INNOVATION CENTRE DENMARK
SHANGHAI

CHINA'S REFORM TO CLOSE THE TALENT GAP

NEW OPPORTUNITIES FOR DANISH UNIVERITY COLLEGES AND BUSINESS ACADEMIES

SEPTEMBER 2018

A PARTNERSHIP BETWEEN
THE MINISTRY OF HIGHER EDUCATION AND SCIENCE
AND THE MINISTRY OF FOREIGN AFFAIRS OF DENMARK

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FOREWORD

At the Innovation Centre Denmark in Shanghai (ICDK Shanghai), we are witnessing a growing interest from Chinese partners with regard to collaboration in higher vocational education.

The demand is driven by the 'Made in China 2025'-plan which Beijing launched in 2015. The plan aims to develop 10 strategic sectors in China, e.g. automation, biotechnology, agriculture, to become internationally leading. The plan is supported by comprehensive investments in technology and infrastructure. But hardware is not enough to reach the target. If China is to be successful in this transformation, it must also reform the vocational-orientated sectors of the higher education system.

China has around 2500 universities. Many of these, however, have in practice been teaching institutions and not as such research universities. This is about to change. As part of the 'Made in China 2025'-agenda, it is expected that 70-80% of China's higher education institutions will start to offer 'applied education' which, from the starting point, is teaching and training orientated towards specific professions. Applied education will take place at regular universities, vocational colleges and, in the Chinese context, a new type of universities called Universities of Applied Science.

Common for the institutions that teach applied education is a great interest in internationalisation. This is encouraged by the government and sought after by the individual institutions as they develop and professionalise their programmes.

Against this background, it is no surprise that China and Chinese institutions have singled out Denmark and Danish higher education as attractive partners for their higher vocational education. Besides, the timing is good in the sense that it was only recently, in 2017, that the Danish University Colleges and Business Academies were included on the Chinese Ministry of Education's positive list of officially recognised international partners.

Traditionally, China's vocational colleges and the practice-orientated universities have not been the most obvious partners for Danish higher education institutions. But if the current interest from the Chinese side continues, more and more Danish institutions will face the need to decide how these institutions may (or may not) contribute to existing internationalisation programmes. Besides, the applied education-sector in China is undergoing dramatic changes which are bound to continue in the coming years which may influence collaboration possibilities and incentives.

The current report shed some much needed light on the sector and the ongoing reforms. It is our hope that it will be helpful for institutions and individuals who consider collaboration with Chinese counterparts – particularly in applied education but hopefully it will also be helpful to professionals at Danish universities who work with Chinese partners more generally.

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1 INTRODUCTION

In May 2015, China launched a national plan called 'Made in China 2025' with the aim to upgrade the entire manufacturing industry. Its guiding principles are to have the manufacturing be innovation-driven, emphasize quality over quantity and become more environmentally friendly.[1]

Talent development is fundamental to the plan's success and as a means to enhance China's manufacturing prowess.[2] Currently, however, manufacturers in China are facing severe labour shortage problems. Statistics show that the talent shortage in, e.g. in the IT industry is expected to reach 7.5 million in 2020 and 9.5 million in 2025.[3] In order to boost the development of talent, the Ministry of Education, the Ministry of Human Resources and Social Security and the Ministry of Industry and Information Technology has released the "Guidelines for Manufacturing Talents Development"[4]. In the guideline, the ministries are suggesting a number of solutions to the problem. Some of the central suggestions are to build a modern higher vocational education system, develop better apprenticeship programmes and, maybe most importantly, set up universities of applied science.

China has more than 2500 universities. According to the guidelines, it is expected that approximately 600 universities will be turned into universities of applied science. When put together with the existing 1,300 vocational colleges, this means that China will have more than 1,900 higher education institutions that focus on training professions and technicians, bringing up the percentage from 55% to 70-80% of the institutions.

Danish university colleges and Business Academies are quite experienced in training professions and technicians, e.g. the professional bachelor programmes have a strong focus on professional practice and provide students with theoretical knowledge and its application to professions and industries.[5]

Against this background, ICDK Shanghai sees a considerable potential for collaboration between, on the one hand, Danish university colleges and Business Academies and, on the other hand, the institutions in China that are reformed in order to support the 'Made in China 2025'-plan especially the universities of applied science. However, collaboration with these institutions require thorough due diligence. Especially because many of them are less experienced in internationalisation compared to their university counterparts in China. This report is part of this due diligence.

The report begins with introduction of Chinese education systems, starting from upper secondary level and moving on to higher education. The upper secondary education is included as background to provide deeper understanding of the higher education sector and its ongoing reform. The following section discusses opportunities for Sino-Danish

[1] Scott Kennedy (2015) Made in China 2025, available at https://www.csis.org/analysis/made-china-2025

[2] Fan Feifei/Cheng Yu (2017) Blueprint to beef up skills in manufacturing sector, available at http://english.gov.cn/state_council/ministries/2017/02/17/content_281475569905759.htm

[3] More talent gap estimation in different industries, see appendix 1.

[4] The Ministry of Human Resources and Social Security, The Ministry of Industry and Information Technology, The Ministry of Education(2016) Guidelines for Manufacturing Talents Development, available at http://www.miit.gov.cn/n1146290/n4388791/c5500114/content.html

[5] The Ministry of Higher Education and Science, The Ministry for Children, Education and Gender Equality and The Ministry of Culture (2016) The Danish Education System, available at http://hfc.dk/me-

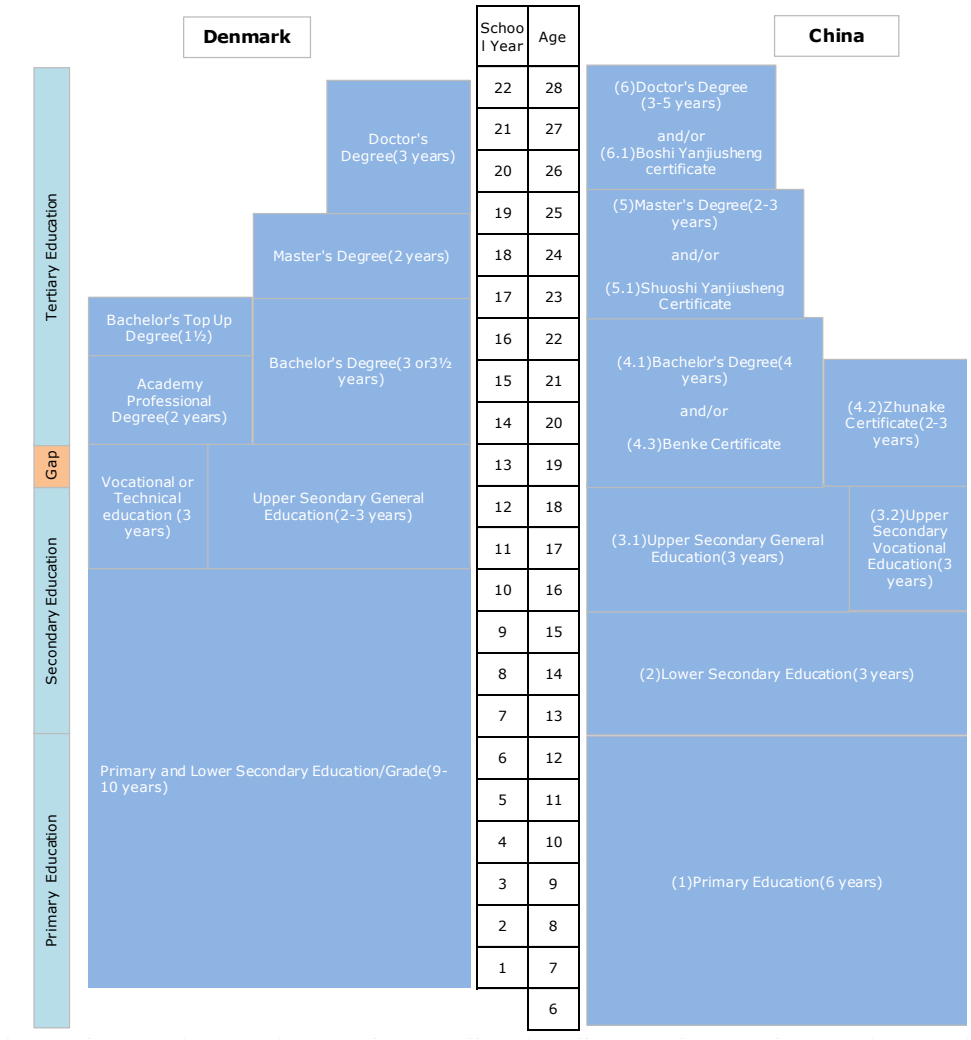
collaboration. The last part of the report provides three case examples of different ways of implementing the new policies on 'applied education' as well as key take-away points for institutions and individuals interested in pursuing collaboration in this field.

The report is the second report published by ICDK Shanghai on the Chinese higher education system. The first one was published in 2014 and focused on matchmaking, i.e. explaining different modes of collaboration. This report does not include a comprehensive section on matchmaking since it is ICDK Shanghai's assessment that most Danish universities, University Colleges and Business Academies have considerable experience in collaborating with Chinese partners. Hence, the 'how to match and collaborate' is no longer a distinct requirement. That said, the report does include a short section on collaboration with Vocational Colleges and Universities of Applied Science and, needless to say, ICDK Shanghai of course still provides practical support when Danish institutions want to reach out to and/or engage potential partners in China.

2 CHINESE EDUCATION SYSTEM

This section provides an introduction to the Chinese education systems at Upper Secondary level and then to Higher Education.[6]

The chart[7] below provides a comparative overview of China and Denmark's education system. There are many similarities in academic progression, school year/age and the division separated into Primary, Secondary and Higher Education. However, the Chinese system entails a double degree/certificate structure which is very different from the Danish system. Along with the reform of the higher vocational sector this dual degree/certificate system will be given considerable attention below.



[6] Primary and Lower level are not directly relevant to the reform of the higher vocational sector and are therefore not included in this report.

[7] Based on UNESCO's International Standard Classification of Education (ISCED) 2011-levels of education as a framework for comparison. Further information is collected from Danish Ministry of Education, Danish Ministry of Higher Education and Science, and Ministry of Education of the People's Republic of China.

China operates with a two-track system from the level of upper secondary education (Danish higher school) and upward. On this level, a distinction between "General" (marked as 3.1, 4.1, 5.1 and 6.1 in the figure) and "Vocational" education (3.2 and 4.2) is introduced.

"General education" is typically defined as education programmes designed to develop the students' general knowledge and competencies, as well as literacy and numerical skills – often to prepare them for more advanced education programmes at a higher level in the education system. "Vocational education" is defined as programmes that are designed for students to acquire the knowledge, skills and competencies specific to a particular occupation, trade, or class of occupations or trades. Such programmes often have mandatory work-based components, e.g. apprenticeships, dual-system education programmes and internships.

2.1 Upper Secondary Education

Upper secondary education programmes are typically designed for students to prepare them for higher education or to receive skills relevant to employment, or both. This level of education offers students varied specialisation and in-depth instruction compared to lower secondary education. They are more differentiated, with an increased range of options and streams available.

Upper secondary general education in China is undertaken at the Chinese upper secondary schools, which have many similarities to the Danish "Gymnasium". China has more than 23 million students, attending more than 13,000 upper secondary schools. Studies on this level takes 3 years and upon completion the students will receive a certificate. The certificate gives students access to take the Gaokao (national university entrance exam). Depending on their Gaokao-result and students' own interest, they can then apply to attend a higher general or vocational education. Some may join the workforce directly.

Several options are available in the vocational track. Approximately 16 million students are enrolled at almost 11,000 schools, where they get basic vocational and practical training that is geared towards employment and/or continued education. The vocational education track offers a greater variety of institutions compared to the general track. In the upper secondary vocational school sector, you have three different tracks including Vocational High Schools (Zhi Gao), Secondary Specialised Technical Schools (Zhong Zhuan) and Skilled Workers Schools (Ji Xiao).

Three tracks	English Title	Chinese Title
Upper Secondary Vocational School(3.2)	Vocational High Schools	Zhi Gao
	Secondary Specialised Technical Schools	Zhong Zhuan
	Skilled Workers Schools	Ji Xiao

Vocational High School (Zhi Gao) is similar to the Danish CET programme combining upper secondary general education, vocational education and training - EUX. After graduation from Vocational High School (typically 3 years, more rarely 2 or 4 years), students can apply for higher education or transit to the labour market. Graduation from Secondary Specialised Technical Schools (Zhongzhuan) and Skilled Worker School (Ji Xiao) mainly lead students towards direct employment.

For a student at Vocational High School, he/she has three options to higher education level. One is to take the Gaokao together with its fellow-students from upper secondary general schools. The second is to take special Gaokao that organized only for upper secondary vocational school students, yet one can only choose from a narrowed list of universities and majors. The third is that a student gets enrolled in a 5-year vocational program starting already from upper secondary level, thus entailing 3 years vocational secondary education plus 2 years vocational higher education.

Students graduating from upper secondary general education tend to apply to universities and students graduating from upper secondary vocational education tend to apply to vocational colleges, though both of the paths are available.

2.2 Higher Education

China's duo-certificate system represents a key difference compared to the DK system. In the Chinese system students get a degree and a certificate as a proof of completion of study. The former, the degree follows the same progression as in Denmark with the three levels of academic degrees – bachelor, master and Ph.D., to show that the student has reached a certain academic level. The latter, the certificate, testifies that the student has gone through a full time formal education with all exams passed and is entitled to further his/her study or to a given salary level, if he/she joins the workforce.

Such certificates exist at several levels and at several types of institutions: For short cycle of studies (2-3 years) students get a certificate termed "Zhuanke", offered by higher vocational institutions, which does not match any degree. From bachelor program with a long cycle of 4 years, students get a certificate called "Benke". This can be given both by academic and higher vocational institutions. Students get a postgraduate study completion certificate from master programs, which is called "Shuoshi" and "Boshi" [8] for completion of doctoral programs.

The table below explains the relation between academic degrees and certificates in the Chinese system – and with a comparison to the Danish system.

[8] In order to differ from degrees in English, the certificate is titled in Chinese Pinyin. The official name in Chinse Pinyin are "Shuoshi Yanjiusheng" and "Boshi Yanjiusheng". To make it easier to read, I have shorten the name here.

Certificate (years of study)				Academic degree, China	Academic degree, Denmark
			Boshi (3-5y)	PhD	PhD
		Shuoshi (2-3y)		Master	Master
	Benke (4y)			Bachelor	Bachelor
Zhuanke (2-3y)				No degree	AP degree

Certificates and degrees are delivered by three types of Higher Education Institutions in China:

- Comprehensive and Technical Universities (including Business School)
- Vocational Colleges
- Universities of Applied Science (new and under reform)

The following sections outline each of the three type of institutions.

2.2.1 Comprehensive and Technical University (including Business School)

During the past 20 years, this part of the higher education sector has enjoyed more attention and favourable policies compared to the rest of the sector. The Chinese government has seen the development of science and technology as a cornerstone in the modernisation of the country and attached great importance to China's universities international ranking. Hence, many different funding and reform programmes have been developed to support Comprehensive and Technical Universities (including Business School). The consequences of these initiatives are too wide-ranging to cover here. However, it is important to stress that generally speaking, elite institutions have received way more funding than the majority of institutions which has created a very unbalanced relationship between some institutions that have an abundance of resources and a lot of institutions that are significantly less affluent.

Graduation from upper secondary general education can lead to bachelor degree studies in a comprehensive or technical university (including business schools). The achievement in Gaokao generally decides which type of university a student can get enrolled into. The higher the score a student gets, the greater the chance that s/he can be offered a seat in top university.

There are three types of universities in this category that students can choose from, they are divided according to prestige:

- Type 1: Key universities (e.g. universities from double first class initiative[9], or universities affiliated directly to Ministry of Education)
- Type 2: Non-key universities (e.g. those affiliated to provincial government)
- Type 3: Independent institutions affiliated to a public university

[9] The Charlesworth Group(2017) New Chinese Double First Class University Plan Released, available at https://cwauthors.com/article/double-first-class-list

Compared to Denmark, the years of study differ: Bachelor, 4 years (Denmark: 3 years); Master, 2-3 years (Denmark: 2 years); PhD, 3-5 years (Denmark: 3 years). In other words, a Chinese PhD has up to 12 years of university studies, whereas the maximum in Denmark is 8 to 8½ years – with very few exceptions, 9 years.

2.2.2 Vocational Colleges

This part of the sector has enjoyed less attention from the Government when compared to the comprehensive and technical universities. However, as early as 2006 programmes were launched to give Higher Vocational Education a boost. For instance, the "211 initiative" aimed to upgrade 100 vocational colleges into "national models"[10]. This list of "model colleges" was expanded to 200 colleges[11] in 2010. Those 200 colleges received in total over 16 billion RMB in financial support and were asked to develop new and upgrade existing majors in manufacturing, architecture, energy chemicals, aerospace, transportation, electronic information, agriculture, forestry, animal husbandry and fishery, healthcare and services. More recently, the Chinese government has announced that it will, towards 2020, create a number of world class Vocational Colleges and vocational majors which will supports the government's 'Made in China 2025'-plan.

Higher Vocational Education offers Zhuanke-programmes that are more practical and professional oriented than in the general education track. These take 2-3 years to finish. Students graduating from this type of institutions will get Zhuanke-certificate and no equivalent degree. There exists an upgrading and transition programme of typically 2-3 years, meaning that a proportion of the students can use their zhuanke-certificate to enter a Benke-programme and study for a Bachelor degree. This is similar to the Danish AP programme combined with Top Up-courses that also lead to a Bachelor degree.

There exist more than 1,300 vocational colleges in China. A few colleges combine both upper secondary education and higher education thereby providing a tight link between those two levels. Some colleges collaborate with universities to start up their own bachelor programmes. Yet most of them offer zhuanke programme only.

Vocational Colleges are divided into two types:
- General Vocational College (called Gaozhi): Offers a wide range of vocational orientated programmes such as engineering, IT, marketing and business.
- Specialized Vocational Colleges (called Gaozhuan): Offers programmes in teaching, medical studies (e.g. nurses' education), electricity studies and public security.

2.2.3 New Player: University of Applied Science

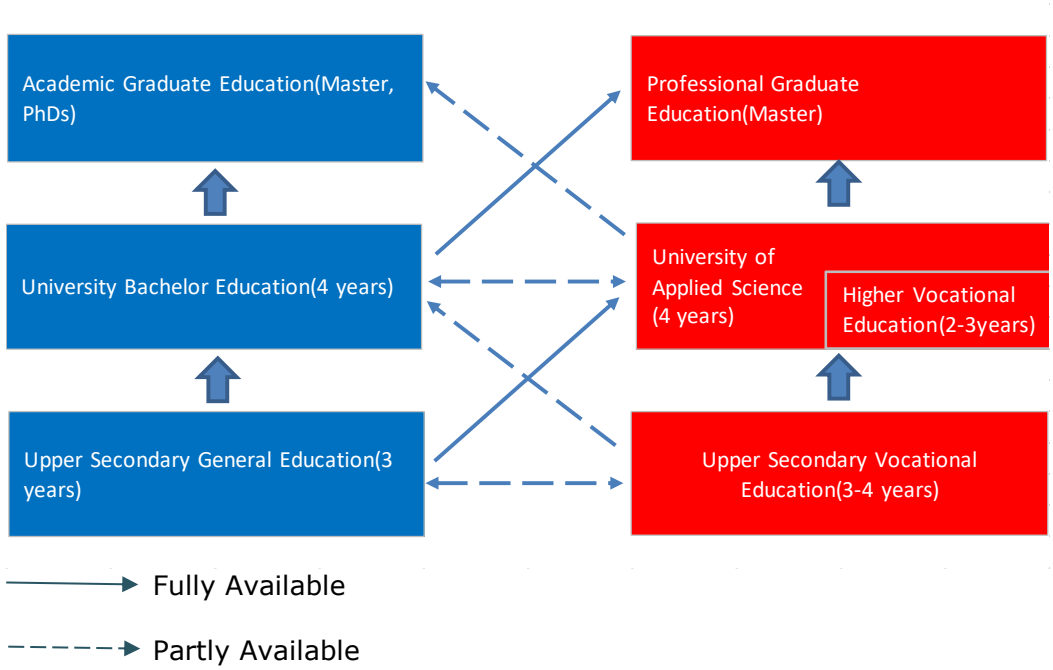
In 2014, The State Council (China's Government) issued the "Decision on Accelerating the Development of Modern Vocational Education"[12], which aims to create a modern vocational education system in China. The so-called Universities of Applied Science are a central element in this transformation.

[10] A list of National Model Vocational colleges(first batch), available at http://edu.sina.com.cn/gaokao/2011-07-15/1052306214.shtml (in Chinese only)
[11] A list of National Model Vocational colleges, second batch(2010), available at http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/s3876/201012/112718.html (in Chinese only)
[12] The State Council(2014) The Decision of the State Council on Accelerating the Development of Modern Vocational Education, available at http://tvet.ac.nz/wp-content/uploads/2015/06/Decisn-of-the-State-Council2014_booklet.pdf

The Chinese education system includes 2,596 higher education institutions. 1,237 are Comprehensive and Technical Universities, the rest are Vocational Colleges[13]. Back in the 1990s these numbers used to be quite different with many more Vocational Colleges. However, as part of the higher education sector reforms that were initiated in 1999 and the increased funding allocated to Comprehensive and Technical Universities, many Vocational Colleges transformed or merged into Universities. Today, such 'upgraded' Vocational Colleges account for up to 55% of China's Comprehensive and Technical Universities.

With the "Decision on Accelerating the Development of Modern Vocational Education", these institutions, which amount to around 600 all together, will be transformed into Universities of Applied Science and will offer degree programs at the bachelor level. An important incentive for the change is to recognise the importance of vocational-orientated institutions and increase their prestige. At the same time, the reform and the new structure of the system also supports the idea that students, in the future, can be more mobile across the different types of institutions.

The new structure is as below:[14]



The Universities of Applied Science will focus on programmes to train professions and technicians and will adapt their programmes to local development needs. Such programmes could be logistics management and textile design. The majority of their programmes will be on the undergraduate level (Benke and Bachelor), however, they will also deliver a limited number of graduate programmes (Shuoshi and Master).

In 2017, the government allocated more than 1 billion RMB in the so-called "University

[13] Ministry of Education(2016) Education Report in 2016, available at http://www.moe.edu.cn/jyb_sjzl/sjzl_fztjgb/201707/t20170710_309042.html
[14] The chart is made based on "Plan of Modern Vocational Education System"（2014-2020）and China Vet Education Info Sheet, page 2.

of Applied Science construction project" which was the first time the central government invested funds directly to the development Universities of Applied Science.[15] Its aim is to establish 100 Universities of Applied Science before 2020 and that these institutions can act as role models for the remaining institutions.

Once the "University of Applied Science construction project" is fully realised, it is expected that China will have approximately 600 Comprehensive and Technical Universities (including business schools), 600 Universities of Applied Science and more than 1,300 Vocational Colleges. This means that more than 1,900 Chinese universities/colleges will be focus on training professions and technicians, bringing up the percentage from 55% to 70-80%.

[15] Ministry of Education(2017) university of applied science construction project , available at http://www.moe.gov.cn/jyb_xwfb/s5147/201708/t20170804_310646.html (in Chinese only)

3 OPPORTUNITIES FOR COLLABORATION

In April 2017, during the visit of Prime Minister of Denmark, Chinese Ministry of Education announced that all the Danish University Colleges and Business Academies have been officially recognized by the Chinese government, including their Academy Profession Degree Programmes. This recognition makes it easier to initiate collaboration between Danish and Chinese partners in higher vocational education as Chinese institutions prefer to collaborate with institutions that have been approved by the Ministry of Education.

Against this background, this section provides some initial guidelines for Danish University Colleges and Business Academies that are interested in collaborating with Chinese Vocational Colleges and Universities of Applied Science.

3.1 Collaboration with Vocational Colleges

China is seeking to expand international cooperation with countries that are leading in higher vocational education, and Vocational Colleges in China are encouraged by the Chinese government to:[16]

- learn from and bring in international higher vocational education standards including professional courses, teaching system and digital education
- establish joint courses/programmes, labs or training centres, and establish cooperation and exchanges between teachers, students including credit transfer with leading international higher vocational education institutions
- establish high level Chinese-international joint education projects, e.g. joint campuses or comprehensive collaboration programmes with leading international companies.

Several Chinese institutions including, e.g. the Shanghai Government, has identified the Denmark and Danish higher vocational education institutions as attractive international partners. There is also an opportunity for Danish University Colleges and Business Academies to recruit full time students directly from Chinese Vocational Colleges through top-up programmes thus allowing them to study for a Bachelor degree. However, ICDK Shanghai is not aware of existing substantial collaboration between Danish institutions and Vocational Colleges in China.

The Ministry of Education maintains a complete list of Vocational Colleges in China.[17]

ICDK ASSESSMENT
From the initial meeting ICDK Shanghai's has held with these institutions, it is clear that they are very interested in international collaboration and that they are already pursuing such links actively. Especially Germany and the UK are active in the field also as a means to supply their manufacturing industries in China with a better educated workforce. However, compared to in many Comprehensive and Technical Universities it is also clear that many Vocational Colleges have limited experience with international collaboration

[16] The State Council(2014) The Decision of the State Council on Accelerating the Development of Modern Vocational Education, available at http://tvet.ac.nz/wp-content/uploads/2015/06/Decisn-of-the-State-Council2014_booklet.pdf - see also case study Qingdao Technical College (section 4.1).
[17] Ministry of Education (2014), available at http://en.moe.gov.cn/Resources/Directories/201506/t20150626_191383.html - see, 'lower college' in the list.

which, all things considered, is likely to complicate collaboration. A related point is that students in these institutions have been less exposed to English compare to their peers in Comprehensive and Technical Universities which challenges exchange and participation in full-time programmes. The Chinese institutions are aware of these issues and are working to improve the English level of both students and programme but it is a long-terms project. It is ICDK Shanghai's assessment that it may be easier for Danish institutions, initially, to find potential partners in the great Shanghai area where it is possible to utilise our links with local government and partners at Comprehensive and Technical Universities to pinpoint those institutions that are best prepared for international collaboration. This is an area where ICDK Shanghai can assist Danish higher education institutions.

3.2 Collaboration with Universities of Applied Science

Compared to the Vocational Colleges, the Universities of Applied Science may be institutionally more compatible with Danish University Colleges and Business Academies, i.e. they focus mainly on undergraduate education, have some research-related activities and are required to work closely with stakeholders in society, especially companies.

However, the implementation of the new policy and the establishment of these institutions are more experimental compared to the strengthening of existing Vocational Colleges. For instance, there is no confirmed list of all Universities of Applied Science in China. Besides, the provinces are relatively autonomous in how they implement the policy and in making decisions about which of their existing Universities they will turn into Universities of Applied Science.

Some provinces, e.g. Zhejiang, Guangdong, Sichuan and Jilin have published lists of their Universities of Applied Science (see appendix for examples). But Shanghai has chosen quite a different approach. Instead of turning the complete universities into University of Applied Science, the city is focusing on specific undergraduate majors (Benke and Bachelor) which they are turning into "applied majors" which will be embedded into Comprehensive or Technical Universities'(including Business Schools) regular curriculum (see more in case study 4.3).

Regardless of the approach, international cooperation is expected to be a cornerstone in the formation of Universities of Applied Science. At the same time, their new obligation to provide "applied education" requires them to work more closely with industry – both Chinese and international companies – and restructure their majors to fit the local economic situation. Compared to their peers in Denmark, this is something these institutions have little experience with and hence international inspiration and input is sought after. Thus, faculty training, knowledge transfer, standard setting and quality assessment are critical issues that Danish institutions could provide through their collaboration with Chinese Universities of Applied Science.[18]

In addition, collaboration with Universities of Applied Science could offer students from Danish higher education institutions a chance to intern in companies in China.[19] Other

[18] Chenchen Liu (2014) China Announces Modern Vocational Education Development Strategy 2014 – 2020, available at http://www.sinoptic.ch/textes/education/2014/20140729_Ambassade.de.Suisse_Apprentissage.en.Chine-en.pdf

[19] The issue of internship visa remains problematic in China. However, the situation is also changing towards more favourable conditions. Today, many cities offer S2-visa as an 'internship visa'. This visa can only be applied from within China. For more information on this issue, please contact ICDK Shanghai.

types of collaboration includes students and staff exchange as well as joint development/research projects . However, as mentioned above, since the establishment of these institutions vary from city to city and from province to province it has not been possible to establish a comprehensive overview. Below are nevertheless some examples of institutions and network that have been established to promote and strengthen the development of Universities of Applied Science:

- 100 Model Universities of Applied Science, e.g. including Liaoning institute of Science and Technology, Hebei Normal University for Nationalities, Taiyuan Institute of Technology, Xuchang University, Nanyang Institute of Technology, Shangqiu Normal University, Huaihai Institute of Technology, Changshu Institute of Technology, Xiamen University of Technology, Hunan Institute of Science and Technology, Shandong Jiaotong University, Chongqing University of Science and Technology, Hainan Tropical Ocean University.
- University of Applied Science Ranking: Guangzhou daily has published the first "University of Applied Science Ranking" in China. It looked into over 800 universities and includes different metrics, e.g. "Applied Index" and "Academic Index".[20]
- China Alliance of Universities of Applied Sciences was established in 2013 and currently has 154 member universities.[21]
- Applied Universities in Yangtze River Delta (see more in case study 4.3)

ICDK ASSESSMENT

Judging from the blueprint it seems evident that Universities of Applied Science are highly compatible partners for Danish University Colleges and Business Academies. But the reform is ongoing which introduces both challenges and opportunities. From the point of view of easily identifying suitable partners, the situation is less than ideal. As long as these institutions are undergoing substantial changes the level of transparency decreases and programmes are likely to be immature. On the positive side, if a Danish Business Academy or University College manages to identify and establish with a partner that is growing its activities with the support of a local government such collaboration can become 'model programmes' which traditionally is a sought-after recognition that means additional funding and visibility. All things considered, the reform of the Universities of Applied Science is a big move in Chinese higher education system which Danish institutions should pay attention to. Especially, since this move also aims to enhance the reputation of higher vocational education in China, making it more attractive and ultimately an education that talented students will consider. It is too early to say if the project will succeed. But if it does, there are some important lessons also for Danish higher education.

[20] Guangzhou Daily(2017) University of Applied Science Ranking, available http://www.gzgddi.com/index.php?m=content&c=index&a=show&catid=3&id=100 (in Chinese only)

[21] China Alliance of Universities of Applied Sciences (2013), available at https://baike.baidu.com/item/%E5%BA%94%E7%94%A8%E6%8A%80%E6%9C%AF%E5%A4%A7%E5%AD%A6%EF%BC%88%E5%AD%A6%E9%99%A2%EF%BC%89%E8%81%94%E7%9B%9F(in Chinese only)

4 CASE STUDIES: 'APPLIED EDUCATION' INITIATIVES

This section provides three case studies, the first from Qingdao Technical College as a representative for Vocational Colleges, the second is Hefei University as an example of University of Applied Science, while the last one is higher education from a local's perspective (Shanghai).

4.1 Qingdao Technical College and its internationalization

Being one of the national model Vocational Colleges, Qingdao Technical College puts a lot of efforts in internationalization. It has established international cooperation with 74 higher education institutions overseas within 21 countries. 150 students exchanged to partner universities abroad so far and over 270 students continued their further studies through partner universities abroad.

The school's teaching system combines local vocational education framework and international resources and intelligence. Half of the staff have either studied abroad or received training overseas. Its international cooperation includes:

- Established joint schools with 6 foreign universities, with 1,000 graduates.
- Brought "competence-based education" from Netherlands, and built joint programme with universities from Netherlands.
- Built joint programme with Waikato Institute of Technology from New Zealand. Cooperation includes teachers exchange, course development, and credits transfer between two institutions.
- Built Sino-Singapore, Sino-Korea, Sino-Netherlands, Sino-US vocational education research institution or research team.
- Brought in 47 foreign experts from various countries for, e.g. higher vocational comparison research, academic exchange and teacher training.
- Sent over 600 students to receiving professional practice training in 20 training bases overseas.

4.2 Hefei University and Alliance of Applied Universities in Yangtze River Delta

Hefei University (in Anhui Province) is highlighted as a frontrunner in China's Higher Education Reform, and has persisted in its guideline of "serving the local, training students into applied talent and strengthening cooperation with foreign higher-learning institutions".[22] For the last five years, over 6,000 representatives from more than 500 other Chinese universities have paid visits to Hefei University in order to learn from experience in teaching applied science.

The university has a long tradition for applied science based on the collaboration between Anhui Province and Lower Saxony, Germany which dates back to 1985.[23] More recently, in 2010, the university established, together with German partners, the Hefei-German School Applied Science.

[22] Hefei University profile, available at http://www.hfuu.edu.cn/english/6055/list.htm
[23] Hefei University profile, available at http://www.hfuu.edu.cn/english/6055/list.htm

Anhui Province (where Hefei University located) has been instrumental in establishing the Alliance of Applied Universities in Yangtze River Delta. 25 universities from Anhui, Shanghai, Jiangsu and Zhejiang have joined the alliance (full list in Appendix 2).

Since 2015, the members of the alliance have worked together to develop activities in:

- Student entrepreneurship
- Joint online courses
- Open and expand student exchange programmes
- Encourage visits between mid-level management teams
- Research on 'applied education' standards
- Deepen international cooperation
- Promote the Alliance's results in other parts of china

In 2017, the Alliance's member universities organized an 'Internet Plus' Student Competitions in Innovation and Entrepreneurship as well as an education forum, including discussions on Innovation and Entrepreneurship Education in Universities of Applied Science.

4.3 Higher Education in Shanghai

Shanghai is one of the cities that have the highest number of universities in China: 37 Universities and 31 Vocational Colleges. There are more than 930,000 students enrolled at the higher education level.

Shanghai has launched its "Shanghai Higher Education Structure and Development Plan (2015-2030) in 2015. It aims to increase the number of enrolled students in higher education to 1.05 million in 2020 and 1.4 million in 2030, while the number of enrolled students will be 27% master, 59% bachelor, and 14% Zhuanke accordingly.

According to the plan, higher education institutions in Shanghai could be categorized into four types between "Academic Research", "Applied Research", "Applied Technology" and "Applied Technical", based on the schools' strengths of nurturing talents.

Indicator	**Academic Research**	**Applied Research**	**Applied Technology**	**Applied Technical**
Number of master students/number of bachelor students at school	≥ 0.7 : 1	≥ 0.2 : 1	≥ 0	0
Which kinds of talents to provide?	Academic researchers	Applied researchers	Technology experts	Practical workers
Level of degrees offered	PhD, master and bachelor degree	PhD, master and bachelor degree	Master and bachelor degree	No equivalent degree

For instance, top universities in Shanghai including Fudan University and Shanghai Jiaotong University are among the first group, "Academic Research", tier two universities like Huadong Normal University, Shanghai University of Technology are in the second group, "Applied Research". Newly transformed universities of applied sciences will

be categorized into "Applied Technology" while vocational colleges are "Applied Technical".

In addition, instead of turning the whole university into a university of applied science at once, Shanghai has tried to turn majors at bachelor level in those universities to be "applied majors". Till July 2017, 100 majors from various universities in Shanghai have been selected as pilot majors which are under this reform, covering various fields from engineering, science and technology, arts, etc. It is expected that 200 majors will be turned into applied majors till 2020, which accounts for 60% of total majors in Shanghai universities. A list of "applied majors" and their 'host university' is included in Appendix 3.

5 KEY TAKE AWAYS

- China is committed to closing the talent gap as a means to develop its manufacturing sector and a number of key industries. The "Made in China 2025"-plan and the shortage of qualified engineers/technical personnel that China is facing is pushing the reform in higher vocational education. Eventually 70%-80% of higher education institutions in China will be offering "applied education". The two leading actors in this reform are Vocational Colleges and the new Universities of Applied Science. University of applied sciences provide tracks for students enrolled in higher vocational education, to receive up to master level education.

- During the past few years, China has invested large amounts in building, e.g. "200 Model Vocational colleges" and "100 Model Universities of Applied Science". Those model institutions take lead in the reform while other institutions will follow. Yet finding a right partner is not easy, especially considering China's complicated education system and the many higher education institutions under reform. Adding to the complexity, local governments are implementing the reform differently.

- Both of the Vocational College and Universities of Applied Science are eager and strongly encouraged by the government to learn from international experiences with "applied education". Danish University Colleges and Business Academies are strong in both theoretical and applied education. As such, they are interesting partners for Chinese Vocational Colleges and Universities of Applied Science. There are challenges as well as possibilities provided by the ongoing reform; lack of experience with internationalisation in this part of the sector is the most prominent challenge while the funding that is pouring into the sector (from government and companies) may facilitate new forms of collaboration.

- Finally, the "Made in China 2025"-plan and the reform of China's higher vocational education sector will make Universities of Applied Science, and possibly also Vocational Colleges, more attractive partners for international collaboration. If their development will resemble the development of China's comprehensive universities, the best Universities of Applied Science will become highly sought-after partners internationally. Against this background, it could be worth to partner with some of these institutions at an early stage and anticipate the competition from other international partners. ICDK Shanghai is fully committed to support Danish Business Academies and University Colleges in their search for potential partners in China's higher vocational education sector.

Appendix 1: Talent Gap Estimated in Ten Key Fields in Manufacturing Industry

No.	Key Fields	2015	2020		2025	
		Total Talent	Total Talent Estimated	Talent Gap Estimated	Total Talents Estimated	Talent Gap Estimated
1	IT Industry	10,500,000	18,000,000	7,500,000	20,000,000	9,500,000
2	CNC Tools and Robtics	4,500,000	7,500,000	3,000,000	9,000,000	4,500,000
3	Aerospace Equipment	491,000	689,000	198,000	966,000	475,000
4	Marine engineering equipment and high-tech ships	1,022,000	1,186,000	164,000	1,288,000	266,000
5	Advanced rail transportation equipment	324,000	384,000	6,0000	430,000	1,060,000
6	Energy Saving and New Energy Vehicles	170,000	850,000	680,000	1,200,000	1,030,000
7	Power equipment	8,220,000	12,330,000	4,110,000	1,731,0000	9,090,000
8	Agricultural machinery and equipment	283,000	452,000	169,000	723,000	44,000
9	New Materials	6,000,000	9,000,000	3,000,000	10,000,000	4,000,000
10	Biomedicine and advanced medical devices	550,000	800,000	250,000	1,000,000	450,000

Appendix 2: Member Universities from Alliance of Applied Universities in Yangtze River Delta

Shanghai	Shanghai Institute of Technology
	University of Shanghai for Science and Technology
	Shanghai-Hamburg College
	Sanda University
	Shanghai Lixin University of Accounting and Finance
	Shanghai DianJi University
	Shanghai University of Electric Power
	Shanghai Jianqiao University
Jiangsu	Jinlin Institute of Technology
	Changshu Institute of Technology
	Xuzhou University of Technology
	Changzhou Institute of Technology
	Sanjiang University
	Taihu University of Wuxi
Zhejiang	Ningbo University of Technology
	Zhejiang University of Finance & Economics Dongfang College
	JiYang College of Zhejiang A&F University
	Ningbo Dahongying University
	Taizhou University
Anhui	Hefei University
	Anhui Science and Technology University
	Hefei Normal University
	West Anhui University
	HuangShan University
	Chuzhou University

Appendix 3: Applied Majors in Shanghai Universities

Shanghai Polytechnic University	Mechanical Engineerin	1st Batch
Shanghai Polytechnic University	Automation	1st Batch
Shanghai DianJi University	Mechatronic Engineering	1st Batch
Shanghai DianJi University	Automation	1st Batch
Shanghai University of Electric Power	Electric Engineering and Automation	1st Batch
Shanghai University Of Engineering Science	Transportation (aeronautical equipment maintenance)	1st Batch
Shanghai Jianqiao University	Automobile Support Engineering	1st Batch
Shanghai Finance University	Marketing	1st Batch
Shanghai Shanda College	Nursing	1st Batch
University of Shanghai for Science and Technology	Prosthetic orthopedic Engineering	1st Batch
University of Shanghai for Science and Technology	Packing Engineering	1st Batch
Shanghai University of Traditional Chinese Medicine	Nursing	1st Batch
Shanghai University of Traditional Chinese Medicine	Rehabilitation Therapy	1st Batch
Shanghai Lixin University of Commerce	Accounting	1st Batch
Shanghai Lixin University of Commerce	Finance	1st Batch
Shanghai Business School	Business Administration (retail management)	1st Batch
Shanghai Business School	Hotel Management	1st Batch
Shanghai Normal University TIANHUA College	Pre-school education	1st Batch
Shanghai Normal University TIANHUA College	Automotive Engineering Services	1st Batch
Shanghai Normal University	Tourism Management	1st Batch

Shanghai Institute of Technology	Chemical Engineering and Technology	1st Batch
Shanghai Institute of Technology	Electric Engineering and Automation	1st Batch
Shanghai Institute of Visual Arts	Arts and Crafts	1st Batch
Shanghai Institute of Visual Arts	Animation	1st Batch
Shanghai University of Sport	Athletic Rehabilitation	1st Batch
Shanghai University of Sport	Sports Training	2nd Batch
Shanghai Polytechnic University	Mechatronic Engineering	2nd Bacth
Shanghai Business School	E-commerce	2nd Bacth
Shanghai Institute of Technology	Civil Engineering	2nd Bacth
Shanghai Institute of Technology	Landscape Architecture	2nd Bacth
Shanghai Jianqiao University	Engineering Management	2nd Bacth
Shanghai Institute of Visual Arts	Visual Communication Design	2nd Bacth
Shanghai University of Engineering Science	Flight Technology	2nd Bacth
Shanghai University of Traditional Chinese Medicine	Food Safety and Nutrition	2nd Bacth
Shanghai Normal University TIANHUA College	Tourism Management	2nd Bacth
Shanghai DianJi University	Software Engineering	2nd Bacth
Shanghai Lixin University of Accounting and Finance	E-commerce (payment and settlement)	2nd Bacth
Shanghai Polytechnic University	Internet Engineering	2nd Bacth
Shanghai DianJi University	Marketing	2nd Bacth
Shanghai Lixin University of Accounting and Finance	Accounting	2nd Bacth
Shanghai University of Electric Power	Energy and Power Engineering	2nd Bacth
Shanghai University of Engineering Science	Polymer Materials and Engineering (Coating Engineering)*	2nd Bacth

Shanghai Lixin University of Accounting and Finance	Taxation	2nd Bacth
Shanghai University of Electric Power	Environmental Engineering	2nd Bacth
Sanda University	Pedagogy (Health Education)	2nd Bacth
Shanghai Maritme University	Marine Technology	3rd Batch
Shanghai Maritme University	Marine Engineering	3rd Batch
Shanghai University of Sport	Performance (Martial Arts)	3rd Batch
Shanghai University of Sport	Broadcasting and Hosting (sports)	3rd Batch
Shanghai Ocean University	Marine Fishery Science and Technology	3rd Batch
Shanghai University of Electric Power	Mechanical Design Manufacture and Automation	3rd Batch
Shanghai University of Electric Power	Measurement and Control Technology and Instrument	3rd Batch
Shanghai University of Traditional Chinese Medicine	Biomedical Engineering (Traditional Chinese Medicine Information and Engineering)	3rd Batch
Shanghai Normal University	Broadcast and TV director	3rd Batch
Shanghai University of Engineering Science	Broadcasting and Television Engineering	3rd Batch
University of Shanghai for Science and Technology	Visual Communication Design	3rd Batch
Shanghai Institute of Technology	Food Science and Engineering	3rd Batch
Shanghai Institute of Technology	Mechanical Design Manufacture and Automation	3rd Batch
Shanghai Polytechnic University	Computer Science and Technology	3rd Batch
Shanghai Polytechnic University	Credit Management	3rd Batch
Shanghai Lixin University of Accounting and Finance	International Economics and Trade	3rd Batch
Shanghai Lixin University of Accounting and Finance	Economic Statistics	3rd Batch
Shanghai Lixin University of Accounting and Finance	Insurance	3rd Batch
Shanghai DianJi University	International Economics and Trade	3rd Batch

Shanghai DianJi University	Welding Technology and Engineering	3rd Batch
Shanghai Business School	Logistics Management	3rd Batch
Shanghai Business School	Visual Communication Design	3rd Batch
Shanghai University of Political Science and Law	Financial Management	3rd Batch
Sanda University	Rehabilitation Therapy	3rd Batch
Sanda University	Finance	3rd Batch
Shanghai Institute of Visual Arts	Cultural Industries Management	3rd Batch
Shanghai Normal University TIANHUA College	Rehabilitation Therapy	3rd Batch
Shanghai Jian Qiao University	Internet Engineering	3rd Batch
Shanghai Jiao Tong University School of Medicine	Food Safety and Nutrition	4th Batch
Shanghai Maritme University	Ship Electronic and Electrical Engineering	4th Batch
Shanghai Maritme University	Naval Architecture and Ocean Engineering	4th Batch
Shanghai DianJi University	Sports Economics and Management	4th Batch
Shanghai Ocean University	Aquaculture Science	4th Batch
Shanghai Ocean University	Packaging Engineering	4th Batch
Shanghai University of Electric Power	Electronic and Information Engineering	4th Batch
Shanghai University of Electric Power	Engineering Management	4th Batch
Shanghai University of Traditional Chinese Medicine	Public Utilities Management	4th Batch
Shanghai Normal University	Finance	4th Batch
Shanghai Normal University	Advertising	4th Batch
Shanghai University of Engineering Science	Electric Engineering and Automation	4th Batch
Shanghai Institute of Technology	Perfume and Aroma Technology and Engineering	4th Batch
Shanghai Institute of Technology	Materials Science and Engineering (materials for building energy saving)	4th Batch
Shanghai Polytechnic University	Environmental Engineering	4th Batch
Shanghai Lixin University of Accounting and Finance	Financial Engineering (FinTech)	4th Batch

Shanghai Lixin University of Accounting and Finance	Logistics Management	4th Batch
Shanghai DianJi University	Electric Engineering and Automation	4th Batch
Shanghai DianJi University	Intelligent Motor and Electrical Appliance	4th Batch
Shanghai Business School	Marketing	4th Batch
Shanghai Business School	Tourism Management	4th Batch
Shanghai University of Political Science and Law	Social Work	4th Batch
Sanda University	Hospitality Management	4th Batch
Shanghai Institute of Visual Arts	Conservation and Restoration of Cultural Relic	4th Batch
Shanghai Normal University TIANHUA College	Digital Media Arts	4th Batch
Shanghai Jian Qiao University	Gemmology and Materials Technology	4th Batch
Shanghai University of Medicine&Health Sciences	Rehabilitation Therapy	4th Batch