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Cooperation of vocational colleges and enterprises in China:
Institutional foundations of vocational education and skill formation
in nursing and mechanical engineering - Preliminary findings

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INSTITUTE OF
EAST ASIAN STUDIES

ARMIN MÜLLER

**Cooperation of Vocational Colleges and
Enterprises in China.
Institutional Foundations of
Vocational Education and Skill Formation
in Nursing and Mechanical Engineering –
Preliminary Findings**

NO. 120

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CONTENT

1	Introduction	5
2	Literature Review	6
3	Case Selection Strategy	7
	3.1 Disciplines and Sectors of the Economy	7
	3.2 Type and Level of Education Facility	9
	3.3 The Two Colleges	10
4	Conceptual Framework	11
5	Cooperation of Schools and Enterprises	13
	5.1 Exchange of Teachers and Employees	14
	5.2 Organization of Internships	15
6	Coupling of Education and Employment	18
	6.1 Nursing: The National Nursing Licensure Examination	19
	6.2 Mechanical Engineering: Level-Evaluation Certificates	20
7	The Emerging Role of Industry Associations	22
8	Conclusion	24
	List of Interviews	27
	References	27

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Abstract

In the context of the ongoing transformation of China's economic development model, the central government under Xi Jinping announced a general upgrading of China's skill-formation system. The initiative is part of a larger strategy to avoid the middle income trap and move towards a high-skill route of development. One of the core challenges in this respect is to consolidate the cooperation of enterprises and vocational schools and colleges, and to couple the realms of education and employment more tightly. The aim of this paper is to analyze these issues in the institutional context of state-permeated capitalism from the perspective of actor-centered institutionalism. By conducting a structured and focused comparison of the fields of nursing and mechanical engineering in two vocational colleges in Eastern China, it identifies important factors facilitative to reforms. The nursing case illustrates that bureaucratic integration and a dominance of the public sector facilitate the cooperation of schools and enterprises and the coupling of education and employment. Here, hierarchical steering can reinforce cooperation and couple education and employment via vocational qualification certificates. The fragmentation of bureaucratic authority and marketization, on the other hand, require new patterns of cooperation and coupling. The case of mechanical engineering illustrates the potential of well-performing education facilities to attract cooperation partners without direct state support, and of industry associations to play an intermediary role between schools and companies, and to develop new vocational qualifications geared to companies' requirements. The case study design focuses on areas of vocational education with high incentives for cooperation and good material conditions. The preliminary results indicate that the generally negative assessment of China's TVET system in the literature may be somewhat too pessimistic, and that a more differentiated analysis is needed.

Keywords

China, vocational education, vocational colleges, skill formation, nursing, mechanical engineering

1 INTRODUCTION

In the wake of the world financial crisis, and faced with the risk of falling into the middle income trap, the People's Republic of China has been intensifying efforts to restructure its economy over the past decade. Various reform initiatives aim at strengthening domestic demand vis-à-vis exports, strengthening the service sector and moving the Chinese economy up the value chain. An expansion of outwards investment in infrastructure under the label "one-belt-one-road" is meant to open up new markets for China's industrial output, and render its trade less dependent on sea routes. The envisioned transformation of China's state-permeated capitalism (Brink 2016) will encounter no small amount of challenges, one among them is for China to provide its ageing population and decreasing workforce with the skill-sets necessary to support the transformation.

With regard to education and training, China's economic development was largely based on broad advanced basic education, which was complemented by specialized skills in certain segments of the economy (Brink 2016). Among the various policy initiatives of the Xi Jinping administration is a reform of China's system of technical and vocational education and training (TVET), which is meant to strengthen the integration of production and education (*chanjiao jiehe*, 产教结合) and facilitate the cooperation between schools and enterprises (*xiaoqi hezuo*, 校企合作) (Guofa 2014). By 2020, half of China's higher education facilities are to become technical or vocational in nature, and substantial advances in the quality of TVET are to be made. Decision 19 of the State Council in 2014 and subsequent documents on TVET reform have to some extent reaffirmed and specified existing initiatives and concepts of the central government, rather than putting forth essentially new ideas. These documents reflect the government's consciousness of the insufficiencies of the TVET system and

the education system at large. The reform aims at a greater dissemination of specialized skills to support the envisioned transformation of the economy.

The aim of this article is to explore specific segments of specialized skill formation in vocational education and training to discover how the cooperation of schools and enterprises and the integration of production and education can be facilitated by government reforms. Focusing on regular full-time vocational education, it asks the following questions: Why is the cooperation of schools and enterprises and the integration of production and education more successful in some areas than in others? To what extent can the ongoing reforms promote the cooperation of schools and enterprises, and the integration of production and education, thus facilitating specialized skill formation on a broader scale? Section 2 will present a review of the literature on TVET in China, which overall is highly pessimistic regarding the cooperation of schools and enterprises, and the integration of work and education. Section 3 develops a case study design that excludes many externally-given factors in order to compare institutional conditions of skill formation that can be influenced by skill formation policies. It chooses nursing and mechanical engineering at two vocational colleges as case studies. Section 4 presents the conceptual framework regarding cooperation and introduces vocational qualification certificates as the dominant mode of coupling education and employment. Section 5 analyzes the cooperation of schools and enterprises, and section 6 focuses on the coupling of education and employment. Section 7 focuses on the foundry industry as a special case, and section 8 presents the conclusions.

The findings presented in this study are preliminary results from fieldwork carried out in 2016, and focus on a limited set of two case

studies. Most notably, the focus is on vocational colleges and regulatory institutions, while the perspectives of employers and students still need more consideration. Furthermore, secondary TVET has been largely excluded from

the analysis, while the findings from the disciplines this study focuses on – nursing and mechanical engineering – do not necessarily also apply to other fields of TVET. These limitations should be considered in the interpretation.

2 LITERATURE REVIEW

The focus of reform on the integration of production and education, and the cooperation of schools and enterprises, points to a perception that TVET in China is overly theoretical and does not effectively teach students practical and relevant skills. Woronov's ethnography of two secondary vocational schools in Nanjing illustrates these points. The curriculum the schools taught was over-emphasizing general skills¹ and theory, rather than practical, industry-specific skills, and much of the curriculum was simply outdated. Many teachers were young university graduates without much practical experience, who were hired on a temporary and part-time basis and were continuously scouting for better jobs. Students often spent their days sleeping through boring and abstract classes. A cornerstone of TVET are the internships students are required to do in their last year of studies; but few actually conducted internships corresponding to their disciplines, and many preferred to stay at home altogether. This behavior appears rational given the mode of coupling between TVET and the labor market: most students expected to find jobs through parents' *guanxi* connections, rather than a formalized process of acquiring and marketing skills. Participating in school-organized internship programs and distributing one's CV to employers at job fairs was only a second choice

for those without *guanxi*. Upon employment, these graduates tended to be job-hopping between entry-level positions, rather than pursuing an upwardly mobile career track. Overall, Woronov describes a lack of integration between the worlds of production and education, which in turn undermines the transmission of practical skills and the attractiveness of the schools and their graduates for companies. It provides in-depth insights into the complex, multi-causal mechanisms that undermined the effectiveness of vocational education, and largely corresponds with the views of Chinese researchers. (Woronov 2016)

Companies' practices regarding internships and TVET have been described as problematic in the literature. With regard to internships, recent studies have criticized the lack of educational value and the abuse of interns as flexible low-wage labor (Brown and deCant 2013). In particular, companies in the electronic industry cooperate with schools to handle temporary peaks in production, with teachers playing an active role in the supervision of students in the workplace and receiving payment from the company for this (Smith and Chan 2015; see also: Lüthje et al. 2013). Underfunded secondary vocational schools in central China arguably use this approach to raise their revenues. Chinese enterprises also tend to pay little attention to training once staff is hired, with some variation across sectors and ownership types. Somewhat more training is provided in industries such as mining, manufacturing, construction and transport. Foreign joint ventures and state-owned enterprises emphasize training more than enterprises from

1 General skills mean skills that are valid across the entire economy; specific skills mean skills valid only in the context of a particular company, but not in the labor market as a whole; industry-specific skills in turn refer to skills which are valid in certain sectors of the economy. See also: Booth and Snower 1996; Estévez-Abe et al. 2001; Thelen 2004.

Greater China and private enterprises (Cooke 2005; Heberer 1994). Overall, companies lack the motivation to cooperate with schools in TVET, which is partly caused by the high rates of turnover and the risk of not reaping the fruits of the investment. Overall, TVET appears to be trapped in a vicious cycle of a decreasing quality of education and a decreasing status of graduates in the labor market, which is fueled by the expansion – if not inflation – of regular academic education, to which more social value is attributed.

This pessimistic view conveyed in the literature is, however, relativized by the existence of segments of the economy where specialized skills are effectively transmitted via TVET. The health sector and nursing education in particular con-

stitutes a case in point. Vocational nursing programs are often hosted by specialized health schools, rather than comprehensive vocational schools. Nursing graduates need to pass the National Nursing Licensure Examination (NNLE) in order to be allowed to register and practice in public hospitals. Practical training is usually concentrated towards the end of the three-year programs and organized in structured hospital internships. Even though vocational schools arguably have some problems finding enough internship positions, the existing literature points to a strong coupling between employment and education, and institutionalized forms of cooperation between schools and enterprises. (Chan and Wong 1999; Hou et al. 2014; Wang et al. 2013; Xu et al. 2000)

3 CASE SELECTION STRATEGY

The existence of apparently well-functioning corners of TVET raises two questions: first, why does school-enterprise cooperation work in these sectors? Second, how can the current reforms broadly improve TVET based on these experiences? Given the complexity and multi-causality of the problems of TVET, a careful selection of case studies is required to reduce the complexity of the analysis and exclude as far as possible causal factors that education policy cannot directly control. This includes two larger sets of factors: first, factors related to the discipline and the corresponding sectors of the economy; these factors cannot be directly influenced by education policy alone, and in general the influence of policy is rather weak. Second, factors related to structures and dynamics of government and public administration can be regarded as external. Even though they are the result of policy, structural issues such as the dysfunctional fiscal system and the incentives it generates for local governments have a substantial impact on TVET in a local context. However, tackling these issues goes beyond the realm of mere education reforms. Overall, the case se-

lection strategy is strongly inspired by the idea of a most-similar-systems design (George and Bennett 2005): it aims at a best-case scenario regarding the cooperation of schools and enterprises and the coupling of education and employment.

3.1 DISCIPLINES AND SECTORS OF THE ECONOMY

With regard to disciplines and sectors of the economy, this study distinguishes three factors: skill-dependence, technological change, and the scarcity of skilled human resources in the labor market. The author expects the incentives to cooperate to be higher in fields where the influence of these factors is strong. First, the study focuses on fields where (industry-specific) “skills” in the sense of psychomotoric abilities play an important role (Winterton et al. 2005). This can include fields such as cooking, musical performance, nursing, or manufacturing activities such as welding or tool fitting. The author expects incentives for cooperation to be stronger in such fields, because vocational education

here possesses unique advantages which pure academic education cannot easily reproduce. Counter-cases would be fields such as accounting or software programming. While vocational education can potentially be competitive in such fields as well,² it has a genuine advantage regarding the production of psychomotor skills that creates incentives for companies to cooperate and increases the need to integrate production and education. With the increasing automatization of manufacturing and services, however, this advantage may gradually erode in fields where manual labor can be substituted.

Second, this study focuses on fields characterized by rapid technological change. Technological change can exert pressures for updating curricula on a regular basis, which in turn requires close cooperation between schools and enterprises. Schools need knowledge about changes in production processes to transmit it to their students, and companies potentially have an interest in having graduates who enter the labor market be as up-to-date as possible. Fields such as nursing or mechanical engineering are strongly affected by changes in production and curative technologies, whereas change in the curricula in music or cooking is slower and driven by changes in consumer taste and demand, rather than technological changes.³

Third, this study focuses on sectors characterized by a scarcity of skilled labor. The assessment of scarcity here relies on the interviews in the field, i.e. how the teaching and administrative staff perceived labor market demand in the local environment of their colleges. In the case of cooking, the assessment has been somewhat complicated, as many students apparently study cooking without intending to search for a job in the field upon graduation. Furthermore, especially in small restaurants, cooks often have little formal training. However, at the same time, there appears to be a severe lack of trained cooking staff in several Chinese cities (MoHRSS 2014). Overall, more research is needed to systematically triangulate the assessments of the college staff with other quantitative and qualitative data regarding the labor market.

These considerations suggest that the fields of nursing and mechanical engineering are suitable case studies with regard to disciplines and sectors of the economy. In both fields, graduates from vocational education constitute a substantial part of the labor force. Both are characterized by strong skill dependence, swift technological change, and a scarcity of skilled human resources. Therefore, there are stronger incentives for enterprises and schools to cooperate than in other fields.

Table 1: External factors influencing incentives for cooperation in different fields⁴

	Skill-dependence	Technological change	Scarcity of qualified staff
Nursing	strong	strong	strong
Mechanical engineering	strong	strong	strong
Cooking	strong	weak	weak/medium
Tourism management	weak	weak/medium	strong
Logistics	weak	strong	strong
Music, dance	strong	weak	weak

2 For example, if the curricula are well designed, and if teaching staff with practical experience and practical tuition decreases companies' costs of integrating graduates into production.

3 Interview 20160908b, with the leader of the TCM College's School of Nursing; Interview 20160913, group interview with teaching and administrative staff from the Technical College and the Arts College.

4 The case of tourism management is considered mainly for comparative purposes. See also: Dettmer 2016; Sohu, May 16, 2017.

3.2 TYPE AND LEVEL OF EDUCATION FACILITY

Fourth, this study will analyze schools at the top of China's vocational education system, rather than representative ones. The average vocational school has been reported by various Chinese and Western scholars to be rather dysfunctional. In order to target comparatively well-functioning facilities, this study will focus on (tertiary) vocational colleges that have grown out of a particular branch of secondary vocational schools – the Technical Middle School (*zhongdeng zhuanye xuexiao*, 中等专业学校), or *zhongzhuan*. This constitutes a dual selection – by type of school and by level.

Since the 1980s, there have been three basic types of vocational schools in the PRC. The most common type are the Vocational Middle Schools (*zhiye zhongxue*), which have been created in the course of the 1980s by simply “vocationalizing” less performing regular schools. These schools are under the administration of the Ministry of Education and its line bureaucracy. They initially focused strongly on the service sector, while covering a large scope of disciplines in general. As many teachers had begun their career in regular schools, this type of school had problems from early on regarding the skills of the teaching staff. Its graduates were among the first in China who had to find jobs in the newly emerging labor markets, which they often did in growing sectors such as tourism. Its development largely reflects the problems commonly associated with vocational schools in China. (Biermann 1999; Thøgersen 1990, 101–105; Risler 1989; Whiteside and Zhang 1992)

The other two types of schools have been oriented towards Soviet models and were imported to the PRC in the 1950s. The Skilled Workers Training Schools (*jigong xuexiao*, 技工学校) were middle schools placed under the authority of the Ministry of Labor (MoL, today the Ministry of Human Resources and Social Security, MoHRSS). These schools have been closely affiliated to and

dependent on state-owned enterprises, and the decline of the public sector since the late 1990s has negatively affected their financial situation and the job opportunities of their graduates. The MoLSS today retains comprehensive jurisdiction over Skilled Workers Training Schools, including school administration, the disciplines taught, and issuing graduation certificates. (Biermann 1999; Risler 1989; Thøgersen 1990, 105ff.; Whiteside and Zhang 1992)

The Technical Middle School was based on the Soviet *Tekhnikum* and specialized in training technicians, primary school teachers, nurses, and public health workers among others. These schools were usually placed under the dual jurisdiction of the line bureaucracies of the Ministry of Education (MoE) and the branch ministry in charge – health schools under the Commission of Health and Family Planning (CHFP, former Ministry of Health), and art schools under the Ministry of Culture. In the 1980s and 1990s, the Technical Middle Schools have often been described as the most prestigious type of vocational school due to their more formalized education approach bound to nationally standardized job classifications, their ample and well-trained teaching staff, and the good career perspectives they offered in the public service. Even though many Technical Middle Schools today are barely distinguishable from other vocational schools in terms of quality (Woronov 2016), some nevertheless retain a heritage of sectoral or professional focus and specialization. (Biermann 1999; Risler 1989; Thøgersen 1990; Whiteside and Zhang 1992)

Fifth, the level of the schools is important due to the trend of “tertiarization” that also affected vocational education. Since the middle of the 1990s and the Asian Crisis in particular, China has witnessed an unprecedented expansion of higher education. The expansion contributed to decreasing the status of vocational education graduates in the labor market, but also led to considerable unemployment among university graduates. It further included the upgrading

of secondary vocational schools to vocational colleges, which decreased the status of the secondary vocational schools. The period between 1998 and 2002 was in particular characterized by a massive transition. Under Zhu Rongji's premiership, a substantial number of industrial ministries were abolished, and many Technical Middle Schools were decentralized, from the central level to the provincial or city level (Xu 2009). This trend contributed to a loss in status and resources of the Technical Middle Schools, and the concurrent reforms of state-owned enterprises decreased the employment opportunities of the two Soviet-inspired school types considerably. At the same time, however, a process of mergers and upgrading began in which vocational schools could become colleges at tertiary level (Xu 2009). This facilitated a dualization of vocational education: the leading schools with quality education were upgraded, while the laggards remained at secondary level. Colleges have a strong advantage compared to secondary schools regarding financial and human resources, which makes them more attractive cooperation partners.

Selecting colleges also allows the problematic effects of administrative fragmentation at the secondary level to some extent to be circumvented. The parallel existence of three types of schools under different administrative authorities has facilitated the "small-but-comprehensive" phenomenon (*xiao er quan*, 小而全). In a locality such as a city, there are numerous secondary schools that share the same pool of fiscal resources and students. However, the administrative fragmentation largely prevents these schools from cooperating and specializing based on an institutionalized partition of labor (Zhong 2009). Furthermore, they are often critically underfunded due to the fiscal problems of local governments – most notably in Central and Western China (Wong 2009) – and the low priority of TVET vis-à-vis academic education and other spending items (Woronov 2016). This is particularly problematic for disciplines that require high fixed-capital investments, such as mechanical engineering. Focusing on colleges

helps to circumvent these issues to some extent, because they are smaller in number and tend to have more stable sources of funding.

3.3 THE TWO COLLEGES

This study therefore focuses on two vocational colleges and fields: the School of Nursing at the Traditional Chinese Medicine College (TCM College), and the School of Mechanical Engineering at the Technical College. The two colleges are both former Technical Middle Schools located in comparatively wealthy regions of Eastern China. The TCM College was a former health school focused on traditional Chinese medicine. Its upgrading to college level was approved by the Ministry of Education in 2004, and it came under the jurisdiction of the provincial bureaus of health and education. It was located in a prefecture-level city at the coast, a location deemed attractive for recruiting students by the administrative staff. The college overall had about 11,000 students up to 2016, but it was beginning to further expand the numbers.⁵ The Technical College was the result of a merger between a Technical Middle School and another TVET facility, which took place between 1997 and 2002. It was placed under the administration of the provincial bureau of education and a state-owned enterprise. It was located in a provincial capital and had about 10,000 students.⁶ Both facilities had elite status in their field, which made them comparatively attractive cooperation partners for companies.

Both colleges were under provincial administration in wealthy provinces, and thus arguably removed from the scarcity of financial resources that plagues local governments and secondary schools that belong to them (Wong 2009). Interviews in both facilities indicated that about half

5 Interview 20160908b, with the leader of the TCM College's School of Nursing.

6 Interview 20160913, group interview with teaching and administrative staff from the Technical College and the Arts College.

of the revenues came from study fees, and the other half from governmental transfers. The head of the School of Nursing of the TCM College indicated that the amount of transfers depended on the number of students and the amount of fees they paid. The number of students the college was allowed to recruit was set by the government and depended – among other things – on the employment rate of the graduates. The

amount of fees each college was allowed to charge was determined by the pricing bureau, so expanding the number of students was the most straightforward strategy to expand revenues. The colleges were therefore strongly interested in having – or at least reporting – high employment rates for their graduates.⁷ The respective figures they report should therefore be interpreted with caution.

4 CONCEPTUAL FRAMEWORK

The study is largely situated in the conceptual framework of actor-centered institutionalism, and focuses on the interactions of organizations and collective actors (Scharpf 1997). With regard to cooperation between companies and enterprises, the author distinguishes between three levels: exchange of information, exchange of goods and services, and exchange of people.⁸ Information to be exchanged can concern the quantity and characteristics of human resources that a company is in need of, i.e. specific skills that are needed in the workplace or specific opportunities for the placement of interns or graduates. Goods to be exchanged can include specific types of equipment, which the company gives to the school for training purposes. It can also include particular raw materials or products manufactured in the course of training that schools and companies exchange. Finally, the exchange of people can include regular internships for students, as well as opportunities for teachers to gain practical experience in companies, and for employees to give lectures in schools. The flow of financial resources complements these three dimensions and can serve as an indicator regarding imbalances in the cooperative relationships.

Distinguishing the three levels of cooperation helps to order the various initiatives and experiments mentioned in Chinese policy documents. For example, mandatory paid internships for students (MoE 2016), sending teachers to companies to gain practical experience, or creating posts for dual teachers (*jianzhi laoshi*, 兼职老师)⁹ mainly focus on the exchange of people. The exchange of information – for example, about new production techniques or the human resource need of companies – helps schools keep their curricula up-to-date and produce human resources that companies actually require. Finally, the exchange of financial resources is an important indicator for the asymmetry of exchange. For example, whether or not companies pay their interns or the teachers who gain practical experience at the company is an indicator for the market value of the skills of the latter two. Facilitating cooperation between schools and enterprises is crucial for integrating production and education more closely, which is a paramount goal of China's TVET reforms. (Guofa 2014)

A central component of the integration of production and education is the coupling between one's discipline and degree on the one hand, and the type of employment – if any – one finds upon graduation. In Western societies plagued by

7 Interview 20160908b, with the leader of the TCM College's School of Nursing; Interview 20160913, group interview with teaching and administrative staff from the Technical College and the Arts College.

8 Cf. Lévi-Strauss 2001.

9 Dual teachers consecutively hold posts in an enterprise and a school.

youth unemployment, the employment rate (*jiuyelü*, 就业率) is an important indicator for this coupling. In China, however, youth unemployment is rather associated with university graduates than with vocational education. Of greater importance are the questions whether students seek/find employment corresponding to their discipline and field of specialization (*duikou jiuyelü*, 对口就业率; *zhuanye xiangguandu*, 专业相关度), and whether they get employed by a company where they previously received practical training (cf. Ebner 2013). These rates tend to be significantly lower than the reported employment rates – which typically approximate 100 percent for vocational graduates.

The Chinese government has long enacted policies that were intended to facilitate a correspondence between jobs and qualifications. The MoHRSS operates a National Qualifications Framework (NQF)¹⁰ with vocational qualification certificates (*zhiye zigezheng*, 职业资格证书), which are to complement school and college degrees. Students and employees can take tests for their practical skills at organs of the state, which – in theory – should facilitate their access to jobs suitable to their skill level. The NQF constitutes an institutionalized yet contested bridge between education and the labor market. One among various criticisms leveled against the NQF certificates is that they tend to be technologically outdated, and often overlapping and redundant. NQF certificates may be issued by different state-bureaucratic clusters (including some industry associations), and beyond the NQF there

are other certificates by industry associations or multinational companies. Different certificates may overlap, compete with, or complement one another. One reason that industry associations and companies issue certificates of their own is their greater command of specialist knowledge. Finally, not all vocational disciplines and specializations have corresponding certificates – some have no certificates, some have only one, and some have multiple certificates. (Dahlman et al. 2007, 72–78; Yuan and Geng 2015)

The administrative responsibility for the NQF certificates is concentrated at the MoHRSS today, but the system it operates is a merger of formerly separate systems of the former Ministry of Personnel and the former Ministry of Labor. The original intention was to bind access to certain professions and functions to a standard level of knowledge and skills – most notably in the public sector, and professions that affect human livelihood and security (Guofa 1986; Laobu-fa 1994). As of today, the NQF distinguishes between entry certificates (*zhunrulei*, 准入类; *zhiye zige*, 执业资格) and level-evaluation certificates (*shuiping pingjialei*, 水平评价类). The former control legitimate access to a profession, whereas the latter are less strictly enforced and serve instead as guidelines for the evaluation of skills and work experience of an individual employee. Furthermore, the system distinguishes between Professional and Technical Staff – largely associated with white-collar jobs – and Skilled Personnel – largely associated with blue-collar jobs. Finally, the NQF roughly distinguishes five skill

Table 2: List of Chinese terms related to the NQF

职称	<i>zhicheng</i>	Professional Job Title
职业资格证书	<i>zhiye zige zheng</i>	Vocational qualification certificate
专业	<i>zhuanye</i>	Discipline, profession
专业技术人员	<i>zhuanye jishu ren yuan</i>	Professional and Technical Staff (white collar)
技能人员	<i>jining ren yuan</i>	Skilled Personnel (blue collar)

10 For background information on National Qualifications Frameworks, see: Young 2005; Young 2007; Young and Allais 2013.

levels, of which the lower two are more associated with blue-collar jobs and the upper three with white-collar jobs.

The number of public skill certificates had arguably increased substantially since the 1990s, facilitated by both horizontal and vertical fragmentation of state authority. As of 2013, the organs of the state council had established 618 categories of vocational qualification certificates – 219 for Professional and Technical Staff, and 399 for Skilled Personnel. Sub-national levels of government had established 1,875 types of skill certificates – 389 for Professional and Technical Staff and 1,486 for Skilled Personnel (Certificate Net 2015). Under the Xi administration, several rounds of cuts drastically reduced the number of central certificate types from 618 in 2013 to 151 in 2017 – 58 categories of Professional and Technical Staff and 93 categories of Skilled Personnel (MoHRSS 2016). The number of local certificates was to be reduced by 90 percent. By early 2017, Liaoning Province reported it was operating without any local certificates at all, after having abolished 429 categories since 2015 (China Government 2017). The reports reflect the perception that many of the abolished certificates were overlapping. Furthermore, producing teaching materials and conducting skill tests arguably became a lucrative business. Therefore, there is an expectation that this reform will

facilitate employees' mobility and decrease their burden of skill-testing in terms of time and financial resources.

With the latest reforms, government control of professions has been reduced. Among Professional and Technical Staff, entry certificates exist for 34 professional categories encompassing 49 specific professions, and the Nursing Licensure Examination is one of them. The field of healthcare is relatively large, including nine professions in six categories. The category of registered engineers includes ten different professions, including Registered Mechanical Engineers (*zhuce jixie gongchengshi*, 注册机械工程师), Registered Electrical Engineers (*zhuce dianqi gongchengshi*, 注册电气工程师) or Registered Chemical Engineers (*zhuce huagong gongchengshi*, 注册化工工程师). For Skilled Personnel, entry certificates only encompass eleven professions in eight categories, including Civil Flight Attendants (*minhang chengwuyuan*, 民航乘务员), Welders (*hangong*, 焊工), Road-Passenger-Transport-Vehicle Drivers (*daolu keyun qiche jiaoshiyuan*, 道路客运汽车驾驶员), Railroad-Train Drivers (*guidao chelie siji*, 轨道列车司机), and Firefighters (*xiaofangyuan*, 消防员). Overall, the number of vocational qualification certificates has been substantially reduced, and the control of professions via entry certificates clearly focuses on white-collar jobs.

5 COOPERATION OF SCHOOLS AND ENTERPRISES

The data presented in the following sections was collected via semi-structured interviews during fieldwork in the summer of 2016 in three provinces, two in Eastern and one in Central China. For the Technical College, interviews with teaching and administrative staff, students, and human resource staff at a cooperation company were conducted at the site and in the wider area. For the TCM College, a similar infiltration was not possible. Interviews with nursing department managers at two public hospitals and several

nursing students have been conducted as well, but they did not belong to the TCM College or its cooperation partners. The field of nursing is, however, highly standardized and displays much less local variation than other fields. Therefore, the most important dynamics could nevertheless be reconstructed.

The cooperation of schools and enterprises displayed very different dynamics at different colleges and in different fields of study. The ex-

change of information and personnel was central to this cooperation in all schools and disciplines, whereas the exchange of goods mattered mostly in fields related to manufacturing. The following sections will first examine the exchange of teachers and employees, before analyzing the organization of internships in greater detail.

5.1 EXCHANGE OF TEACHERS AND EMPLOYEES

For vocational education to stay in touch with practical issues and deliver good practical training, it is essential for teachers to gain frequent practical experience in business enterprises. Teachers are required to gain two months practical experience every two years; they are encouraged to be active in industrial associations (*hangye xiehui*, 行业协会); enterprises are encouraged to send experienced staff to schools for teaching purposes; and the government calls for expanding positions for so-called dual teachers, who concurrently hold positions in schools and companies (Jiaofa 2014). The exchange of people is meant to facilitate the exchange of information between schools and enterprises, and to enable schools to adapt their curricula in accordance with technological change and the human resource requirements in the respective industry.

At the TCM College's School of Nursing, it was mainly the teaching staff in the nursing-related subjects (as opposed to general subjects) who had to gain practical experience. According to the head of the School of Nursing, clinical practice was changing fast due to technological developments, so the nursing curriculum had to be adapted every two to three years in order to keep up. Practical experience at hospitals was necessary to prepare such changes. At the same time, the staff situation at the college was rather strained: staff numbers had not kept up with the expansion of student recruitment in recent years, and some of the (mostly female) nursing teachers had opted to have a second child after

the recent liberalization of birth control. Nursing teachers were indispensable at the college during the semester, and therefore needed to use the holidays to gain practical experience at cooperating hospitals. The college paid their salary during their stays, and the nursing teachers usually took the role of passive onlookers rather than actively working: "When we go to the hospital, we are more of a burden for them, we cannot really help them with anything."¹¹ More research is needed regarding the reasons for this passivity, but there are indicators that legal issues connected to medical treatment play an important role. The exchange of teachers was seen as a service public hospitals provided to the college: teachers were paid by the college to go there and bring back information.¹²

The reverse exchange, i.e. hospital staff teaching at the college, works somewhat differently. Actual dual teachers who held concurrent positions at a hospital and the college do not exist. Usually, exchange is organized in the form of lectures, for which the speakers are paid a lecturer's fee. Usually they were staff with a middle-level Professional Job Title (*zhongji zhicheng*, 中级职称), indicating six years of work experience for a nurse with a *dazhuan* (大专) degree.¹³ The director of the School of Nursing indicated that the college needed to be selective about speakers – at some hospitals the staff lacked the qualifications and/or spoke with too heavy a dialect to make a suitable speaker. Here, too, the patterns of exchange of money and information indicate that this was more of a service of the hospital to the college. Overall, the relationship between the two actors appears somewhat imbalanced.

11 Interview 20160908b, with the leader of the TCM College's School of Nursing.

12 Interview 20160908b, with the leader of the TCM College's School of Nursing.

13 A *dazhuan* is a higher vocational degree, which is usually obtained by through a curriculum of three years. See also: Med66, 2015.

At the School of Mechanical Engineering of the Technical College, the professor in charge of the discipline of Mechanical Engineering and Automation emphasized the increasing importance of teachers gaining practical experience in enterprises. It was paramount, and highly dependent on a relationship of trust to the teachers, for companies feared losing their business secrets. The college had both private and public cooperation partners, unlike the School of Nursing which cooperated exclusively with public hospitals. As a Professor of Foundry explained: "The opportunities for practical experience do not depend so much on whether a company is public or private, but on whether the specialist knowledge of the teachers is useful to it."¹⁴ This indicates a more equal relationship between the two, as the college staff here does not simply take the role of a passive onlooker, but makes active contributions to the companies' development. Beyond the training of skilled employees, the development and application of new technologies were central motivations for companies to cooperate with the Technical College. However, both professors were reluctant to talk about the details of such cooperative efforts.¹⁵

Keeping the curriculum and teaching materials up to date was described as a challenge due to the rapid pace of technological development in manufacturing, and a key motivation for teachers to approach enterprises. The school took an active role in developing new teaching materials and had already published several books that were used by other schools. However, the speed of developing them was perceived as too slow – as of 2016, the school still operated with materials from the 12th five-year plan period.

14 Interview 20160923 with a Professor of Foundry concurrently active at the Foundry Industry Association; Interview 20160913, group interview with teaching and administrative staff from the Technical College and the Arts College.

15 Interview 20160913, group interview with teaching and administrative staff from the Technical College and the Arts College.

For example, in the field of intelligent manufacturing, the students needed the most up-to-date materials to be able to handle advanced sensor technologies when entering the labor market. Therefore, the teachers hoped for more leeway in working with loose materials and leaflets as teaching materials, which would enhance their flexibility.¹⁶

The exchange of goods was a dimension of school-enterprise relations at the School of Mechanical Engineering – unlike at the School of Nursing – albeit a subordinate one. Companies sometimes provided the school with equipment, but this was not very common. One exception for this were so-called Ordered Classes (*dingdanban*, 订单班), a form of cooperation where companies have entire classes of students trained for them exclusively. As the point of this form of cooperation is to familiarize students with company-specific procedures early on, the provision of training equipment is in the best interest of the company. Some companies also provided the college with materials to be processed by the students during practical training. The professor proudly explained that the products were of sufficient quality to sell them on the market, but quickly added that this was not a source of profits due to the low value added.¹⁷

5.2 ORGANIZATION OF INTERNSHIPS

All colleges offered classic *dazhuan* programs in higher VE, which is in between a BA and a senior high school degree. The norm was a three-year curriculum focusing on general and basic education in the first year, specialization within the discipline in the second year, and practical experience in the third year – which involved an internship of several months. Sometimes these

16 Interview 20160913, group interview with teaching and administrative staff from the Technical College and the Arts College.

17 There are criticisms that practical training in some vocational schools serves the schools to make profits, rather than the purpose of education (Biermann 1999).

programs were extended by two years – either to offer *dazhuan* students the chance to study two more years to receive a BA degree, or to directly recruit junior high school graduates and bind them to the college. Central regulations regarding internships distinguish between three types: internships for familiarization (*renshi shixi*, 认识实习), where students get a brief introduction to a company and sector;¹⁸ internships where students follow a supervisor without working independently (*gengang shixi*, 跟岗实习); and internships where students work independently on a post (*dinggang shixi*, 顶岗实习). (MoE 2016)

5.2.1 NURSING INTERNSHIPS

In the field of nursing, internships displayed a high degree of standardization and educational orientation. State regulation requires a duration of at least eight months in a comprehensive or teaching hospital. The focus of the internships is usually on the departments for surgery and internal medicine. At the TCM College, these departments took two months each and were mandatory, just like gynecology and pediatrics, which took one month each. Further stations could include the emergency room, the psychiatric department or the TCM department. As the department head at a public hospital in Central China explained, each station in the internship is followed by a formal test. The internships approximate the *gengang* type, because the interns are only allowed to work under supervision, and not independently. Furthermore she explained that in order to ensure the quality of learning, there could never be too many interns in the same department or under the same supervisor at a time. Students from medical Technical Middle Schools were rarely accepted for internships: she associated them with a lack of discipline and maturity, and saw students from medical colleges as far more qualified and suitable.¹⁹

18 In practice, this is often more of a guided visit.

19 Interview 20160902a, with the leader of the nursing department of an urban public hospital in Central China; Interview 20160908b, with the leader of the TCM College's School of Nursing.

Leading staff at colleges and hospitals indicated that interns could not contribute too much to the hospitals' operations. As the head of a nursing department in a military hospital in Eastern China explained: "When they arrive they know all the theory, but they are basically not capable of doing anything practically. At the end of the internship, they are at least capable of doing basic things, such as injections and medications."²⁰ Nursing internships have a strong educational component, which is visible with regards to finances. As the head of the School of Nursing explained, "... we use the students' study and accommodation fees to pay for the internship fees (*shixifei*, 实习费) and accommodation fees (*zhushufei*, 住宿费) at the hospital. We even pay for the administrative fees for the teaching instructors (*banzhuren guanlifei*, 班主任管理费) and the travel costs. Our students only need to pay for water and electricity."²¹ In other cases, colleges only paid for school-organized internships, and interns had to pay themselves if they searched for a hospital themselves. These practices arguably moved from a legal grey zone to a violation of state regulations in early 2016, when the Ministry of Education passed new regulations on internships that required interns to be paid.²² They do however reflect the informal rules regarding the exchange of people between hospitals and nursing departments in colleges and schools.

5.2.2 MECHANICAL ENGINEERING INTERNSHIPS

The students of Mechanical Engineering and Automation at the Technical College followed

20 Interview 20160909, with the leader of the nursing department of an urban public hospital in East China.

21 Interview 20160908b, with the leader of the TCM College's School of Nursing.

22 Previously, the Vocational Education Law of 1996 required a salary for *shanggang shixi* (上岗实习), which might be associated with the *dinggang shixi* category. In 2007, a decree of the MoE required interns from secondary vocational schools to be paid for internships. The 2016 regulations explicitly forbid internship fees (MoE 2007, 4; MoE 2016; Renda 1996).

a similar curriculum structure in their *dazhuan* programs. From the perspective of the faculty, internships largely corresponded to the *ding-gang* type, indicating that the focus was on the interns working independently in a manufacturing company. The college required students to go on internships in every year of their studies: during the first year, this “internship” was more of a short-term visit to an enterprise to get to know the industry. In the second year, students were expected to go on an internship lasting three to four months, where they would usually work independently on a post. It usually took place between May and August. In the third year, they would do a final internship of one semester before graduating. As a coordinator for college-enterprise relations explained, the final internship was seen as a bridge into the labor market. Very often, the students’ first jobs would be in the enterprise where they conducted their final internship. As it would determine their future, students made a more careful selection of final internships than of second-year internships.²³

The allocation of internships was organized via a recruitment fair (*zhaopin*hui, 招聘会) at the college, where companies and students could present themselves. A professor estimated that 90 % of the students got their internships at these fairs, whereas about 10 % relied on relationships – in many cases, their parents were entrepreneurs with factories of their own. In 2016, more than 500 companies had offered more than 2,000 internship positions at the fair.²⁴ In each year, the college had one cohort of about 3,000 students looking for second- and third-year internships respectively.²⁵ As the coordinator explained, in

this province there were few large industrial companies like the steel mills in Northern China. Small and medium-sized enterprises dominated, and they usually only offered a limited number of positions. For second-year internships, good cooperation partners could take up to 10 students, whereas many hired only one. For final internships or in special cooperation programs, the numbers could be slightly higher.²⁶

Not all students at the Technical College selected internships corresponding to their field of study. Unlike the highly educational nursing internships, internships in mechanical engineering apparently often consisted of regular production work with limited educational components, which might be unattractive to students. According to the coordinator, some of the students also lacked affection for their field of study or were not ready to work under the conditions the companies offered:

“For example, if you study Electrical Engineering, during your holiday internship you should work on an assembly line. Some students however prefer to work at KFC instead, because KFC has air conditioning whereas most factories only have a ventilator. In some cases, the parents do not want the child to do exhausting work at the assembly line and get them some kind of office job instead. The internship then does not correspond to the field of study, but at least they are comfortable.”²⁷

His perception was that the mode of selecting the field of study via the *gaokao* system contributed to such choices: some students did not achieve the grades necessary for their preferred field of study or university; furthermore, the decisions were often made by parents rather than the students themselves, and did not always reflect the

23 Interview 20160914, with a coordinator for college-enterprise relations at the Technical College.

24 Interview 20160913, group interview with teaching and administrative staff from the Technical College and the Arts College.

25 According to the education quality report, the School of Mechanical Engineering produced about 700 of the about 2,600 graduates of the college in 2015 (Technical College Education Quality Report 2016).

26 Interview 20160914, with a coordinator for college-enterprise relations at the Technical College.

27 Interview 20160914, with a coordinator for college-enterprise relations at the Technical College.

preferences of the latter. The college's statistics for second-year internships indicated that about 60 percent of the second-year internships had a basic or high level of correspondence to the field of study. For final internships, the coordinator

estimated the rates to be similar, for those who wanted to work in a corresponding job would get the opportunity to do so. Those who did not tended to use the internship to orient themselves towards other job profiles.²⁸

6 COUPLING OF EDUCATION AND EMPLOYMENT

The coupling of the field of study on the one hand, and the labor market on the other hand, differs widely between disciplines. This coupling can be measured quantitatively in terms of (1) overall employment rates, (2) employment corresponding to one's field of study and degree, and (3) employment at the enterprise where one has received practical training or done an internship (Ebner 2013). As relevant statistical data is only partly available, this study intends to shed light on the institutional foundations of this coupling. When comparing mechanical engineering and foundry on the one hand, and nursing on the other, there are some profound differences. One difference lies in the prevalent forms of ownership of employers. In the field of nursing, employment is strongly concentrated in the public sector. As of 2015, 2.7 million registered nurses (83.36 percent) were employed in public healthcare providers – the vast majority in public hospitals – and only 539,535 (16.64 percent) in private healthcare providers.²⁹ The institutional structures of the health sector are largely similar across the country, and thus also apply to the nursing graduates of the TCM College. The 2016 education quality report of the Technical College on the other hand indicated that 83 percent of the graduates found employment in private or semi-private enterprises, whereas less than 12 percent went to state-owned or foreign invested enterprises or to public service units. Both the

Technical and the TCM College reported a solid coupling between disciplines and fields of employment.³⁰ Overall, the discipline of nursing was primarily oriented towards public sector employment, and the Technical College was primarily oriented towards private sector employment.

There is also a notable difference regarding the governance structure of the sectors. In the health sector, not only does public ownership dominate, but it is also largely governed by one line administration. The Commission of Health and Family Planning plays a dominant role in policy formulation at the central level and its line bureaucracy on the lower administrative levels directly manages the network of public hospitals and other health providers. The TCM College was jointly managed by the provincial authorities of health (*zhuguan bumen*, 主管部门) and education (*yewu bumen*, 业务部门). The Technical College, on the other hand, catered to a labor market dominated by private companies. The old Ministry of Mechanical Engineering (*jixiebu*, 机械部) had been transformed into the Chinese Mechanical Engineering Industry Federation (*Zhongguo*

28 Interview 20160914, with a coordinator for college-enterprise relations at the Technical College.

29 While 2.05 million were employed in public hospitals, only 355,561 were employed in private hospitals (CHFP 2016, 30 & 43).

30 The information they publish on coupling is however not standardized and does not provide too many details. Overall, 45.8 percent of the Technical College's graduates went into manufacturing. Among the graduates of Mechanical Engineering and Automatization, about 5.8 percent continued with a BA degree and 9.1 percent founded their own businesses. At the TCM College, more than 99 percent arguably found employment, and 92.2 percent found employment corresponding to their discipline. Information taken from the education quality reports of the Technical College (2016) and the TCM College (2017).

Jixie Gongye Lianhehui, 中国机械工业联合会), an umbrella organization encompassing 48 associations in more specific fields – including the Chinese Foundry Association (*Zhongguo Zhuzao Xiehui*, 中国铸造协会) and its local counterparts. In administrative terms, the Technical College was under the oversight of the provincial bureau of education, but was operated by a provincial-level state-owned enterprise. Overall, the Technical College's environment had been more heavily transformed in the reform period, which was visible in the more fragmented governance structures and the dominance of private sector employment.

6.1 NURSING: THE NATIONAL NURSING LICENSURE EXAMINATION

In nursing, the institutional coupling of the field of study and the labor market is manifested in the National Nursing Licensure Examination (NNLE), which is jointly administered by the CHFP and the MoHRSS. Passing the NNLE is the precondition for receiving a Nurse Qualification Certificate (*hushi zhiye zige zheng*, 护士执业资格证) issued by the health authorities, which in turn is a precondition for becoming a registered nurse at a public hospital. It also assigns the nurse an entry-level Professional Job Title (*chuji hushi zhicheng*, 初级护士职称), which plays a role in determining the salary and can be gradually increased via taking exams. The NNLE can be taken by nursing students at secondary vocational, or higher vocational and general education institutions who completed a three-year full-time course of study in nursing or midwifery – including an internship of at least eight months as described above. It is only open to students in the field of nursing, which constitutes a strong integration of production and education. The field of employment is protected from career changers not only by a high dependence on industry-specific skills, but also by strict government regulations.³¹ (State Council 2008)

The NNLE has a reputation of being a challenge. Only about 50 percent of those who take it ac-

tually pass it,³² and rates have been decreasing in recent years. The director of the School of Nursing at the TCM College indicated that about 83 percent of their students who registered for the NNLE passed it – she considered this a low level and attributed it to recent changes in the exam questions.³³ For comparison, at a medical Technical Middle School in an urbanizing region in Central China, the employment coordinators estimated that about 40 percent of their students passed the NNLE, which they considered average in the context of their province.³⁴ The students who did not pass the exam usually still found jobs related to their field of study, for example as a care worker (*hugong*, 护工) for elderly people in individual households.³⁵ Therefore, the rate of employment corresponding to the field of study at the Technical Middle School was seen at around 90 percent, a similar level as postulated by the Quality Report of the TCM College for its graduates.³⁶ The social status distributed by the different degrees and schools however differed: the Technical Middle School graduates were more likely to fill the ranks of the rural healthcare system or the informal urban labor markets, whereas the *dazhuan* graduates were more likely to work in regular public hospitals on the county level and above. According to the staff at schools, the vast majority of nursing students found employment corresponding to their skills and education, which was related to the high demand for skilled workers in this market.

At the TCM College, students from nursing and other fields of study often took exams for oth-

31 Interview 20160908b, with the leader of the TCM College's School of Nursing.

32 Sohu 2017.

33 Interview 20160908b, with the leader of the TCM College's School of Nursing.

34 Many arguably also did not get the opportunity of a nursing internship at a public hospital.

35 Interview 20160802b, with the employment coordinators of a Technical Middle School in Central China.

36 TCM College Teaching Quality Report 2017.

er vocational qualification certificates from the NQF as well. The nursing certificate functioned as an entry-type certificate, with subsequent steps in the professional hierarchy being bound to the Professional Job Title. Nursing students could however also take exams for level-evaluation certificates in related fields, which were not tied to a directly corresponding course of study and not necessarily a mandatory precondition for access to a specific field of work. The most common certificates were Infant Nursery Teacher (*yuyingshi*, 育婴师) and Elderly-Care Nursing Worker (*yanglao huli yuan*, 养老护理员). The head of the nursing department indicated that such certificates could improve the employment opportunities of those who did not pass the nursing exam. Both these exams have survived the most recent reforms, whereas other alternatives have disappeared from the NQF – such as two masseur certificates (*tuina anmoshi*, 推拿按摩师; *baojian anmoshi*, 保健按摩师).

The TCM College had been a medical Technical Middle School until 2004, and its nursing program had focused on TCM Nursing (*zhongyi huli*, 中医护理). When it was upgraded to a college, TCM Nursing became problematic. On the one hand, the MoE issues a catalogue of disciplines to which vocational colleges are expected to conform, and this catalogue does not list TCM Nursing as a discipline – unlike the catalogue for middle schools (Jiaozycheng 2010; Jiaozycheng 2015). A college would have to issue a formal application to experiment with such a discipline, with the aim of it ultimately entering the disciplines' catalogue. More importantly, however, there was no corresponding entry certificate for TCM Nursing. Therefore, TCM nurses would have to pass the same exam as regular nurses unless the MoHRSS and the CHFP decided to issue a new certificate. Furthermore, the employment opportunities of TCM nurses would be restricted to TCM hospitals, which arguably rendered such a discipline less attractive than regular nursing. Therefore, TCM Nursing was only offered as a specialization within a regular nursing degree, even though the college focused on TCM. This il-

lustrates how the tight integration of production and education facilitates standardization in the field of nursing, at the expense of experimentation and diversification.

6.2 MECHANICAL ENGINEERING: LEVEL-EVALUATION CERTIFICATES

Compared to the health sector, standardization in manufacturing appeared to be a lot weaker. The case of the Technical College may be less representative for China as a whole than the TCM College, as differences in the economic and industrial structures – most notably size and ownership type of enterprises – may facilitate substantial regional differences. In mechanical engineering, coupling of education and employment is more loose and fuzzy than in the health sector. In institutional terms, it was usually meant to be achieved via level-evaluation certificates, which linked specific types of work (*gongzhong*, 工种) and occupations (*zhiye*, 职业) to disciplines at vocational schools and colleges. This form of coupling is comparatively weak for a number of reasons. First, there are a number of disciplines at vocational schools and colleges for which there are no matching skill certificates – a number that arguably increased substantially during the latest reforms.

Second, the coupling between certificates and disciplines is rather fuzzy, with many certificates open for multiple disciplines and many disciplines offering the choice between various certificates. For example, within the umbrella category of Processing and Manufacturing Disciplines (*jiagong zhizao lei*, 加工制造类), the subjects of Machine Manufacturing Technology (*jixie zhizao jishu*, 机械制造技术) and Machinery Processing Technology (*jixie jiagong jishu*, 机械加工技术) had five out of nine of their skill certificates exclusively assigned to them. For Hot Metal Processing (*jinsu re jiagong*, 金属热加工), it was three out of four certificates. Finally, many certificates do not require a corresponding discipline or degree, which leaves the opportunities they provide less protected from career chang-

ers. The fuzzy coupling arguably allows – at least in theory – for a certain flexibility regarding specialization and usage of human resources. (See also: Jiaozhicheng 2010; Li 2012; MoHRSS 2016)

At the Technical College, an entry- or middle-level skill certificate was a mandatory precondition for graduation – a policy called Dual Certificates (*shuangzhengshu*, 双证书). The college was an official testing site for vocational qualification certificates of the MoHRSS, which meant that students could take the necessary exams on campus. Integrating vocational qualification examinations with a regular vocational curriculum can be a challenge, as the certificates have a curriculum structure of their own, which may contradict that of the disciplines. The high frequency of exams resulting from the integration has reportedly caused additional stress for students or forced schools to compromise on quality (Yuan and Geng 2015). The teaching staff at the Technical College, however, did not see that as a problem. On the one hand, the tests could be done step by step over the three years. More importantly, however, the skill certificate tests were perceived as rather simple – for students who could handle the regular curriculum, they constituted no significant challenge.³⁷

In Mechanical Engineering and Automatization, the MoHRSS certificates were seen as the standard for students. Interestingly, they contradicted the hierarchy between students recruited from secondary vocational schools and students from academic middle schools who entered the college via the *gaokao* exam. The former had usually studied a corresponding discipline at the secondary level and were often required to pass an examination for a corresponding entry-level certificate before graduation. Therefore, at the college they could take tests directly for certificates of the second or third level. The students from

academic middle schools however had to begin with entry-level certificates. Of the 17 vocational qualification certificates loosely associated with the discipline of Mechanical Engineering and Automatization in 2010, 10 were either changed or abolished by 2017. Among those most closely associated with the discipline, a core of 5 out of 9 certificates remained unchanged (Jiaozhicheng 2010; MoHRSS 2016).³⁸ However, students were also allowed to take exams for certificates outside their specialization. This could provide an opportunity for those who did not plan on working in their field of study to gain basic qualifications for an office job. Students were allowed to acquire multiple certificates, but at the School of Mechanical Engineering, this was described as the exception rather than the rule.³⁹

Independent certificates from industrial associations were arguably a common alternative to the certificates of the MoHRSS. From the perspective of a professor teaching the discipline, it was necessary for associations to provide certain certificates, as they were more closely in touch with the industry than the MoHRSS and thus commanded more specialist knowledge. In mechanical engineering, the Mechanical Engineering Craft Certificate (*jixie gongyishu*, 机械工艺书) of the Chinese Mechanical Engineering Industry Federation was described as a common option. According to the professor, the MoHRSS

37 Interview 20160913, group interview with teaching and administrative staff from the Technical College and the Arts College.

38 The 2010 catalogue of disciplines for secondary vocational schools links disciplines at secondary level to vocational qualification certificates, and lists corresponding disciplines in higher vocational and academic education. The certificates closely associated with Mechanical Engineering and Automatization at tertiary level are those connected to the secondary disciplines 051100 and 051200, such as the certificates for Tool Fitters (*gongju qiangong*, 工具钳工) or Machine-Repair Fitters (*jixiu qiangong*, 机修钳工). More loosely associated certificates include for example those related to Ship-Building and Repair (*chuanbo zhizao yu xiuli*, 船舶制造与修理; discipline 051900), such as the Ship Electrician (*chuanbo diangong*, 船舶电工) (MoE 2010).

39 Interview 20160913, group interview with teaching and administrative staff from the Technical College and the Arts College.

did not recognize this certificate, even though it also did not have one that directly competed with it. Nevertheless, the MoHRSS certificates were described as the norm.⁴⁰

With regard to the import of certificates in the labor market, the professors and the representatives of a cooperating private enterprise in the field of robotics indicated that the impact of the NQF certificates was not very big, which confirms previous findings (Dahlman et al., 2007). The representatives of the enterprise indicated

that they mattered only insofar that students usually had them, so it would raise eyebrows if there were exceptions to this rule. But this would not stand in the way of hiring a student that had proven productive as an intern. They estimated that in state-owned enterprises, the NQF certificates might influence salary levels and welfare benefits.⁴¹ Interestingly, they did not mention the industry association's independent certificate described above, but indicated that the company encouraged employees to take the test for the Professional Job Title of an Engineer.⁴²

7 THE EMERGING ROLE OF INDUSTRY ASSOCIATIONS⁴³

In the field of foundry work, the provincial Foundry Industry Association (*Zhuzao Hangye Xiehui*, 铸造行业协会) played an important intermediary role, and facilitated the exchange of people and information. As the professor in charge of the Foundry Specialty (*zhuzao fangxiang*, 铸造方向) at the Department of Material Technology (*cailiao jishu xi*, 材料技术系) explained, the college had only limited information about the development of the foundry sector, whereas the association was in close contact with many of the companies. Under its umbrella, there was an experts' council which sent representatives of the industry to the college for lectures. At the same time, the association could help the college evaluate the scope and nature of its demand for human resources. The college used this information to upgrade and change the curriculum and teaching materials.

At the Technical College's School of Mechanical Engineering, Foundry was a specialty in the

discipline of Material Forming and Control Technology (*cailiao chengxing yu kongzhi jishu*, 材料成型与控制技术).⁴⁴ It had been selected as a pilot for the "Modern Apprenticeship System" (*xiandai xuetuozhi*, 现代学徒制). At the core of the pilot was an increasing orientation towards industrial practice. As the professor explained, the old foundry curriculum was too broad, thus students lacked the practical knowledge to be directly integrated into production upon graduation, and companies had to invest in deepening their training.⁴⁵ For example, companies' skill requirements could differ substantially depending on whether companies worked with iron, steel or aluminum. The Modern Apprenticeship System aimed at facilitating the transition to the

40 Interview 20160913, group interview with teaching and administrative staff from the Technical College and the Arts College.

41 There are also indicators that the Chinese labor unions promote vocational qualification certificates in state-owned enterprises, where their presence is stronger than in private ones (Jürgens and Krywdzinski 2014).

42 Interview 20160921, with human resource staff of a private company in the field of robotics.

43 Unless otherwise indicated, the information in this section is taken from: Interview 20160923 with a Professor of Foundry concurrently active at the Foundry Industry Association.

44 This is discipline No. 560106 in the MoE's catalogue of higher vocational disciplines. It is noteworthy insofar as there is also an independent discipline of Foundry Technology (*zhuzao jishu*, 铸造技术) – No. 560108 (MoE 2015).

45 Similar problems exist in the car industry, see: Jürgens and Krywdzinski 2014.

labor market by strengthening practical training and foundry-related subjects in the curriculum. In the first year of their *dazhuan*, students were taught about the goals and methods of the Modern Apprenticeship System, and were already required to do an initial internship during the holidays. In the second year, they had to gain more in-depth knowledge about foundry work, including the details of working with different types of metal. In the third year, the focus was on practical work and internships.

The Modern Apprenticeship System was described as taking some inspirations from the German apprenticeship system. As one professor jokingly remarked: "Germany has an apprenticeship system; we have a Modern Apprenticeship System; we like to copy stuff from Germany and put new names on it."⁴⁶ But while this approach to skill formation was distinctive, it nevertheless retained the structure of a *dazhuan* degree, in which school-based theoretical and practical training remained of paramount importance. The association transmitted information regarding internship opportunities, thus complementing more established practices such as the internship fair and independent searches by families and students. The cooperation enterprises were primarily state-owned. As the Professor of Foundry explained: "We hope to cooperate with respectable enterprises that are supervised by the government. In SOEs, we do not have to worry about the safety of our students, whereas in private enterprises we would not even know if they have an office for security in the workplace. Also, private enterprises often lack qualified staff to supervise the apprentices. SOEs tend to be larger and have better technical capacities."⁴⁷ These views are substantiated by the China Foundry Yearbook published by the association: about 75 percent of foundry enterprises in the province

were described as medium and small enterprises working with comparatively simple technologies and producing less than 2000 tons of output per year.⁴⁸ The modern apprenticeship system at the Technical College thus displays two characteristics typical for the PRC: first, the institutional frame of a *dazhuan* degree; and second, the concentration of school-enterprise cooperation in the public sector, which strongly resembles the pattern in nursing.

The students of Material Forming and Control Technology, too, were required to take a skill certificate when graduating.⁴⁹ However, students were not encouraged to take the exams of the MoHRSS, which the professor saw as too broad and too basic to be of any value in the labor market. Instead, the students were encouraged to work towards a certificate called Foundry Student Engineer (*zhuzao hangye jianxi gongchengshi*, 铸造行业见习工程师), which he described as a joint effort of the industrial association and the companies under its umbrella that was compatible with international standards. The association was invested with the authority to conduct the skill testing. Companies were described as playing an active role in promoting the certificate to their students, because it enjoyed a higher prestige among them than those in the NQF.

The Modern Apprenticeship System disadvantaged students from secondary vocational schools vis-à-vis students from the academic branch. First, they lost the comparative advantage regarding regular vocational qualification certificates by the MoHRSS. But as these were considered too broad and basic to begin with, this arguably does not constitute a great loss. Second, and more importantly, the revised cur-

46 Interview 20160913, group interview with teaching and administrative staff from the Technical College and the Arts College.

47 Interview 20160923 with a Professor of Foundry currently active at the Foundry Industry Association.

48 China Foundry Association 2005.

49 The 2010 catalogue linked two disciplines at secondary vocational level and nine vocational qualification certificates to Material Forming and Control Technology at tertiary level, and only one certificate was affected by the reforms in recent years (Jiaozhicheng 2010, 4; MoHRSS 2016).

riculum increased the requirements regarding students' command of natural sciences such as chemistry. As the professor indicated, students from the academic branch were better prepared for the more practically-oriented curriculum. Students from vocational secondary schools often lacked solid foundations in natural sciences, and faced substantial challenges at the Technical College.

The field of foundry illustrates the development potential of China's industrial and trade associations with regard to skill formation. The professor described it as a special case, though: he saw companies in the foundry industry sharing many technical procedures and having similar human resource problems, therefore their preferences

regarding skill formation resembled one another. At the same time, companies demanded different skills, depending on the types of metal they worked with. Furthermore, both the industrial sector and foundry as a subject in education were of comparatively small scope, which facilitated the coordination between companies and schools. The association played a crucial intermediary role in collecting and transmitting information about technical issues and human resource demand, thus facilitating the exchange of interns, teaching staff and experts from the industry. The association is a registered "mass organization" under the direction of the State-owned Assets Supervision and Control Commission (SASAC), which may explain some of its bias towards the public sector.

8 CONCLUSION

This study sought to identify factors facilitating effective cooperation between schools and enterprises, and the integration of education and production. The case study design eliminated a number of influences directly related to external factors – most notably the level of skill dependence, the impact of technological change, and the scarcity of skilled workers. These factors cannot be directly influenced by reforms of the TVET system and thus generate a variation in the results which is difficult to exploit for policy analysis. Furthermore, the design eliminated much variation related to regional differences in economic development and the fiscal problems of local governments – and their public service units – by selecting vocational colleges under provincial administration, which had emerged from elite Technical Middle Schools. This selection allows us to abstract from structural problems in the fiscal system. The result approximates a most-similar-systems design: comparing fields with high skill dependence, fast technological change and a scarcity of skilled labor (nursing and mechanical engineering) at colleges under provincial administration in coastal

provinces. With regard to external factors facilitating cooperation, the study can be considered a best-case scenario.

The focus of the analysis was on the cooperative relations between schools and enterprises – conceptualized as exchange of information, goods and people – and the coupling between education (discipline and degree) and employment (corresponding to discipline and degree). With regard to coupling, the focus was on institutions regulating the transition from education to employment, most notably vocational qualification certificates. In the field of nursing, the cooperation between schools and enterprises was highly standardized and institutionalized, and internships appeared to have a strongly educational character because of it. The relationship between the schools and enterprises was, however, asymmetric: nurses' and nursing teachers' contributions to hospital operations were very limited, while the TCM College assumed the costs of practical training. Furthermore, a tight coupling was reinforced between the discipline and the profession of nursing by the NNLE.

Table 3: Overview of cooperation and coupling practices

	Nursing	Mechanical engineering
Cooperation of schools and enterprises	Standardized, asymmetric: students pay for highly educational internships	Non-standardized, symmetric: paid (but less educational) internships; cooperative projects
Coupling of education and employment	Strong: skill-based coupling reinforced by government regulations	Medium: skill-based coupling, multiple certificates
Ownership structure of sector	Public dominant	Private dominant (at the field site)
Structure and mode of governing	Bureaucratic integration; hierarchical steering	Bureaucratic fragmentation; market-based interactions

Mechanical engineering on the other hand was a lot less standardized. The School of Mechanical Engineering housed a number of disciplines, whose coupling with the labor market was rather fuzzy. From the state's perspective, it was intended to be regulated by level-evaluation certificates, rather than entry certificates, which were less binding in nature. According to the views of professors and companies, these MoHRSS certificates did not enjoy a good reputation in the private sector. There are some indicators that independent certificates issued by industry associations do a better job in signaling relevant skill levels to companies. However, more research about China's NQF and alternative vocational qualifications is needed to substantiate this.

Cooperation in the health sector was strongly facilitated by the dominance of the public sector and bureaucratic integration. Healthcare is dominated by a single line bureaucracy, which plays a major role in administrating the main employers – public hospitals and other service units – as well as vocational schools and colleges. The bureaucracy can impose on hospitals the responsibility to accept and teach interns, as those are part of the public sector and directly managed by the health administration. It is questionable whether a similar degree of integration could be achieved with private hospitals, as internships are a substantial burden for them. A progressive privatization of the hospital sector could thus inflict heavier burdens on the remaining public hospitals, and intensify the need for new modes of cooperation between schools and enterprises. Furthermore, the health administration controls

a critical amount of specialist knowledge, as it directly manages public hospitals and employs many medical specialists. It can set vocational standards for the health sector and enforce a tight coupling because of this position. Bureaucratic integration and the dominance of the public sector allow for the asymmetric patterns of exchange to be sustainable, and for the tight coupling via vocational qualifications to be stable.

The situation differed markedly in mechanical engineering: there was no bureaucratic integration as the industrial ministry had long been abolished; and the role of public-sector enterprises in training and employment was much smaller than in the health sector. The certificates in the NQF under the authority of the MoHRSS were not always up to date, and their enforcement as a basis for employment and wage-determination in the private sector was rather weak. Independent vocational qualifications by industrial associations appeared to be replacing the MoHRSS certificates in some areas, and this trend may well be strengthened with the decrease in the number of NQF certificates in recent years. SOEs were still perceived by the teaching staff to be at the top of the sector in terms of size, scope of operations and level of technology. Nevertheless, the structure of the manufacturing sector required new forms of coupling, which state organs had difficulties to deliver. Furthermore, cooperation was a more reciprocal relationship compared to the health sector, and more strongly based on questions of supply and demand. This indicates that the at-

tractiveness of colleges as cooperation partners was decisive. These findings are to some extent specific for the region of the field site.

What are the implications for the larger process of TVET reforms in China? The preliminary results indicate that the public and private sectors of the Chinese economy may require different approaches regarding the cooperation of schools and enterprises and the coupling of education and employment. As the nursing case illustrates, the quality of human resources can be improved in the public sector if administrative responsibility for enterprises, schools and certificates is centralized in a single line bureaucracy, which commands substantial specialist knowledge. The case of mechanical engineering indicates that for the private sector, more market-oriented mechanisms should be explored. Industry associations provide opportunities for developing such mechanisms, where they command sufficient specialist knowledge and human resources, and issue meaningful, up-to-date vocational qualifications geared to companies' needs. In the public sector, the government and bureaucracy can rely on hierarchical steering to enforce cooperation, even if it is asymmetric. In the private sector, cooperation is more strongly based on the demand and the resources of companies, and the attractiveness of schools as cooperation partners. A less hierarchical and more incentive-based approach is needed to facilitate the up-skilling of the labor force and the up-grading of companies, but this may not be equally feasible in all sectors of the economy.

The focus of this study has been on fields favorable to cooperation, and TVET facilities at the top of the hierarchy. There has been a bias

towards schools, teaching staff and administrative institutions, while companies' and students' preferences and points of view still need more exploration. Also, the number of cases analyzed was limited, which is why these results should be interpreted carefully. The preliminary results indicate that vocational training in the PRC can potentially produce meaningful skills and thus support the economic transformation. The conditions to do so, however, are arguably better in some fields than in others. In disciplines that lack a genuine dependence on (psychomotor) skills, vocational students potentially face a higher risk of being crowded out by the large numbers of – often unemployed – university graduates. Many schools – particularly on the secondary level – lack the financial and human resources to transmit meaningful skills. This is especially problematic in subjects requiring high fixed-capital investments. The underlying causes of this underfunding include bureaucratic fragmentation and fiscal imbalances, and these issues have been avoided altogether in this paper. More research is needed to analyze how local governments try to overcome these problems, and how they affect the interactions between secondary and tertiary schools in TVET. Finally, many students in vocational education arguably lack a passion for their disciplines that could motivate them to pursue a corresponding career – a problem that appears to be strongly rooted in the family-based decision-making processes regarding education and the *gaokao* system. More research is needed regarding the interplay between the field of specialization on the one hand, and the educational biography on the other, to explore potential differences in the motivation of different student groups and their potential effects on the labor market.

LIST OF INTERVIEWS

Interview 20160802b, with the employment coordinators of a Technical Middle School in Central China.

Interview 20160902a, with the leader of the nursing department of an urban public hospital in Central China.

Interview 20160908b, with the leader of the TCM College's School of Nursing.

Interview 20160909, with the leader of the nursing department of an urban public hospital in East China.

Interview 20160913, group interview with teaching and administrative staff from the Technical College and the Arts College.

Interview 20160914, with a coordinator for college-enterprise relations at the Technical College.

Interview 20160921, with human resource staff of a private company in the field of robotics.

Interview 20160923 with a Professor of Foundry concurrently active at the Foundry Industry Association.

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