the promotion of industry 4.0 in Hong Kong for reference:¹³

(i) Hong Kong Far Infrared Rays Association Limited, “A Far InfraRed Technology and Reliability Support Programme for Hong Kong Industries” (project #: D09001023).

(ii) Hong Kong Polytechnic University, “Workflow Management Best Practices in Electronics Industry” (Chinese version only) (project #: D10001004).

(iii) Hong Kong Polytechnic University, “Information Technology—Integrated Logistics Strategies Best Practices” (Chinese version only) (project #: D10001004).

(iv) Federation of Hong Kong Industry, “Challenges, Opportunities and Strategic Responses of Logistics SMEs under the National 12th Five-Year Plan” (Chinese version only) (project #: D12001004).

THE INNOVATION AND TECHNOLOGY BUREAU - THE TECHNOLOGY VOUCHER PROGRAMME

The Innovation and Technology Bureau introduced a “Technology Voucher Programme” (TVP) in 2016. The TVP is a new pilot scheme under the Innovation and Technology Fund (ITF) to subsidise local SMEs in using technological services and solutions to improve productivity, or upgrade or transform their business processes. This would also provide business opportunities to technological service providers.¹⁴

The programme would be implemented on a pilot basis for an initial period of three years from 2016, with an initial funding of HK\$500m. The ITF was established in 1999 under the Tung's Government to finance projects to promote innovation and technology upgrading in manufacturing and service industries. The Government estimated that TVP would benefit up to 2,500 SMEs with adopting technological services and IT solutions in their operations.¹⁵

Under the TVP scheme, eligible companies must fulfil the requirements for the company to be classified as an SME, i.e. a manufacturing company having less than 100 employees and less than 50 employees for a non-manufacturing company, with at least one full year of operations. Each SME may receive a cumulative funding up to HK\$200,000 on a 2:1 matching basis for a maximum of three projects. The applicant enterprise must contribute no less than one third of the total approved project cost in cash. Each project should normally be completed within 12 months.¹⁶

Given the rapid development of technologies, the TVP has not defined the types of technological services that can be subsidised. SMEs are encouraged to examine their business operations and identify necessary technologies to address business challenges in order to improve productivity, or upgrade or transform their business processes. TVP funding could cover:

- (i) Technology consultancy;
- (ii) Purchase, rental or subscription of

customized equipment/hardware, software and technological services or solutions that form an essential part of the project;

(iii) Purchase, rental or subscription of off-the-shelf/readily available equipment/hardware, software and technological services or solutions that form an essential part of the project (this item should not constitute more than 50% of the project's cost); and

(iv) Project auditing for projects with approved funding exceeding HK\$50,000 (the maximum audit fee to be counted towards the total project cost is HK\$3,000).

The assessment criteria of TVP projects include the relevance of the proposed project to the applicant enterprise's business, reasonableness of the budget, reasonableness of the implementation details and performance records of consultants and/or service providers. As at the end of January 2017, 836 SMEs have registered on the TVP website. Among the first two batches of 23 eligible applications, 21 were supported for funding, with a success rate of over 91%. The total funding approved was about HK\$2.8m, averaging about HK\$130,000 per project.¹⁷

THE OFFICE OF GOVERNMENT CHIEF INFORMATION OFFICER - THE SME CLOUD PROMOTION CAMPAIGN

The SME Cloud Promotion Campaign (CPC) was organised by the Office of the Government Chief Information Officer ("OGCIO") during the period December

2014 to June 2015. The CPC aimed at increasing awareness of the benefits of cloud computing and how to select the relevant cloud platform to fit each SME's needs. InfoCloud is a portal platform, which was launched under the CPC on 18 December 2014. It was a collaborative effort with members from the Expert Group of Cloud Computing Services and Standards.

The InfoCloud platform aimed to provide enterprises, mainly targeted at SMEs, with accessible information and resources on cloud computing technologies as well as samples, guidelines and best practices used to achieve desired benefits in implementing cloud computing. The Platform also provided an estimate of 40 free training courses and materials for SMEs categorised in six different sectors, which included retail, catering, import and export trade, logistics and land transport, sales and marketing as well as HRM and accounting. It was estimated that the CPC could have benefitted up to 3,800 SMEs practitioners.¹⁸

The Hong Kong Management Association—The Quality Award Scheme

In the promotion of Industry 4.0 and advanced IT applications, the initiation by the private sector and enhancement of public-private partnership are very important. For example, the “Quality Award Scheme” organised by the Hong Kong Management Association (HKMA) since 1991, which is supported by the Government, is definitely having the appreciable impact. The Scheme is to bring public recognition to those business organisations that have achieved outstanding standards of quality and made a lasting commitment to the process of quality management. In particular, a “Special Award for SMEs” category was established in 2005 to encourage their pursuit of Total Quality Management. There are seven criteria for assessment that embody the core values of quality (based on the Baldrige Criteria for Performance Excellence: leadership, strategy, customers, measurement and analysis and knowledge measurement, workforce, operation and results).¹⁹

Concepts of industry 4.0 theoretically can penetrate in all the above seven criteria. The adaptation of the concepts of industry 4.0 can be found in large companies. For example, in 2017, HKMA presented an excellent award to The Dairy Farm Company Ltd that operated more than 300 supermarkets in Hong Kong.²⁰ To be responsive to their customers, Dairy Farm adopted a multi-channel approach to reach customers, followed by research and data analytics leading to customer satisfaction. This is achieved by well developed IT systems for sharing information and knowledge. The company increased IT investment by more than 30% in the past 4 years, indicating a vivid example of the concept of Industry 4.0 in action and the Internet of Things and Services in practice. Besides investments in reporting and data infrastructure, other innovative IT applications include special mobile device apps for checking product’s expiry dates in stores, “e-allocation system” to adjust

each store's required product volumes, and "flow-through" and "batch picking" supply models. Along with support from the Supply Chain Optimization Centre, the system ensures an efficient "Go-to-Market Process". The concept of Industry 4.0 also showed up in workforce management, E-library and E-learning system which are created for knowledge sharing and employee learning. An internal Pioneers Hub via social media is established for circulation of best practices and encouraging innovation through the Store Efficiency Enhancement Projects.

THE 2017 QUALITY AWARD TO SMEs

In 2017, the "Special Award for SMEs" was offered to four companies. The following abstracts are mainly drawing from the "Reports from the Board of Examiners" for reference.²¹

Case 1 - Antonhill Company Limited

Antonhill (established in 1981) is a pioneer in providing one-stop services on corporate uniform solutions. It has around 15 staff in its Hong Kong office and around 150 in its factory in Dongguan, the Mainland China. Its ERP system provides efficient process and production management. This permits a comprehensive overview of customer requirements. With effective resource planning, flexible production and choice of latest clothing materials, Antonhill is capable of meeting urgent customers' needs at a short notice.

Case 2 - Arnhold & Co. Limited

Arnhold was founded as a trading com-

pany in 1966. It is headquartered in Hong Kong, a leading name in building materials and engineering equipment distribution. It has sales offices in Macau and Shanghai and a stone-processing factory in Dongguan, the Mainland China. It also provides maintenance and sourcing services. Arnhold has established itself as a world-class supplier of decorative stone products. Its portfolio of brand name products and the recently developed own brand products are well-received by the market.

An ERP system was installed to control all-round operational functions, including product ordering, order process, payment, inventory control, delivery schedule and order record. Data from the ERP system are used to study project flow, market trends and stocking position. A strong accounting and financial management system is in place as well. SWOP analysis is employed for analysing the information collected from the market, customers, trade exhibitions and overseas suppliers. Key Performance Indicators are also formulated and analysed. It is admirable that about half of staff have been servicing the company for more than 10 years.

Case 3 - Ultra Active Technology Limited (UATL)

UATL is a top ranking company in Video Conference market (founded in 1997) and the distributor of Polycom Video Conferencing Solutions (a leading brand in the industry). Its businesses cover sales, design, installation and maintenance services. The company's key

customers are large corporations, education institutions and public organizations. UATL has a workforce of more than 40, with 75% attaining tertiary education.

A sophisticated ERP system has been developed to keep track of business performance, operation control and plan execution. It is a strong on-line system with real time work flow processing and financial accounting updating system. Data are instantly mapped into different categories for top management's review. UATL is also certified with ISO 9001:2008 and ISO 14001:2004.

Case 4 - Well Synergy International Ltd (WSIL)

WSIL (founded in 2011) is a leading marketing and distribution firms for fast-moving food items. It is the sole authorised distributor for many international brands. These key brands are having more than 70% of the retail market. The management team is formed by sales and marketing experts with over 20 years of experience. An advanced ERP system creates reports and KPI to monitor the sales performance. The comprehensive database leads to business expansion and improvement in efficiency.

SUCCESSFUL FEATURES OF SMES RECEIVING THE QUALITY AWARD

The success of these SMEs in Hong Kong proved to sustain the following features:

- (i) Establishing for many years;
- (ii) Promoting of corporate culture from the top management;

- (iii) Adopting an advanced ERP system;
- (iv) Good communication with customers;
- (v) Forward looking at market trends and potentials based on data analysis;
- (vi) Sustaining quality of services;
- (vii) Dedicated workforce; and
- (viii) Display social responsibility.

The initiations by trade and professional organizations and strengthening of public-private partnership are very important for promoting and achieving Quality Excellence which is the core value of Industry 4.0 as well. Well-established business awards, conferences, exhibitions, training programmes, etc. would have a sustainable impact on attaining excellence by MSMEs.

Difficulties in Adopting IT and other Technologies by MSMEs in Hong Kong -Experience of the Logistics Sector

Although we have reported some successful cases of application of the concept of Industry 4.0 to SMEs in Hong Kong, most other SMEs are having serious difficulties to follow the market development. According to a Report published by the Federation of Hong Kong Industry (2013), the adoption of new technologies (including barcode, QR Code, ERP system, radio frequency identification, digital-trade-transport-network system, warehouse management system, ROCARS by HK Custom Department, e-freight and e-Air Waybill by ITAT, cloud technology, etc.), by the SMEs in the logistics sector was relatively low in Hong Kong, due to the following major reasons:

- (i) SME firms do not have the capability to understand the benefit of the technology. They do not have the capability to choose, follow the development, implement and maintain the IT products.
- (ii) SME firms do not have the financial

resources to adopt the technology. They are mainly serving the low-end market, competing on prices without customer loyalty. (According to the trade information, a simple ERP system for the retail sector could easily cost US\$25,000).

- (iii) The market does not have suitable and cost-effective products for SMEs. For example, ready-made ERP products could not be easily adapted for the requirement of MSMEs in Hong Kong.
- (iv) SMEs would worry about the security of IT products. They do not have confidence in the reliability and sustainability of these products.
- (v) Without the cooperation of partners at the various stages of the supply chain, it is impossible for the SME logistics companies to initiate the adoption of certain IT and electronic technology, which should be user-friendly and cost effective to other relevant partners as well.

(vi) Large institutions (e.g. government departments, IATA, national and international payment systems, etc.) are introducing different and non-compatible platforms and systems. SMEs do not have the capability to participate into them effectively and efficiently.

These features are likely to be the case for most MSMEs involving in many other sectors in Hong Kong, which is also similar to the findings of the PwC Study (see Section 2.3).

Concluding Remarks and Ways Forward for APEC

The journey for modernization towards Industry 4.0 (and the Internet of Things and Services as well) is an evolutionary process, particularly for MSMEs. As every APEC economy is having its own characteristics and at different stages of development, the dedication for local adaptation of the core value of Industry 4.0 by the Government is the essence of the issue. Hong Kong is mainly a service economy. This is also true for the urban sector of the APEC economies. Other than direct applications to the manufacturing sector, the concept of Industry 4.0 could have a broader application to the upgrading and restructuring of various service sectors as well. It is mainly manifested as the application of IT (i.e. the Internet of Things and Services) through the entire supply chain of the services provided, with enhancing efficiency to the firm and quality of services to customers as objectives. Overall, it can be considered that the Hong Kong SAR Government adopts a multi-

dimensional approach to promote Industry 4.0 and advanced IT applications to MSMEs in Hong Kong. It is no doubt that the application of IT in large firms in Hong Kong has been very much sophisticated. However, IT solutions to large firms in service sectors would not be easily applicable to MSMEs.

The pioneer effort by the Hong Kong Productivity Council in promoting Industry 4.0 to the manufacturing sector of Hong Kong is only at its very preliminary stage. The Hong Kong SAR Government have implemented many other schemes and policies to promote IT applications by MSMEs in various service sectors. Professional and business organizations are also playing a crucial role in the restructuring. As there is no blue print for success, some public funding schemes seem to operate under a trial-and-error basis. MSMEs are facing tremendous problems to implement "Internet of Things and Services"

and other relevant technologies. Their results have not been evaluated comprehensively yet.

In the APEC economies, the flourishing urban sector which is the engine of growth, is also mainly service oriented. A parallel concept of “Service 4.0” for MSMEs would be relevant for policy considerations with urgency. APEC member economies could establish the platform for exchange of experience, and establish the standards and road map for the development of MSMEs in service sectors in due course.

References

- Federation of Hong Kong Industry, (2013), Challenges, Opportunities and Strategic Responses of Logistics SMEs under the National 12th Five-Year Plan (Chinese version only), published by Federation of Hong Kong Industry.
- Hong Kong Government, (2017), 2017 Policy Address, (18/1/2017).
- Kagemann, H, Wahlster, W and Helbig, J, (2013), Securing the Future of German Manufacturing Industry: Recommendations for Implementing the Strategic Initiative of INDUSYRIE 4.0, Final Report of the Industrie 4.0 Working Group, Plattform Industrie 4.0, April, 2013.
- Law, Cheung-kuok and Leung, Michael, (2017), The Development of MSME Policies in Hong Kong, APEC Study Centre, the Chinese University of Hong Kong, 2017-05 Working Paper Series—01.
- PwC, (2016a), Industry 4.0: Building the Digital Enterprise, PwC's 2016 Global Industry 4.0 Survey.
- PwC, (2016b), Internet of Things: New Wave of Adoptions to Push Connected Devices to Center of Business in Asia Pacific, PwC's 2016 APEC CEO Survey.
- Schroder, C., (2017), The Challenges of Industry 4.0 for Small and Medium-sized Enterprises, FES.

End Notes

- ¹ A comprehensive review of the concept of Industry 4.0 can be found in Kagemann, Wahlster and Helbig (2013).
- ² Hong Kong Government. 2016 Policy Address. Paragraph 84.
- ³ US\$1 = HK\$7.80.
- ⁴ Hong Kong Productivity Council. <http://www.hkpc.org>.
- ⁵ Manufacturing firms employing less than 100 persons and non-manufacturing firms employing less than 50 persons in Hong Kong.
- ⁶ Trade and Industry Department. Small and Medium Enterprises Committee (SMEC). Retrieved from <http://www.tid.gov.hk/english/aboutus/advcommittee/smecMembershipList.html>; Small and Medium Enterprises Committee. 2001. A Report on Support Measures for Small and Medium Enterprises. Retrieved from https://www.tid.gov.hk/english/aboutus/publications/smes/smes04_chapter2.html.

- ⁷ Hong Kong Productivity Council. <http://www.hkpc.org>.
- ⁸ Legislative Council. 2017. "Policy Initiatives of Commerce, Industry and Tourism Branch, Commerce and Economic Development Bureau." Retrieved from <http://www.legco.gov.hk/yr16-17/english/panels/ci/papers/ci20170125cb1-464-3-e.pdf>.
- ⁹ Legislative Council. 2015. "Funding Injection and Enhancement Measures for SME Development Fund and SME Export Marketing Fund." Retrieved from <http://www.legco.gov.hk/yr14-15/english/panels/ci/papers/ci20150616cb1-971-5-e.pdf>.
- ¹⁰ Trade and Industry Department. "SME Funding Schemes - Statistics." Retrieved from https://www.smefund.tid.gov.hk/english/sgs/sgs_statistics.html.
- ¹¹ Innovation and Technology Commission. 2017. "Innovation and Technology Fund: Statistics of Approved Projects." Retrieved from <http://www.itf.gov.hk/l-eng/StatView101.asp>.
- ¹² Hong Kong Productivity Council. "Enterprise Support Programme." Retrieved from <http://www.bud.hkpc.org/>.
- ¹³ Trade and Industry Department. "SME Development Fund - List of Project Results." Retrieved from https://www.smefund.tid.gov.hk/english/sdf/sdf_deliverables.html.
- ¹⁴ Information Services Department. 2016. "Technology Voucher Programme Opens for Application". Retrieved from <http://www.info.gov.hk/gia/general/201611/21/P2016112100458.htm>.
- ¹⁵ Information Services Department. 2016. "Voucher Scheme Set for SMEs". Retrieved from http://www.news.gov.hk/en/categories/finance/html/2016/02/20160225_134803.shtml.
- ¹⁶ Innovation and Technology Commission. "Technology Voucher Programme (TVP)." Retrieved from <http://www.itf.gov.hk/l-eng/TVP.asp>.
- ¹⁷ Legislative Council. 2017. "Technology Voucher Programme and Government Policy on Procuring Information and Communications Technology Products." Retrieved from <http://www.legco.gov.hk/yr16-17/english/panels/ci/papers/ci20170221cb1-555-3-e.pdf>.
- ¹⁸ Information Services Department. 2015. "SME Cloud Competition Recognises Exemplary Cloud Computing Adoption by SMEs." Retrieved from <http://www.info.gov.hk/gia/general/201506/11/P201506110463.htm>.
- ¹⁹ Hong Kong Management Association. "HKMA Quality Award." Retrieved from <https://www.hkma.org.hk/qa/award.htm>.
- ²⁰ Hong Kong Management Association. "HKMA Quality Award." Retrieved from <https://www.hkma.org.hk/qa/award.htm>.
- ²¹ Hong Kong Management Association. "HKMA Quality Award." Retrieved from <https://www.hkma.org.hk/qa/award.htm>.



APEC Study Centre

Policy for Promoting MSMEs Modernization towards Industry 4.0

IN HONG KONG, CHINA

The first three industrial revolutions developed as a result of mechanization, electricity invention and applications of information technology (IT). The 3rd industrial revolution started with the first programmable control system automating production in 1969. Since then, a continuous technological breakthrough in engineering, computer and IT led to the 4th industrial revolution which was termed "Industry 4.0" in 2011.

This paper attempts to provide an overview of the government policy and programmes in Hong Kong that may play a direct and indirect role for the adaptation of Industry 4.0 by the MSMEs.

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