

Lai, J.H.K., Tu, K.J., Lian, J.K.M. and Kim, J.H. (2019), Facilities management education in the Four Asian Dragons: a review, *Facilities*, Vol. 37 No. 11/12, pp. 723-742. <https://doi.org/10.1108/F-06-2018-0066>

## **Facilities management education in the Four Asian Dragons: a review**

### Structured abstract

#### **Purpose**

This paper aims to reveal and compare the characteristics of the facilities management (FM) education programmes in Hong Kong, Taiwan, Singapore and South Korea (i.e. the Four Asian Dragons), and make suggestions for their future development.

#### **Design/methodology/approach**

A team consisting of academics from the Four Asian Dragons held a face-to-face meeting to discuss and define the scope and framework of the review, followed by an extensive search to identify literature and information germane to the study. Individual parts of reviews, prepared by the team members for their respective places, were cross-reviewed before refinement and consolidation into the current paper.

#### **Findings**

The term ‘facility (or facilities) management’ appears in most of the programmes reviewed but terms such as ‘environment’ and ‘property’ also appear in some programmes’ titles. The programmes reviewed range from certificate level to doctorate level; those between diploma level and master level are more common. Most of the programmes have obtained professional accreditations, but some are accredited by FM-related rather than FM-specific professional bodies.

#### **Research limitations/implications**

Further research should investigate issues such as the performance of the programmes reviewed, extent to which they have met the market needs, and how they compare with the counterparts in other regions (e.g. Europe, America). For such research, the process of the study reported here and its findings about the *status quo* of the programmes can serve as references.

#### **Practical limitations/implications**

To strengthen FM as a well-established discipline, it is imperative to have the programmes accredited by FM-specific professional bodies.

#### **Originality/value**

Providing the first-ever international review on the major FM programmes in Asia, this paper is useful to programme planners, educators and researchers in the FM field.

#### **Paper type**

Literature review

#### **Keywords**

Education; facilities management; professional institutes; research; teaching; universities

## **Facilities management education in the Four Asian Dragons: a review**

### **Introduction**

Facilities management (FM), a discipline that integrates people, place, process and technology for efficient delivery of support services, is indispensable for every organization in the built environment. In the 1970s, FM emerged as a profession in the United States (US) and then extended to the United Kingdom (UK) and places around the world (Best et al. 2003). In the 1990s, FM started to grow in Asia (Lomas, 1999; Moore and Finch, 2004). As the FM market continues to expand, professional organizations such as the International Facility Management Association (IFMA) headquartered in the US, the British Institute of Facilities Management of the UK and the European Facility Management Network (EuroFM) have been established. In parallel, the increasing demand for FM professionals has intensified the need for FM education.

Involving teaching and research, FM education has taken root in the higher education sectors (Drion et al. 2012). Across the world an estimated 50+ universities now provide FM education at undergraduate, graduate and in some cases at doctor of philosophy (PhD) level. In Architecture, Engineering, Building Construction Management, Real Estate and Management/Business schools, FM has been a growth field (Roper, 2017). Based on the recent developments in the field, FM largely meets the criteria for qualifying as an academic discipline (Junghans and Olsson Nils, 2014).

Over the years, various studies on higher education for the built environment sector have been conducted. For instance, the study of Durning and Jenkins (2005) sought to reveal the teaching/research relations from the perspectives of built environment academics. The research of Lai (2010) investigated the education needs for building operation and maintenance in Hong Kong. Based on a critical review and the lessons drawn from experience in international development, Koehn and Uitto (2014) elaborated a framework for assessing higher-education curricular, research, and community-outreach programmes devoted to sustainability. Through developing a competency mapping framework for quantity surveying programmes, the research of Perera et al. (2017) aimed to improve the alignment between the UK's higher education in construction and what is sought by the construction industry.

To date, however, there have been no reports that provide a comparative analysis of the major FM higher education programmes in Asia. To plug this niche area, a study was initiated by an international team to review the FM programmes in the higher education sector of Hong Kong, Taiwan, Singapore and South Korea - the Four Asian Dragons with highly-developed economies and highly-educated workforce. According to Vogel (1993), the Asian Dragons together with Europe and North America are the three pillars of the modern industrial world order. The study aimed to provide a contemporary portrait of the FM education programmes in the four places, compares the characteristics of the programmes, and make suggestions for their future development. Such results, in addition to contributing to the body of knowledge related to FM education programmes, are useful information for stakeholders including educators and policy makers in the FM community.

The next section recounts the method used and the materials collected for the purpose of the study. Then, the demand and professional bodies of FM in the four places are reported, followed by an examination on, and comparisons between, their major FM higher education programmes. At the end are the conclusions drawn from the study, based on which suggestions are made for the sustainable development of FM education.

## **Method and materials**

At the beginning, the lead author lined up three other academics (i.e. the co-authors) to form a project team for the study, with each team member coming from one of the Four Asian Dragons. Working for reputable universities, the four members are conversant with the FM sector. The key roles they play include leader of FM or FM-related education programmes and president or committee of FM associations in their respective places.

During a face-to-face meeting, the team members discussed the purpose and scope of the project. Aimed at producing a paper that provides a clear picture of the FM higher education programmes in the four places, the main questions asked include: What sorts of programmes are the targets of this review study? From what sources the information about the programmes can be retrieved? What elements of the programmes are to be covered in the review process? How to accomplish the study, including what are the roles and duties of each of the team members? After discussion and upon agreement among the team members, a list of the tasks

required for the study, a list of the programme elements to be reviewed and an outline structure of the paper were prepared. To ensure an effective process for the project, a schedule indicated with deadlines for each task was set. Having agreed on the above items, the project team carried out the research works required through a desktop study.

To achieve the study's objectives and, in view of the nature of the study, an extensive literature search was conducted. In doing so, the following tasks were carried out for each of the four places. First, the websites of public bodies (e.g. government bureaus, authorities), FM associations and professional institutions related to FM (e.g. property management, real estate management) were visited in order to identify reports and statistics on property, manpower, etc. that are germane to the study. Second, where data such as membership size of the professional institutions could not be obtained from the first task, emails were sent to the respective institutions to request for the data needed. Third, a search was made on the website of the IFMA Foundation, which accredits and recognizes FM higher education degrees (IFMA Foundation, 2017). The purpose of this search was to identify any of the accredited FM programmes belonging to the four places and the institutions offering such programmes. Fourth, on the website of the Education Bureau or Ministry of the respective place where the registered education programmes were listed, those with a title bearing "facility management", "facilities management", "property management" or "real estate management" were identified, and the institutions offering such programmes were recorded. Fifth, a further search was made to the website of each of the institutions. Through this process, programme information (e.g. level, duration, study and funding modes, accreditation/certification body) displayed on webpages or contained in electronic pamphlet/brochure was collected. Sixth, keywords including facility (facilities) management, building management, property management, built environment, construction, program (programme) review, competence (competency) were used to search publications from two academic FM journals (i.e. *Facilities* and *Journal of Facilities Management*) and education journals including *Studies in Higher Education*, *Higher Education*, *The Review of Higher Education*, and *The Journal of Higher Education*.

The materials identified from the above were reviewed in accordance with the list of elements mentioned earlier. Such elements, for showing the FM market demand and the scales of FM/FM-related professional institutions in the four places, include building stock, property price, manpower, and membership sizes of the institutions. For the materials pertaining to the

FM education programmes, the elements reviewed include offering institution (e.g. university, polytechnic), programme title, funding mode, study mode, professional accreditation/recognition and duration of study. After these processes, key findings of the elements reviewed were consolidated for analysis, followed by making discussions on the comparative findings of the four places.

In preparing this paper, each of the team members was responsible for writing the part corresponding to his place. Throughout the project period, the drafts of the individual parts were circulated for comment among the team members. Subsequent to this peer-review process, the lead author collated, refined and edited the various parts to become the manuscript of this paper.

## **Demand and professional bodies of FM**

### ***Hong Kong***

Located at the south-eastern tip of China, Hong Kong is a metropolis with a population of over 7.3 million. According to the Census and Statistics Department (2016), the stock of permanent living quarters has increased from 2,431.2 thousands in 2005 to 2,695.6 thousands in 2015. The stock of private non-domestic premises has also expanded, from 43,927 thousand sq.m in 2005 to 46,425 thousand sq.m in 2015. The property value of Hong Kong is one of the highest in the world. For example, in Central (a central business district), the average price of Grade A private offices in 2015 was HK\$354,300/sq.m (or US\$45,423/sq.m; US\$1 $\approx$  HK\$ 7.8).

The real estate services industry, one of the major economic pillars of Hong Kong, embraces property management and maintenance (PMM) as one of its five sectors. While there is no specific statistics on FM manpower, the PMM sector, which is largely about FM, employed most (64%) of the manpower of the real estate services industry. In 2015, the number of PMM vacancies was 1817, which doubles the vacancies in 2005 (Vocational Training Council, 2005; 2015).

Professional institutions, particularly the International Facility Management Association, Hong Kong Chapter (IFMA-HKC) and the Hong Kong Institute of Facility Management (HKIFM),

were established in 1992 and 2000 respectively. The IFMA supports 24,000 members in 104 countries. Among the 600 IFMA members in Hong Kong, around 380 have joined the local chapter (i.e. IFMA-HKC). The HKIFM, based in Hong Kong, has a membership size of over 400.

### *Taiwan*

Taiwan has a land area of about 36,000 km<sup>2</sup> and a population exceeding 23 million. According to the Ministry of Interior, the annual total floor area of construction permits issued decreased from the recent peak of 39,760 thousand sq.m in 2013 to 32,596 thousand sq.m in 2015 (Construction and Planning Agency, 2015). But the number of housing units increased from 6,993 thousand in 2000 to 8,074 thousand in 2010 (Directorate-General of Budgeting, Accounting, and Statistics, 2011).

Figure 1, which depicts an overall picture of the development framework of Taiwan's property management (PM) or facility management (FM) industry, illustrates the relationships between (1) the demand and supply sides of the market, (2) the public authority, (3) the professional certificates, (4) the professional institutions, and (5) the educational systems.

“Insert Figure 1 here”

1. Demand and supply sides (Figure1-❶): The term ‘PM service provider’ was not legalized in Taiwan until 1996 when the Condominium Management Act was enacted. After 20 years of development, there were 680 registered PM service companies (Yen, 2014). The major consumers of PM services are the commissions of private residential properties while the FM departments of certain institutions or non-private-residential properties are in the minor group.
2. Public authority (Figure1-❷): The Construction and Planning Agency, Ministry of Interior (CPAMI) administers the Condominium Management Act, which mainly regulates the rights of strata title in residential properties and the minimum professional level of PM service companies.
3. Professional training programmes and certificates (Figure1-❸): The CPAMI has established three types of entry level (level 1) PM training programmes, which are offered

by some qualified professional PM institutions. As of December 2014, there were 67,808 PM practitioners granted with either one of the three types of certificates (Yen, 2014).

4. Professional institutions (Figure1-4): The Taiwan Institute of Property Management (TIPM), established in 2006, is the most representative FM-related professional institution in Taiwan and it has 120 individual members, 16 group members and six student members. The TIPM has defined an advanced level (level 2) of professional PM competencies for on-site PM managers. Besides, the Royal Institution of Chartered Surveyors (RICS) has set up a branch in Taipei to recruit professional FM practitioners as members.

### *Singapore*

Singapore has a land area of 719.1 sq. km with a total population of 5.54 million. In 2015, there were 1,323 thousand dwelling units and 57,879 thousand sq.m of commercial and industrial properties (Singapore Department of Statistics, 2016). In the first quarter of 2017, the median price of office space in the Central Area was S\$12,121/sq.m (or US\$8,658/sq.m; US\$1  $\approx$  S\$1.4), which is 38% higher than it was ten years ago (Urban Redevelopment Authority, 2017). Over the same period, the median price of non-landed residential properties in the Core Central Region increased by 26%, to US\$10,649/sq.m.

The Real Estate Services Industry employed 90.7 thousand persons in 2015. (Singapore Ministry of Manpower, 2016). According to the Singapore Standard Industrial Classification 2010, this includes residential, commercial and industrial real estate management, valuation, letting and operating of real estate (Singapore Department of Statistics, 2010). Security and cleaning services are grouped under Administrative and Support Services Activities.

Singapore has a national target for green buildings – at least 80 percent of buildings will be green buildings by 2030 (Singapore Building and Construction Authority, 2014). The first Green building masterplan in 2006 focused on ‘greening’ new buildings, the second in 2009 focused on ‘greening’ existing buildings. The third Green building masterplan launched in 2014 focuses on building tenants and occupants, promoting reduction in energy consumption and improved indoor environmental quality. In order to achieve this, there is a need to increase the number of green specialists (including facilities managers) to serve the growing green building industry (Singapore Building and Construction Authority, 2014).

The Association of Property and Facility Managers (APFM), established in 1995, has a membership of about 100 (Association of Property and Facility Managers, 2017). The Association has a Certified Property and Facility Manager (CPFM) Scheme with two categories. Besides, IFMA has a Singapore chapter that began in 2000 (International Facility Management Association, 2017). In 2016, it gave awards in various categories: Best FM Building Owner/Facility Occupier and Best FM Service Provider.

### ***South Korea***

Located on the peninsula at the eastern end of the Asia continent, the republic of Korea has an area of 99,720 sq.km (CIA, 2017) and a total population of 51,753,820 (Ministry of Interior and Safety, 2017). The capital city, Seoul, has an area of 605 sq.km. It accommodates about one fifth of the total population (Seoul Statistic, 2017).

The major business districts of Seoul are divided into three parts: ‘Urban areas’ including Jongno-gu/Jung-gu, ‘Gangnam areas’ including Gananam-gu/Seocho-gu, and ‘Yeouido areas’ including Yeouido/Mapo area. These areas accounted for 81.2% of the total office spaces in Seoul: 23% (Urban areas), 40.8% (Gangnam areas), and 17.4% (Yeouido areas).

The average rent of office space in Seoul is ₩116,040 per pyeong (or US\$102 per pyeong; US\$1 ≈ ₩1,137 and 1 pyeong = 3.3 sq.m). The urban, Gangnam and Yeouido areas are recorded with a rental level of US\$121, US\$105 and US\$92 per pyeong, respectively (Genstar, 2017). The sale price per pyeong of office space has increased over the years, from US\$8,320 in 2006 to US\$1,768 in 2016 (Table 1).

“Insert Table 1 here”

While having a large volume of office spaces, only 17.8% of domestic office buildings are managed by specialized asset management companies. The rest of the buildings are managed by in-house management team (42.8%) or co-sourcing management team (38.8%). This

indicates that building management work is being carried out in a rudimentary way without recognizing the importance of FM.

Started as an FM Research Institute in 1995, the Korea Facility Management Association (KFMA) was given its current name in 1996. In the same year, the KFMA received permission from the Minister of Commerce & Industry (now Minister of Trade, Industry and Energy) for registration as a non-profit academic organization (KFMA, 2017).

Most of the major asset management companies and large construction companies in Korea are KFMA members. There are about 4,100 individual members including 49 corporate members in KFMA. The KFMA Journal, which is listed in the National Research Foundation of Korea (NRF), is published twice a year, and a FM handbook titled ‘Understanding Facility Management’ was published in 2012. Since 2013, Korea Certified Facility Manager (KCFM) training courses have been established to train FM specialists (KFMA, 2017).

## **FM higher education programmes**

### ***Hong Kong***

Among the government-funded institutions in Hong Kong, the City University of Hong Kong (CityU), the Hong Kong Polytechnic University (PolyU) and the University of Hong Kong (HKU) are the main ones that offer built environment-related academic programmes. Besides PolyU, the School of Continuing and Professional Education of CityU (City SCOPE) and the School of Professional and Continuing Education of HKU (HKU SPACE) also provide FM programmes, as summarized in Table 2.

“Insert Table 2 here”

- *CityU School of Continuing and Professional Education*

The Certificate in Facility Management programme targets junior FM personnel and those who wish to join the FM industry for career advancement. At Level 3 of the QF

(Qualification Framework, 2018), the programme aims at enabling students to: demonstrate their readiness and background knowledge in joining the field of facility management; explain the competencies required of a facility professional in accordance with IFMA and HKIFM; and possess the knowledge for further studies in facility management and pursue lifelong learning (CityU School of Continuing and Professional Education, 2017a).

At Level 4 of the QF, the Advanced Diploma in Facility and Property Management (ADFPM) programme aims to, inter alia, equip students with the required technical knowledge, analytical abilities and management techniques for being a professional in the facility and property management industry (CityU School of Continuing and Professional Education, 2017b). After successful completion of Year 1, students will have an intermediate award - Professional Diploma in Property Management (PDPM). PDPM graduates who have registered as Chartered Institute of Housing Asian Pacific Branch (CIH) student members at the commencement of the programme are eligible to apply for Member Cert. upon successful completion of the Practical Experience Requirements. ADFPM is to prepare students to sit in four online assessments of FMP credential of IFMA.

- *HKU School of Professional and Continuing Education*

With multi-exit points to suit the training needs of facility and property management practitioners, the Advanced Diploma in Facility and Property Management programme of HKU SPACE aims to: develop applied knowledge and skills in Facility Management for property management practitioners to effectively integrate users' and organizations' needs for physical assets; provide in-depth academic training with a balanced and comprehensive scope that forms a solid foundation for further career advancement in the Facility Management discipline; and provide a part-time study programme as a bridging course that leads to a degree and/or professional qualification in FM (HKU School of Professional and Continuing Education, 2017a). Graduates of the programme are eligible to apply for Associate Membership of both the RICS and the HKIFM.

Another programme, titled Postgraduate Diploma in Facilities Management, targets those

who wish to become professional facilities managers. It aims to train students to exercise their theoretical knowledge and professional competences to strategically coordinate and manage relevant aspects of the built environment, people and process in relation to the effective operation of organizations (HKU School of Professional and Continuing Education, 2017b). Graduates of the programme are eligible to apply for Associate Membership of HKIFM.

- *The Hong Kong Polytechnic University*

Launched in 1996, Master of Science in Facility Management is the first FM programme in Asia. It aims to equip students with knowledge covering all of the elements that affect the efficient performance of buildings, appropriate policies, management processes and the people who work in the FM environment (The Hong Kong Polytechnic University, 2017). Offered within the Postgraduate Scheme in Construction and Environment of PolyU, this mix-mode programme admits both full-time and part-time students at a collective quota of 40 per year. Depending on their study pace, full-time students normally require one year to complete the programme while part-time studies normally finish in two to three years; the maximum study period is five years. The programme is the most accredited; recognitions have been given by four professional organizations: HKIFM, IFMA, the Chartered Institution of Building Services Engineers (CIBSE) and the Royal Institution of Chartered Surveyors (RICS). In addition, PolyU offers a PhD programme in FM, which may be studied full-time (three or four years) or part-time (six to eight years).

- *Collaboration between non-local and local institutions*

Apart from the above programmes, there are some non-local FM programmes in Hong Kong. For instance, the Bachelor of Science (Hons) in Facilities Management programme of the University of Central Lancashire, which is on the list of registered courses of the Education Bureau (2017c), is operated by the Hong Kong College of Technology International Limited. Referring to the list of exempted courses (Education Bureau, 2017d), HKU is the operator of the following programmes: Bachelor of Science (Honours) in Work Based Learning Studies (Facilities Management) of the Middlesex University; and Master

of Science in Facilities Management, Postgraduate Certificate in Facilities Management, and Postgraduate Diploma in Facilities Management of the University of Greenwich.

### ***Taiwan***

A decade after the enactment of the Condominium Management Act in 1996, the National Development Council decided to foster the PM service industry and launched the ‘Flagship Project: Property Management Services Operations Integration Demonstration Project (2005~2008)’ for subsidizing universities or colleges to establish PM-related departments (National Development Council, 2004). As a result, some PM-related departments and programmes appeared in certain higher education institutions of Taiwan for the first time. After another decade of development, two major types of PM-related departments/programmes have emerged:

1. PM departments (Master, Bachelor): Several private institutions have decided to transform some of their departments (civil engineering or environmental engineering) towards PM-oriented departments. For example: (1) a Department of Environment and Property Management offers PM bachelor and master degree programmes (Jing-Wen University of Science and Technology (JUST), 2017); (2) a Department of Assets and Property Management offers PM bachelor and master degree programmes (Hwa-Hsia University of Technology (HHUT), 2017); and (3) a Department of Property Management, offers a bachelor degree program (Chien-Hsin University of Science and Technology, 2017). Graduates are granted with PM Bachelor Diploma or Postgraduate Master Diploma.
2. PM sub-programmes in construction-related departments: Initiated by individual faculties with PM specialties, some departments in universities offer specialized PM sub-programs. For example: (1) a Department of Architecture offers a real estate management sub-programme at graduate level (National Taiwan University of Science and Technology (NTUST), 2017); (2) a Department of Construction Engineering offers a construction and property management sub-program at graduate level (National Yunlin University of Science and Technology, 2017); and (3) a Department of Civil Engineering offers a construction and property management sub-programme at undergraduate level (Feng-Chia University, 2017). Each graduate is granted with a PM certificate in addition to a diploma

or postgraduate diploma.

Among those mentioned above, two representative PM departments and one PM sub-programme are further introduced, as summarized in Table 3.

“Insert Table 3 here”

- *Jing-Wen University of Science and Technology*

The Department of Environment and Property Management of JUST offers a full-time four-year bachelor degree PM program and a part-time two-year master degree PM program. The bachelor programme, which admits 60 students every year, aims to enable students to have the knowledge and skills required to ‘manage’ a property or facility professionally. The master programme, with an annual intake of 20 (graduate students with at least one-year work experience in the PM or FM field), equips students with the knowledge and skill required to ‘make PM plans’ for properties or facilities professionally (Jing-Wen University of Science and Technology, 2017).

Transformed from the Department of Environment Management, the Department of Environment and Property Management features knowledgeable faculties as well as professional training facilities and equipment. It is particularly well known in the ‘cleaning profession’ area of property management in Taiwan. While its bachelor and master degree programmes are not accredited by any external professional bodies, their students are encouraged to join the TIPM as student members.

- *Hwa-Hsia University of Technology*

The Department of Assets and Property Management of HHUT offers three types of PM programmes: (1) full-time four-year bachelor degree; (2) part-time two-year bachelor degree (as juniors and seniors); and (3) part-time two-year master degree. The two bachelor degree programmes admit seven full-time and 60 part-time students every year. The programmes aim to enable students to become middle-level property managers specialized

in PM services, facility operations and maintenance, and real estate management (Hua-Shia University of Technology, 2017). Each year, the master degree programme admits 14 graduate students with at least one-year of working experience in the PM or FM field. This programme develops students to become high-level property managers specialized in professional real estate management and property management.

The above bachelor and master degree programmes are the only ones in Taiwan that are accredited or recognized by external professional bodies, namely the CIH. Graduates are eligible to apply for associate or professional membership of the CIH.

- *National Taiwan University of Science and Technology*

The Department of Architecture of NTUST offers three types of architecture degree programmes: (1) full-time four-year bachelor degree; (2) master degree (full-time two-year or part-time three-year); and (3) PhD. The master degree programme admits 40 full-time and 10 part-time graduate students every year (National Taiwan University of Science and Technology, 2017).

Within the master degree programme, there is a ‘Real Estate Management’ sub-programme. It enables students to establish a comprehensive real estate life cycle view and enhance their professional real estate knowledge and skills needed at different phases (e.g. real estate investment, operations and management, professional PM and FM services). Featuring strong university-industry collaborations, the sub-programme is supported by the industry: internship opportunities and teaching staff with professional experiences are provided by large organizations. While the sub-programme is not accredited by external professional bodies, students are encouraged to join the TIPM as student members.

## *Singapore*

Three of the five polytechnics in Singapore offer diploma programmes in facilities management. These are the Diploma in Facilities Management programme at Singapore Polytechnic (Singapore Polytechnic, 2018), the Diploma in Hotel and Leisure Facilities Management programme at Ngee Ann Polytechnic (Ngee Ann Polytechnic, 2017a) and the Diploma in

Integrated Facilities Management at Temasek Polytechnic (Temasek Polytechnic, 2017). The latter two are closely associated with the hospitality sector.

Ngee Ann Polytechnic also offers a Specialist Diploma in Sustainable Facilities Management which is offered under the Singapore Government's SkillsFuture Earn and Learn Programme (Ngee Ann Polytechnic, 2017b). This is a one year part-time programme that includes working at a facilities management company. In addition, the BCA Academy, the training arm of Singapore Building and Construction Authority (BCA), offers both part-time (BCA Academy, 2017b) and full-time (BCA Academy, 2017a) diplomas in FM.

At Singapore's publicly funded autonomous universities, there are two degree programmes that have 'facilities management' in their programme title. They are the Bachelor of Science (Project and Facilities Management) programme (National University of Singapore, 2017a) and the Bachelor of Science (Facilities and Event Management) programme (Singapore University of Social Sciences, 2017).

A list of the main FM programmes is shown in Table 4. Three of these programmes (one at diploma level, one at specialist diploma level, one at undergraduate level) will be further examined in the following.

“Insert Table 4 here”

- *Temasek Polytechnic*

The Diploma in Integrated Facilities Management is the first diploma programme in the world accredited by the IFMA Foundation (Temasek Polytechnic, 2017). The programme offers two clusters of elective subjects in the areas of hospitality facilities and aviation facilities, creating a pipeline of talents for Singapore's integrated resorts and airport. In 2017, the planned intake of students is 100. The various certifications that the graduates of this diploma programme will receive include: the IFMA Young Professional membership and IFMA Facility Management Professional (FMP), Associate Certified Project Engineer of the Institution of Engineers Singapore and bizSAFE levels 2 and 4 under the Singapore

Workplace Safety and Health Council.

- *Ngee Ann Polytechnic*

To be completed in one year on a part-time basis, the Specialist Diploma in Sustainable Facilities Management is for diploma graduates who are working in the facilities management sector (Ngee Ann Polytechnic, 2017b). The diploma is made up of two certificates. The first (Post-Diploma Certificate in Facilities Management) is made up of three taught modules in applied property management, building services management and fire safety management. The second (Post-Diploma Certificate in Built Environment Management) consists of two taught modules in green building management and workplace health and risk management, and a third module that is a project case study in facilities management. Graduates can register with the Singapore Civil Defence Forces as a qualified Fire Safety Manager.

- *National University of Singapore*

The Bachelor of Science (Project and Facilities Management) programme provides students with a strong grounding in building technology, construction technology, building information modelling, and building systems (structural, mechanical and electrical) (National University of Singapore, 2017a). With this knowledge, facilities management (FM) and project management are taught allowing students to manage buildings across the entire life cycle. The FM portion of the programme covers operations and maintenance management, energy management, maintainability, facilities planning and design, strategic facilities management, FM law, event management and green development. In academic year 2016/17, the intake of Year 1 students was 130 (National University of Singapore, 2017b).

## ***South Korea***

In Seoul area, 17 out of the 37 universities (except Kyung Hee University, which got accredited by IFMA) have FM-related majors such as architecture, real estate, architectural engineering,

etc. Of these, relatively few FM-related courses are being offered. In other words, even if FM-related courses are offered, only a few schools established practical facility management courses.

Of the universities outside Seoul area, there are 11 FM-related departments (Korean Council for University Education, 2017), as summarized in Table 5. Courses being offered are mainly in construction management, building equipment, and indoor architectural environment.

“Insert Table 5 here”

There are seven FM-related departments in Seoul area (Korean Council for University Education, 2017), including architecture, architectural engineering, architecture and environmental engineering, interior architecture, construction system engineering, real estate and energy engineering (Table 6). In the 24 FM-related departments located in Seoul, every year a total of approximately 1,533 new students enter 4-year colleges and about 5,500 students from freshman to senior level are enrolled in the FM-related departments. In addition, 16 of the departments have master and PhD programmes on top of undergraduate courses.

“Insert Table 6 here”

- *Kyung Hee University*

The College of Human Ecology of Kyung Hee University (KHU) offers Bachelor of Art in Housing & Interior Design with a concentration in property and facility management track (PM & FM Track). This is the only FM programme in Korea, with six years full accreditation given by the IFMA in 2016. Focusing more on the management level than the technical level, the PM & FM Track covers issues of building life cycle processes (from design to construction, operation & maintenance, and demolition) in order to achieve the objectives of the FM programme. Students should take 15-18 credits per semester for graduation in four years.

All professors of the programme have control of having guest lecturers from the architecture, engineering and construction (AEC) industry. At least once per course per semester, special guest lectures are provided. In addition to joining field trips as needed, students are encouraged to participate in Summer Abroad programmes such as the Property Management Program between The University of Hong Kong and KHU, Facility Management Program between Georgia Institute of Technology and KHU, etc.

Internship, which is required for all students, runs for about four weeks. Additionally, the 'Facility Management Practice' course under the programme is another type of internship held within the FM department of Kyung Hee University through the agreement with the school office. In this way, not only the students are given the opportunities to apply theoretical knowledge into practice, they are also part of the research team that investigates real-world problems and explores solutions for application to the on-campus facilities.

### **Comparisons between the Four Asian Dragons**

The term 'facility (or facilities) management' appears in most of the programmes reviewed but, in some cases, other terms such as 'environment' and 'property' (e.g. in Taiwan) or 'project' (e.g. in Singapore) also appear in the programme titles. Programmes that are specifically titled 'facility (or facilities) management' are those in Hong Kong (e.g. PolyU) and Singapore (e.g. Temasek Polytechnic). Such programmes, common to each other, are among the first batch of FM programmes launched in Asia. On the other hand, the new IFMA-accredited programme in South Korea, with 'housing & interior design' in its title, incorporates FM as a particular track.

A summary showing the key features of the programmes is shown in Table 7. The qualification levels of the programmes range from certificate to PhD and, comparatively, programmes at diploma, advanced diploma, bachelor, postgraduate diploma and master levels are more common. Programmes across the entire range of the qualification levels are offered in Hong Kong. In South Korea where the history of FM programme development is relatively short, the main programme (i.e. the FM track) is at bachelor level. Even though the history of PM higher education programmes in Taiwan is comparatively longer (15 years as of 2018), there is only one type of PM certificate system (at 'basic' level), which is unable to produce workforces at

middle to high levels.

“Insert Table 7 here”

Institutions including not only universities but also polytechnics (e.g. Singapore Polytechnic, Temasek Polytechnic) offer the FM-related programmes. In Hong Kong, certificate and diploma programmes are run by some universities’ professional and life-long education schools (e.g. City SCOPE, HKU SPACE). Some programmes are jointly offered by a local organization and an overseas university, e.g. the bachelor programme involving the University of Central Lancashire of the UK. Yet, this kind of joint FM programmes is not found with Taiwan, Singapore or South Korea. Unlike Hong Kong, Taiwan and Singapore where FM programmes have been run by more than one institutions, South Korea has only one university offering an FM programme.

In terms of funding for the programmes, it varies not merely between the Four Asian Dragons but even between the institutions within the same place. In Taiwan, for instance, some of the programmes are self-financed (e.g. JUST and HHUT) while the programme of the NTUST is funded by the Ministry of Education. For the programmes in Singapore, government subsidy is provided for Singaporeans and Permanent Residents. In contrast, all the FM programmes in Hong Kong are self-financed.

The study mode of most of the programmes is either full-time or part-time. Under some programmes, such as those in Hong Kong (PolyU) and Taiwan (HHUT and NTUST), there may be both full-time and part-time students. With these different study modes available, the durations of the programmes also vary - the shortest one being 0.5 year for the certificate programme of CityU SCOPE in Hong Kong. The longest one, e.g. for the part-time PhD programme of PolyU, is eight years.

Programme accreditation is an important means for ensuring the delivery of education. For programmes of the traditional, long-established disciplines in the built environment sector such as architecture and civil engineering, they are typically accredited by the professional bodies of their respective fields (Royal Institute of British Architects, 2018; American Society of Civil Engineers, 2018). Studies in the past (e.g. Dickison et al, 2009) also showed that students who

had attended an accredited programme performed better in a credentialing examination. While the current study found that programmes accredited by the IFMA (the main professional FM organization worldwide) exist in the Four Asian Dragons, many of such programmes have obtained accreditation or recognition from some professional bodies in housing (e.g. CIH), property management (e.g. TIPM) or surveying (e.g. RICS) instead of FM. This phenomenon is ascribable to two major reasons. First, building-related disciplines such as housing and property management have a longer history of development than that of FM. Second, such professional bodies have expanded their scope to cover FM.

## **Conclusions**

Hong Kong, Taiwan, Singapore and South Korea, which are the Four Asian Dragons with highly-developed economies in the region, all have a dense urban environment. As revealed above, the populations and building stocks of the four places have continued to increase, leading to the rising demand on the management for facilities in and around the buildings. Associated with this trend is an expanding FM industry where more and more competent professionals are needed.

To produce sufficient FM professionals, especially those at tactical and strategic levels, higher education programmes are essential. The above review portrays a clear picture of the major FM programmes in Asia. This outcome, attributed to the concerted effort of the international project team, can be taken as reference for stakeholders including FM educators and education policy makers. As regards the performance of the programmes (e.g. graduation rates), extent to which they have met the market needs (e.g. any FM manpower shortage), and how they compare with the counterparts in other regions such as Europe and America, further studies need to be conducted.

As FM is essentially a profession-oriented discipline, many of the programmes, as reviewed, have been accredited by professional bodies. But some of the programmes have obtained accreditations from FM-related (e.g. surveying) rather than FM-specific professional bodies. As pointed out above, the traditional disciplines (e.g. architecture, civil engineering) in the built environment sector have their education programmes accredited by their respective professional bodies. To make FM an established discipline and to strengthen its professionalism

to a level comparable to that of the traditional disciplines, it is imperative to have the FM programmes accredited by FM-specific professional bodies.

Higher education institutions are increasingly confronted with a variety of challenges. Besides providing education programmes with quality teaching, research is a crucial activity that affects the performance of universities (Hicks, 2012). Whereas the delivery of training courses and programmes at sub-degree levels (e.g. certificate, diploma) mainly requires teaching the right materials at the right levels, programmes at the higher levels including bachelor and master typically require students to do research projects on top of taking taught subjects. An even higher requirement on research, indubitably, is needed for PhD programmes. Eminent research together with quality teaching and support from professional bodies are key to the sustainable development of higher education programmes for FM.

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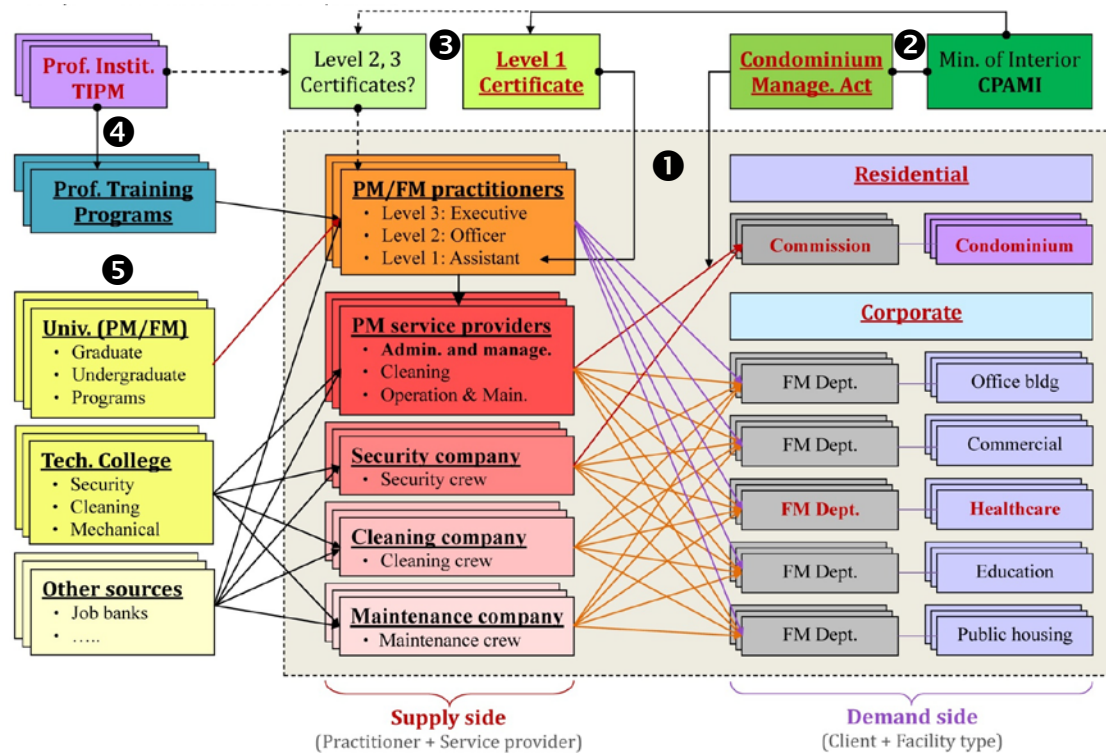
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**Fig.1** The development framework of the PM/FM industry in Taiwan

Table 1. Office Trading in Seoul (Genstar, 2017)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Number of transactions	41	38	40	57	46	48	52	37	39	53	62
Total Trading Amount (million US\$)	1,231	3,430	3,342	3,958	3,694	3,958	4,398	3,782	5,101	3,342	7,388
Price/pyeong (US\$)	8,320	13,087	12,858	12,287	12,014	13,430	12,410	14,521	16,588	14,802	15,550

Table 2. Main FM Programmes in Hong Kong

<b>Institution</b>	<b>Programme</b>	<b>Funding</b>	<b>Mode</b>	<b>Accreditation/ recognition</b>	<b>Duration</b>
CityU SCOPE	Certificate in Facility Management	Self-financed	Part-time	Students can apply for student membership of IFMA	0.5 year
	Advanced Diploma in Facility and Property Management	Self-financed	Part-time	Eligible graduates can apply for Member Cert. of CIH	2 years
HKU SPACE	Advanced Diploma in Facility and Property Management	Self-financed	Part-time	Graduates are eligible to apply for Associate Membership of RICS and HKIFM	2 years (maximum 5 years)
	Postgraduate Diploma in Facilities Management	Self-financed	Part-time	Graduates are eligible to apply for Associate Membership of HKIFM	1 year and 6 months
PolyU	Master of Science in Facility Management	Self-financed	Full-time or part-time	Accredited/recognized by HKIFM, IFMA, RICS and the Chartered Institution of Building Services Engineers (CIBSE)	Normal: 1 year (full-time), 2.5 years (part-time); maximum 5 years
	Doctor of Philosophy	Self-financed or government-funded	Full-time or part-time	-	3 – 8 years

Table 3. Main PM Programmes in Taiwan

<b>Institution</b>	<b>Programme</b>	<b>Funding</b>	<b>Mode</b>	<b>Accreditation/ recognition</b>	<b>Duration</b>
JUST	Diploma in Environment and Property Management	Self-financed	Full-time	Students are encouraged to apply for student membership of TIPM	4 years
	Postgraduate Diploma in Environment and Property Management	Self-financed	Part-time		2 years (part-time)
HHUT	Diploma in Asset and Property Management	Self-financed	Full-time or part-time	Graduates are eligible to apply for associate or professional membership of CIH	4 years (full-time) 2 years (part-time)
	Postgraduate Diploma in Asset and Property Management	Self-financed	Part-time		2 years (part-time)
NTUST	Postgraduate Diploma in Architecture / Certificate in Real Estate Management	Ministry of Education	Full-time or part time	Students are encouraged to apply for student membership of TIPM	2 years (full-time); 3 years (part-time)

Table 4. Main FM Programmes in Singapore

<b>Institution</b>	<b>Programme</b>	<b>Funding</b>	<b>Mode</b>	<b>Accreditation/certification</b>	<b>Duration</b>
Polytechnics	Diploma in Facilities Management (Singapore Polytechnic)	Government subsidy for Singaporeans and Permanent Residents	Full-time	Graduates are awarded the Fire Safety Manager Certificate and bizSAFE Level 2 Certificate	3 years
	Diploma in Hotel and Leisure Facilities Management (Ngee Ann Polytechnic)	Ditto	Full-time	Graduates are awarded Fire Safety Manager and bizSAFE certifications	3 years
	Diploma in Integrated Facilities Management (Temasek Polytechnic)	Ditto	Full-time	Accredited by IFMA Foundation. Certifications include: IFMA Young Professional, IFMA FMP, Associate Certified Project Engineer, bizSAFE levels 2 and 4, etc.	3 years
	Specialist Diploma in Sustainable Facilities Management (Singapore Polytechnic)	Ditto	Part-time	Graduates are awarded the Fire Safety Manager Certificate	1 year (maximum of 2 years)
Universities	Bachelor of Science in Project and Facilities Management (National University of Singapore)	Ditto	Full-time	Accredited/recognized by RICS	4 years
	Bachelor of Science in Facilities and Events Management (Singapore University of Social Sciences)	Ditto	Part-time	Provisionally accredited by IFMA	-

Table 5. FM-related departments outside Seoul area

Department name	Quantity*
1. Architecture	98

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2. Architectural Engineering	62
3. Civil Engineering	21
4. Environmental Engineering	17
5. Real Estate	5
6. Urban Engineering	10
7. Urban/Region/Geography	5
8. Bridge Engineering	1
9. Disaster Prevention Engineering	1
10. Industrial Engineering	1
11. Others	14
Total	235

\*Note: When there are several departments in the same school, all are counted.

Table 6. FM-related departments in Seoul

Department name	Quantity*
1. Architecture	15
2. Architectural Engineering	9
3. Architecture and Environmental Engineering	6
4. Interior Architecture	3
5. Construction System Engineering	1
6. Real Estate	1
7. Energy Engineering	1
Total	36

\*Note: Targets cover 38 universities in Seoul, except Kyung Hee University. When there are several departments in the same school, all are counted.

Table 7. Key features of the programmes of the four Asian Dragons

	<b>Hong Kong</b>	<b>Taiwan</b>	<b>Singapore</b>	<b>South Korea</b>
<b>Institution</b>	Universities	Universities	Universities, polytechnics, academy	University
<b>Programme level</b>	Certificate, advanced diploma, bachelor, postgraduate diploma, master, PhD	Diploma, postgraduate diploma	Diploma, specialist diploma, bachelor	Bachelor
<b>Funding</b>	Self-financed	Self-financed, Ministry of Education	Government subsidy for Singaporeans and Permanent Residents	Self-financed
<b>Mode</b>	Part-time, mixed mode (full-time or part-time)	Full-time, part-time, mixed mode (full-time or part-time)	Full-time, part-time	Full-time
<b>Accreditation/ recognition</b>	CIH, CIBSE, HKIFM, IFMA, RICS	CIH, TIPM	IFMA, RICS	IFMA
<b>Duration (years)</b>	0.5 - 8	2 - 4	1 - 4	4