

Special Double Issue: Political Economy of Development: Perspectives from Contemporary Russia  
Guest Editors: Tatiana Korobchik, Noah Buckley and Ekaterina Borzova

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# Public-private partnerships for skill development in the United States, Russia, and China

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# Public-private partnerships for skill development in the United States, Russia, and China

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## ABSTRACT

We compare three countries where public policy has explicitly sought to align incentives of employers and educational institutions around closing the gap between skill formation and labor market demand. In large, heterogeneous countries such as the United States, Russia and China, collaborative arrangements such as apprenticeships and other forms of public-private partnerships can be constructed at the subnational level by building on direct, face-to-face ties across educational, business, government, and civic sectors. Drawing on existing literature as well as fieldwork studying a number of specific cases in the three countries, the paper develops a typology of such arrangements and proposes an explanation for the observed variation. It emphasizes the importance of two sets of factors: those that induce cooperation on the part of firms and schools, and those that influence the character of such partnerships.

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## Introduction

### *Skill market failure and inequality*

The task of matching the supply of skill with the demand for it poses significant challenges to societies at all levels of development. Low-income countries face problems when the graduates of higher educational institutions are unable to find employment while at the same time managers of industrial and agricultural enterprises are short of skilled workers; families refrain from investing in their children's schooling unless they are confident that there will be a meaningful return (Easterly 2002). Where existing institutions fail to bridge the gap between the supply of labor and the demand for it, poverty, unemployment, and underemployment in some sectors and regions can coexist with unmet labor demand in others for long periods of time, a condition described many decades ago by Arthur Lewis as a dual economy (Lewis 1954; Fields 2004). The failure of markets for skill to clear is also characteristic of countries stuck in the "middle income trap," where countries can no longer compete in global product markets on the basis of low labor costs but are unable to compete in markets requiring highly skilled labor (Doner and Schneider 2016). In these cases, market failures are due to poor-quality institutions.

Developed countries are also subject to such institutional failures. For example, in the United States, there were 6.8 million who were unemployed as of mid-2017, and another 6.7 million who were underemployed and looking for full-time work (Fuller and Raman 2017). Yet at the same time,

there were 6.1 million unfilled job vacancies posted by employers. One reason for this is that many employers – often using automated screening algorithms – treat possession of a bachelor’s degree as a proxy for basic skills even though the jobs they are seeking to fill do not require a four-year college degree. As a result, many individuals lacking a college degree are screened out, while many who are hired because they have a college degree are underemployed. The result is massive inefficiency in the economy and alienation in society (Halperin 1988; Hoffman 2011; Fuller et al. 2014; Stern 2015; Schwartz 2016; Hoffman and Schwartz 2017).

Such labor market disjuncture grows still more acute in times of recession. For example, immediately following the great recession of 2008–2009, underemployment among recent college graduates in the United States reached a peak of 50% (Abel and Deitz 2016). The mismatch of skills and jobs is also uneven across educational specializations. For example, as of 2013, among recent college graduates majoring in the performing arts, underemployment – that is, employment in a job not requiring a college degree – was 66%; for men majoring in criminal justice, it reached over 75%. On the other hand, for individuals who had majored in civil or mechanical engineering, by contrast, the risk of underemployment was less than 2%. Where obstacles to geographic mobility exist, regional pockets of unemployed and underemployed people, and people who have dropped out of the labor force altogether, coexist with other regions facing severe shortages of labor. In the United States, cross-regional mobility has dropped sharply in the last decade, with low-income individuals by far the least likely to move from one area to another in search of better-paying employment (Austin, Glaeser, and Summers 2018; Nunn, Parsons, and Shambaugh 2018). One consequence of such dualism is high economic inequality (Temin 2016).

Although neo-classical economics would argue that labor markets, like other markets, will always ultimately clear, we know that poor institutions can impede the effect of supply and demand for long periods of time (e.g., North 1990).<sup>1</sup> Thus, where market imperfections create frictions in the labor market, there will be a substantial underinvestment in the kinds of skills needed both by employers and potential employees. In many countries, in response to these market frictions, governments and organized social partners may create institutions fostering complementarity between the formation of skill and the demand for skill in the labor market.

From a theoretical standpoint, we know that where the supply of knowledge and skill is well matched to the demand for it, then education and training yield both private and public returns (Easterly 2002). That is, the complementarity of skills – for example, the availability of a pool of individuals possessing the appropriate mix of technical skills that encourages manufacturing firms to expand and innovate – produces positive external benefits to society in the form of economic growth (Streeck 1992). By the same token, both the public and private benefits of investment in education and training can go *under-provided* if agents doubt whether investment will yield a positive return (for example, if employers fear that trained employees will be poached by rival firms, and if individuals fear that they may not find appropriate employment (Acemoglu and Pischke 1998). In such cases, the public benefit of an educated workforce is not realized, and individuals themselves lose out on the opportunity to benefit from seeing out education.

It is not hard to think of characteristic dilemmas created by the failure of markets for skill to clear. A government of a low-income country subsidizes education for doctors and nurses, but loses many of the graduates to higher-wage countries. Nurses and doctors who emigrate are better off, but the loss of trained health professionals deprives the country of their services and in effect subsidizes the health care systems of rich countries (Joyce and Hunt 1982; Dobson 2004). A high-income country provides public support for general public education but leaves most higher and vocational education to the market. Some individuals cannot afford to pay for private education, but others can. As the gap between those who can afford a high quality education and those who cannot widens due to widening income inequality, opportunity and mobility decline and across generations (Reardon 2011; Fryer and Katz 2013; Chetty et al. 2014, 2017; Chetty and Hendren 2016a, 2016b; Chetty, Hendren, and Katz 2016; Putnam 2016).

### **Case selection, methodology, and data sources**

In this paper, we compare three countries where public policy has explicitly sought to align incentives of employers and educational institutions around closing the gap between skill formation and labor market demand. In all cases, although national policy is broadly supportive of this effort, we focus on local initiatives. This is for two reasons. First, in all three cases, national policy instruments tend to be too weak to succeed in comprehensive reform of the system of technical and vocational education and training. Second, actual control over and funding of educational institutions are located at regional and local levels. Therefore, it is at the sub-national level where actual coordination among educational institutions and employers occurs. In the following sections, we review a number of cases from the three countries to illustrate the variety of models of linkages between educational institutions and employers that exist, propose a typology for classifying these linkages, and offer some preliminary ideas on the reasons that particular types of linkages form.

In this paper, we argue that China, Russia, and the United States share some surprising similarities with respect to the institutional challenges of developing successful partnerships among enterprises and educational institutions for the purpose of raising the quality and effectiveness of technical and vocational education and training (TVET). These similarities stem from the fact that despite their different trajectories of economic development, all three take a market-oriented approach to skill formation. That is, using the conceptual framework advanced by the Varieties of Capitalism literature (Hall and Soskice 2001; Bussemeyer and Trampusch 2012), \*\*\*they rely largely on market forces to match supply and demand for skill in the labor market. In contrast to “coordinated market economies,” where employers, labor unions, educational institutions, and government enter into long-term strategic partnerships to coordinate training and employment, in liberal-type economies, individuals, educational institutions, and employers rely for the most part on market signals in deciding on their investments in skill formation. In the United States, market forces encourage disruptive technology, rapid turnover, high inequality, high risk, and high return as individuals and firms determine how to coordinate their investments in productive technology and skill. In the post-socialist environments of Russia and China, where the system of planned coordination of training and employment was dismantled, employers, educational institutions, and individuals are similarly left to their own devices in determining how to invest in skill formation.

A second similarity justifies our comparison as well. In contrast to the level of analysis characteristic of the Varieties of Capitalism discussions of skill formation in liberal and coordinated market economies, we find wide differences across regions in China, Russia, and the United States in the types of relationships established among schools and firms. We describe this variation along two dimensions – the depth of investments made by the partners, and the breadth of participation in such partnerships. We then describe a series of cases and classify them according to this typology. We conclude by drawing some inferences about the conditions under which public-private partnerships are likely to be “deep” or “broad.”

Our paper is based on a large-scale comparative analysis of cooperative partnership arrangements among educational institutions (usually in the public sector), enterprises (both private and public), and government bodies. Our case studies are drawn from multiple locations in three countries: (1) Russia, including Tambov, Perm', and Ulyanovsk; (2) the United States, including Tennessee, Massachusetts, and South Carolina; and (3) China, including Zhongshan in Guangdong Province, Changsha/Zhuzhou in Hunan Province, Taicang/Suzhou in Jiangsu Province, and Jinjiang in Fujian Province. The regions were selected on the basis of two criteria: all have explicit partnership arrangements among educational institutions and firms, but they reveal variation in the relative depth and breadth of the partnerships.

We take advantage of theoretical research placing the problem of skill development in a broader political economy framework, as well as government policy documents and studies. We also draw upon a series of interviews with enterprise managers, educators, government officials, and policy experts in all three countries in order to develop a series of case studies to illustrate our points. We

begin by outlining some of the major national-level policy initiatives that have been undertaken in our three comparison countries. Then we turn to a series of case studies of actual public-private partnerships for TVET.

## National initiatives

### China

In China, the priority of upgrading TVET has risen steadily over the past four decades. For example, a prestigious team of Chinese and international experts warned of “China’s Looming Human Capital Crisis: Upper Secondary Educational Attainment Rates and the Middle Income Trap” (Khor et al. 2016). The report indicated that as of 2010, fewer than a quarter of the labor force had attended upper (higher) secondary school. They linked this skill deficit to the threat that China might fall into the “middle income trap.”

The government has consistently emphasized the importance not only of improving the quality of vocational education, but also of linking schooling and production more closely. For example, the Vocational Education Act of 1996 declared that government, society, enterprises, schools, and individuals were key stakeholders in TVET sector and urged schools to work closely with industry partners in skill training and certification.<sup>2</sup> In December 2013, at the Third Plenum of the Central Committee of the 18<sup>th</sup> Party Congress, CCP General Secretary Xi Jinping called for “quickening steps in the development of a modern vocational education system.” In particular, he urged: more innovation in TVET and especially more cooperation between schools and firms; higher quality TVET, to include “soft skills” and “comprehensive competencies”; and granting greater authority to the regions to administer schools and their fit to the labor market together with significant support from the central government. In March 2014, Prime Minister Li Keqiang followed up in his work report to the National People’s Congress, calling for the development of “a modern employment-oriented vocational education system.”<sup>3</sup> The central government not only demanded that the share of students in upper secondary vocational schools rise from 20% of the total to 50% by 2020, but in 2014 it called for close and flexible integration of enterprises and schools – including internships and apprenticeships – to be adopted throughout the country.<sup>4</sup> This culminated in a major 2014 State Council decision setting out guidelines for raising the quality and effectiveness of TVET.<sup>5</sup> The general goal is to bring education closer to production. Among other things, the government designated a select number of enterprises to adopt the “contemporary apprenticeship system” linking enterprises with schools as part of a pilot program. But the model has been very slow to spread. Instead, most firms needing skilled workers and engineers develop bilateral ties with vocational high schools and colleges, and contract for company-specific or industry-specific skills. The high turnover of migrant labor deters most employers from investing in training of their lower-skill production workers.

The 19<sup>th</sup> Party Congress of CCP in 2017 explicitly called for deepening school-firm collaboration and education-industry integration. The State Council immediately followed up with a statement calling for deepened education-industry integration in December 2017, highlighting the mission, requirement, and standards for deep integration in TVET and higher education.<sup>6</sup> Three months later, six central ministries jointly issued a regulation for TVET school-firm collaboration in early 2018.<sup>7</sup> In November 2018 the CCP Central Committee for Comprehensive Deepening Reform was established.<sup>8</sup> It was under the direct leadership CCP General Secretary Xi Jinping and it highlighted that vocational education should be prioritized by the society; it should be in line with the development of technology and market demand; and enterprises should provide more support for TVET.

Simultaneously achieving the goals of increasing enrollments, increasing quality, and linking education and industry raises both institutional and non-institutional problems. Culturally, as experts widely acknowledge, the entrenched habit of granting prestige to non-manual occupations and academic education and disdaining manual labor and education leads many to regard vocational

education as a pathway for unsuccessful students or the children of migrant laborers. Surveys of vocational students find that nearly all say that they are there because they could not get into an academic high school (Woronov 2011; Shi 2012; Song, Loyalka, and Wei 2013). Institutionally, the vocational and academic tracks are separate, with few cross-walks between them (Cooke 2005).

The fading attraction of TVET is largely the consequence of the break-up of the institutional complementarity around vocational education in society. Under the planned economy, secondary vocational education provided by SOEs provided a direct pathway to permanent employment and relatively high-wage occupation in the manufacturing sector (Yang, Wang, and Liu (2017). Students were recruited as entry-level workers before they started their dual apprenticeship training in SOE-affiliated vocational education schools, or at least were assigned a job upon graduation. Rural households preferred local vocational schools over regular academic high schools, because graduation from vocational schools could provide an opportunity to change one's household registration status from rural to urban status. Urban *hukou* status brought social entitlement such as access to better public schools and better health services. In the new market economy, the Labor Law of 1995 released SOEs from their social obligation of running vocational schools, and the Vocational Education Act of 1996 further detached secondary vocational schooling from household registration status change. Thus, TVET is institutionally separated from high-quality employment and rural-urban mobility in China and loses out in the competition with academic high schools.

## Russia

Like their Chinese counterparts, Russia's leaders have also increasingly called attention to the need to improve TVET as a way to increase productivity. Vladimir Putin and Dmitrii Medvedev, in their roles as prime minister and president, respectively, set ambitious targets for improving Russia's VET system. During the time he was president, Medvedev called for a major upgrading of vocational education: "Our system of vocational education remains unbalanced across levels and to a significant degree ineffective in spending budget resources ... [The prestige of the manual occupations is low and in effect the system of technical colleges] ... is a system for retraining problem youth" (Medvedev 2010). Both he and President Putin have called for a major upgrading of TVET. In remarks in 2012 Putin went so far as to call for the "restoration of a 'workers' aristocracy" that by 2020 would comprise at least a third of the skilled workforce, or 10 million persons.<sup>9</sup> In his December 2016 message to parliament, President Putin declared that "Russia needs skilled cadres, engineers, workers, who are ready to fulfill tasks of a new level. Therefore together with business we are development a contemporary system of secondary vocational education, and are organizing the training of instructors of secondary vocational schools on the basis of advanced international standards."<sup>10</sup> One of the targets Putin set in his May 2012 decrees was the creation of 25 million new high-productivity jobs by 2020. In Putin's 2013 message to parliament, he called on business and government to collaborate in formulating a new set of professional standards and called for creating a new "national council on professional qualifications." He demanded a substantial upgrading of the system of vocational education that would be based on practical training, "training at real production, when theory is backed up by practical skills."<sup>11</sup> In part at the urging of the German government, and with its assistance and advice, the Russian government has urged regional education departments to form links with industry to promote apprentice-style "dual education" methods (see Remington 2017; Remington and Marques 2020).

The Russian government has responded. There is much less bureaucratic turf-fighting in Russia than in China over which ministry "owns" the reform of vocational education. In 2014 the government laid out a plan for reform of secondary vocational educational institutions that would increase the number of graduates by 2020 to 50,000 people "who had demonstrated a level of training corresponding to the standards of WorldSkills." In 2016, the government launched a program called "Worker Cadres for Advanced Technologies," allocating 24 billion rubles to it (Makeeva 2017).

In 2013 the Agency for Strategic Initiatives (ASI) – an interagency governmental body established by Putin to stimulate business development in Russia – announced a call for proposals from regional governments for plans to upgrade VET by incorporating German-style “dual education” methods. This specifically called for industry participation in both revising the curriculum and overseeing practical training. The goal was to induce schools and firms to offer something like German-style apprenticeships. The ASI gave particular priority to high-technology industries and commitments by enterprises to contribute a substantial share of the funding.<sup>12</sup> Thirteen regions were selected to serve as pilots. Below, we will discuss the patterns of firm-school partnerships that resulted.

### ***The United States***

For the United States, it is generally accepted among experts and policymakers alike that federal workforce development programs are fragmented and ineffective. A Government Accountability Report report in 2011 found that the United States spent 18 USD billion in 2009 for workforce-oriented training through 47 programs administered by different departments. The Labor Department administered four for veterans alone, and the Department of Veterans Affairs administers another. Four separate programs administered training funds for American Indians through three different departments. As the GAO report noted, almost none of the 47 programs had been evaluated as to effectiveness (GAO 2011). As Cathie Jo Martin as shown, the Clinton administration offered a number of proposals to improve workforce development, but the initiative ran afoul of members of Congress, trade unions, and businesses, all of whom had a jurisdictional claim to particular types of programs that they favored (Martin 2000). The tendency is for each new presidential administration to launch a new initiative, overtaking previous initiatives and diverting the resources that had been devoted to them.

The case of the Trump administration is typical of the pattern. In June 2017, President Trump issued an executive order calling for a task force to find ways to expand apprenticeships. The Task Force convened in November 2017, under the labor secretary’s chairmanship and with the participation of the president’s daughter Ivanka. It met four times. In May 2018 it concluded its work by issuing a report calling for the expansion of apprenticeships. The report made no reference to any of the numerous previous efforts by the federal government to increase the use of apprenticeships. In July 2018 President Donald Trump signed an executive order for a new program of apprenticeships that would attempt to train 3.8 million workers.<sup>13</sup> I will be signing an executive order to establish the National Council for the American Worker,” he declared. “That’s a first.” However, as of December 2018, nothing further had been heard from the National Council for the American Worker, which apparently has never met or taken any actions. However, President Trump’s proposed budget for 2019 called for a 40% cut in funding for existing Labor Department workforce development programs.<sup>14</sup> President Trump’s display of interest in expanding apprenticeships is characteristic of a pattern seen in the United States whereby a new presidential administration launches a new initiative to improve training and workforce development that displaces or ignores its many predecessors (see Hamilton 2017). Meantime, the number of individuals participating in registered apprenticeships that meet federal Department of Labor standards is relatively low: around 534 thousand in 2017 (out of a national workforce of about 160 million).<sup>15</sup>

Much of the US federal effort to upgrade training programs for workforce development is administered by the states, using a combination of state and federal funding. For example, the federal Workforce Innovation and Opportunity Act (WIOA) invites states to submit proposals for federal funding aimed at expanding opportunities for individuals, particularly those from disadvantaged backgrounds, to find meaningful employment. At the state level, many of these programs are administered through state and local workforce development boards that represent employers, educators, and civic and governmental interests. With few exceptions, however, state and local workforce development boards do not forge ties to secondary and post-secondary schools, but focus instead on opening jobs for marginalized populations (Hoffman 2015, 17). Only in a few states and

localities do workforce development boards and other intermediary organizations draw on federal funds to establish ongoing links between secondary and post-secondary educational institutions and employers' organizations.

Common to the three countries is that national-level policies and programs are weakened by an absence of meaningful policy levers to induce businesses and local educational institutions to enter into long-term cooperative relations where the payoffs are uncertain and the costs in terms of organizational time and resources relatively high. A comment made by one specialist about China's efforts to upgrade TVET could therefore apply equally well to Russia and the United States: "in general the influence of policy is rather weak" (Müller 2017, 3).

## The varieties of capitalism go local

Much of the political science literature on the political economy of skill development relates systems of education and training to broader institutional patterns of social and economic life. As noted above, the body of scholarship known as the "Varieties of Capitalism" (VOC) literature helps us classify different types of institutional arrangements in democratic capitalism (Hall and Soskice 2001; Iversen and Soskice 2001; Hall and Gingerich 2004). It shows that there are strong institutional complementarities across a country's economy, polity, and society as a result of the historical co-evolution of relationships among them. As Hall and Soskice argue, different forms of democratic capitalism can be equally successful at achieving economic growth based on its own "institutional comparative advantage." They tend to allocate risk and reward differently: the liberal systems tend to feature more radical innovation, more "creative destruction" of capital, higher levels of workforce turnover, and higher insecurity and inequality. Market agents – workers and firms – bear a higher share of market risk and receive a higher share of market reward in liberal systems than in those built around long-term strategic partnerships among organized interests such as labor unions, employer associations, business chambers, banks, enterprises, and political parties. Higher levels of spending on social protection tend to encourage co-investment in firm-and-industry-specific costly technologies and skills on the part of employers and employees by allaying fears that downturns in the business cycle, automation, and globalization will devalue their investments.

A crucial aspect of VOC theory is that it assumes the complementarity of institutions, i.e., each institutional arrangement is more effective in the presence of others. Specifically several features of Coordinated Market Economies (CMEs) encourage coordination of investment in skill development on the part of individuals, companies, and government:

- Generous social insurance protection against risk of income loss from lay-offs, disability, and retirement; encourages investment in industry-specific skills.
- Centralized employer-labor association bargaining links wages with co-investment in skill formation.
- Emphasis on job- and industry-specific training rewards continuous technological upgrading; less likely to see radical innovation through "disruptive technologies."
- Coordinated wage bargaining and generous social protection reduce inequality, insecurity; reward long-term employment and the accumulation of skill.
- Apprenticeships are common; they work to align skill demand and supply.

The critical point is that VOC theory assumes *national-level* institutions, consistent across an entire country. For example, in Germany and Switzerland, federal-level legislation regulates apprenticeships. Similarly, in the US, legislation blocks firms from colluding to regulate labor markets, specifically forcing them to compete for skilled labor.

Given the ineffectiveness of efforts by the central governments of Russia, China, and the United States to improve TVET by spreading apprenticeship-style arrangements throughout the country, and in view of the fact that VOC theory tends to focus on national-level, comprehensive

arrangements, we are led to ask whether collaborative arrangements such as apprenticeships and other forms of public-private partnerships can be constructed at the sub-national level in liberal market economies.

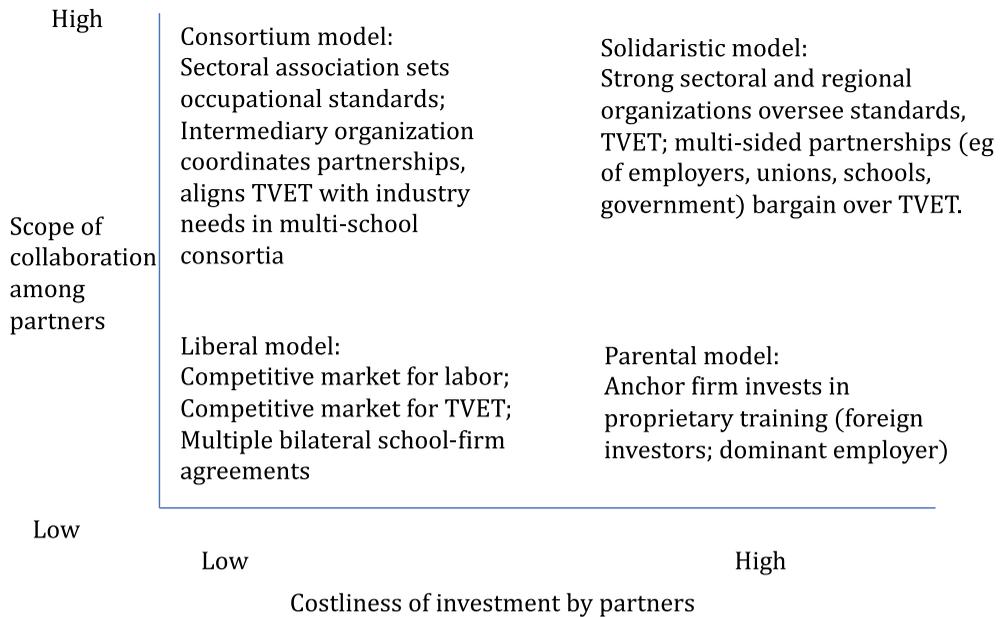
Several considerations suggest that this should be possible. Large, heterogeneous countries, such as the US, Russia, and China, feature wide variation in economic and social conditions across regions. Often regional governments compete to offer investors attractive conditions and develop innovative institutional arrangements to distinguish themselves from other regions. Regional governments can devise functional substitutes for the complementary bundles of institutions found in CMEs. For example, local government-funded *community and technical/vocational colleges* can take the place of business chambers and trade unions in aligning technical education and training (TVET) with needs of local employers. *Firms* can provide career ladders, social insurance plans, and retirement savings plans to encourage investment in skill. Government can create or endorse *intermediary organizations* to monitor and enforce fulfillment of commitments among partners. In all cases, collaborative institutions among firms, government, and educational institutions help improve the match between the demand for and supply of skill.

We can classify variation in types of partnerships for skill development among firms, schools, and governments along two dimensions: the degree of coordination across firms operating in same labor market; and the costliness of resources committed to cooperative arrangements on the part of the partners. For simplicity's sake, we refer to the first dimension as "breadth" and the second as "depth." Theoretically, we should expect a trade-off between breadth and depth. Regardless of whether they provide training in-house or contract with schools or other partners to train, firms are simultaneously interested in maximizing their control over the content of training, while minimizing the cost of training. They must therefore sacrifice some degree of cost-savings if they are to increase their control over content, and vice-versa. These two dimensions yield a  $2 \times 2$  matrix (Figure 1).

In the top right cell are *solidaristic systems*, as some of the literature terms them. They are more common in smaller Northern European countries, where there is high integration in global markets and a practice of sharing the costs and return on skill formation among social partners and taxpayers. Characteristic of such systems are national-level public-private partnerships among the national government, schools, employers, and trade unions for funding and regulating TVET. Employers are legally responsible for determining the qualifications required for occupations in their branches and work through sectoral organizations and business chambers to participate in setting TVET curricula and establishing and administering assessments of competence. A government education body is responsible for ensuring the standardization and quality of schooling. We might note two additional elements characteristic of Germany in particular: the traditionally high social prestige attached to a "calling" (*Beruf*) and the post-World War II social consensus on the importance of "social partnership" in place of labor-capital conflict.

In the bottom left cell are liberal systems. These are characterized by low coordination among firms and low cooperation between firms and government. Typically individuals pay for their own education and training beyond the K-12 general education. Such systems feature higher labor turnover and higher income inequality. Firms pay for training for firm-specific skills. The risks and rewards of skill development are largely borne by individuals and firms. Public education emphasizes general knowledge.

The other two cells are "off-equilibrium," that is, they are not typical of the Liberal Market Economy (LME)/CME dichotomy. In the top left cell are consortium systems. In these we find multiple firms collaborating on training with one or multiple educational institutions, aligning their common interest in general industry skill sets. No one firm bears a heavy cost of investing in training. The fear that a worker whom a firm has trained will be poached by another firm in the same industry and same region is allayed by the common stake of all the firms in the consortium in building a shared pool of workers. Generally, coordination among firms requires strong intermediary organizations that provide information and monitor the commitments made by firms belonging to the consortium.



**Figure 1.** A  $2 \times 2$  matrix showing relationship between scope of collaboration (breadth) and costliness of investment (depth) across types of partnership for skill development.

Generally government plays an encouraging role if it does not indeed serve as the formateur or catalyst of the agreement.

For example, groups of firms representing a particular industry located in a given region might agree on the standards required for certification and licensing in their industry, and offer internships or other forms of workplace-based learning. Coordination occurs through the formation of an organization such as a sectoral council which then works with a group of local TVET institutions at the secondary and tertiary levels to ensure that the TVET curriculum matches the needs of industry for entry-level and mid-skill jobs. In western Massachusetts, for example, small firms in the nano-technology and biotechnology fields have formed “the Massachusetts Advanced Manufacturing Collaborative,” which, among other things, works to align the curriculum of TVET institutions with the needs of member firms as well as to create a pilot apprenticeship program (Jackson 2015).

Another type of consortium arrangement is found in Greenville County, South Carolina. Here, starting in the 1950s and 1960s, in response to the long-term decline of the agriculture and textile industries, local business and government officials began looking for ways to attract foreign investment in high-skill, high-wage industries. Recognizing that tax incentives alone would be inadequate to induce foreign direct investment in manufacturing, civic and business leaders at the local and state level agreed to invest heavily in post-secondary technical education. Greenville Technical College became the motor of the county’s economic development strategy. Overseen by a county-appointed board on which the county school district superintendent, the county Workforce and Investment Board, and major individual firms are represented, the Technical College works closely with firms to develop curricula tailored to their needs. But rather than simply provide customized training services to particular firms, the college converts new technical courses into industry-oriented curricula that can serve multiple firms in the same industry. The county and state governments work closely together, so that successful practices at the local level can be scaled up to the state level, while state-level programs (such as state subsidies to firms that offer apprenticeships) can be adopted locally. The county and state also tap federal workforce development and career-and-technical education funding. The Greenville example is more successful than many, but shares some

common characteristics to consortial arrangements found in the US South: trade unions are simply not part of the partnership; the local (publicly funded) community college is the hub of the cooperation among business, government, and education; multiple firms cooperate with government for the benefit for economic development in the region; and an intense shared perception of competition with other counties helps fuel cooperation across the local, state, and federal levels.<sup>16</sup> A county area development commission is empowered to link business and education as well as to work with prospective foreign investors to ensure that their skill needs will be met. Such a consortial arrangement differs from the solidaristic model in that firms themselves do not provide workplace-based training; they rely on the local authorities to adapt the community college curriculum to meet their needs.

A third example is the Marlborough, Massachusetts STEM (now STEAM) program (Bayerl 2018). This is a high school–based effort to provide both early-college credits to high school students as well as substantial exposure to career-oriented learning opportunities. The community has a relatively high level of economic deprivation: about half the students are classified as economically disadvantaged or at high risk of becoming so, and for over a quarter, English is not the first language in the home.<sup>17</sup> The high school and middle school have formed a partnership with a number of local employers (including health care, advanced manufacturing, and IT) to link students in the STEM program with structured learning opportunities such as job shadowing, team projects, and internships. The intermediary organizations supporting the program include Partners for a Skilled Workforce (now called MassHire), which funds several positions at schools for liaison with employers and a Leadership Steering Committee composed of the employers most closely involved in the program.

In the bottom right quadrant of the figure is an alternative type of partnership arrangement, which we call the “parental” model. Here a single big firm acts as the anchor. If such a firm dominates the local labor market, poaching of skilled workers by other firms recedes as a threat. Usually with the encouragement of local government, local education authorities work with the firm to ensure that the education and training provide not only firm-specific skills, but also more generic skills and knowledge that are transferable to other firms in the industry. In the case of parental relationships, the school depends heavily on its parent firm for material support, such as training equipment, maintenance of facilities, stipends to instruction, practical instruction, and employment of their graduates. Note that parental arrangements are found in Germany as well, as when smaller partner firms rely on a larger “lead” firm (*Leitbetrieb*) to meet training needs for the industry in a given region. The parent firm thus ensures that the classroom instruction at the school complements the workplace-based learning at the firm.

The United States has parental-type partnerships in a number of regions. A notable example is the P-TECH partnership between IBM, the New York City Education Department, and the City University of New York, to provide knowledge and practical training for mid-skill jobs in fields such as IT.<sup>18</sup> Designed as a six-year program (grades 9–14), each student participating graduates with both a high school diploma and an associate (i.e., two-year post-secondary) degree in a technical field such as computers or engineering. Students also have workplace-based learning experiences such as internships offered by partner firms. The success of the initial P-TECH program in Brooklyn, New York, where IBM was the lead firm, has persuaded the state to replicate it throughout New York state. In Carroll County, Georgia, the large copper wire and cable-making company Southwire has active apprenticeship programs with the county schools, which in turn have inspired similar apprenticeship programs in other regional firms such as the Carroll Electric Cooperative.

Such parental relationships also develop when European manufacturing firms locate plants in the United States. For example, large German firms such as Volkswagen typically seek to replicate the German system of dual education as much as possible when they invest in production facilities outside Europe. As in Germany, VW’s model of training is to complement classroom instruction at the technical college with on-the-job training at training centers located at or near the production facility and “learning stations” and master-instructor supervision on the production floor. These

arrangements are quite similar wherever Volkswagen operates assembly plants outside Germany. In the US, where Volkswagen has established a large assembly plant in Chattanooga, Tennessee, the firm has a close and deep partnership with the Chattanooga Community College. In Russia, Volkswagen built an assembly plant in Kaluga Oblast, where it works with the Kaluga automotive industry training center. In China, where Volkswagen has nearly 30 production facilities, it establishes partnerships with local technical colleges. In other countries where Volkswagen has built manufacturing plants, if there is not an adequate technical college available, the company either forms a training facility in collaboration with other automobile manufacturers or does its training in-house. In every case, Volkswagen seeks an educational partner with which to collaborate in dual TVET as a condition of investment. In all cases, support from the regional governor is a critical condition of success.<sup>19</sup>

In recent years, dual TVET systems have even been adopted as statewide policy in two states, among them Colorado. Recently Colorado's governor has championed a project called "Careerwise Colorado" – the premise of which is to establish effective apprenticeship programs throughout every public school district in the state. The apprenticeships are designed as three-year training programs involving three sites: high schools, training centers at community colleges, and on-the-job training in firms. Following completion of the apprenticeship, an individual can choose to accept a job immediately or to continue for a two-year or four-year degree (or both). The occupational fields comprise advanced manufacturing, business operations, financial services, health care, and information technology. A state-sponsored intermediary serves as the broker between employers, firms, schools and school districts, and individual apprentices. It also provides training for the in-firm trainers.<sup>20</sup> Because the program is so new and its scale so small (as of June 2017, 116 apprentices and 40 employers were participating), it is still too early to judge results. However, the Colorado experiment indicates a growing interest in dual TVET systems across the United States. Several other states have adopted comparable programs designed to improve access to TVET and connect students with employers, among them Georgia, Tennessee, and South Carolina.<sup>21</sup>

Russia exhibits all four types of systems in different regions and different sectors.<sup>22</sup> It is important to point out that real "dual education" systems are rare in Russia, as in the United States and China. In most regions, most employers and employees pay for their own training needs; that is, a "liberal model" prevails. As illustrated in the bottom left cell of the matrix (Figure 1), firms form their own bilateral partnerships with educational institutions or concentrate on training in-house. Some of these involve deep cooperation, such as is required by dual education. In these cases, we may see a single vocational-technical school working with multiple firms to provide practical on-the-job training opportunities for students. An example is the Tambov College for Trade, Public Catering, and Service industry, which has contracts with 112 firms for practical training of students along with deeper partnership agreements with 5–7 larger firms.

Some regions/sectors have arrangements closer to multi-firm consortia. Examples include the "Center for Cluster Development" in U'lyanovsk, the "councils of clusters" in Tambov, and the "Agency for Human Capital Development" in U'lyanovsk that is headed by the first vice-governor. Generally, it is the case that larger firms prefer dedicated training programs, featuring depth of investment and higher control over the content of training. Many, in fact, provide in-house practical instruction, which may be developed in collaboration with a technical college along the lines of a "dual education" system. In Russia a major hindrance for firms in providing in-house training is the legal requirement that to grant any kind of educational diploma or certificate, an organization must possess an appropriate license. Some large Russian enterprises do in fact have their own training facilities and educational licenses. This facilitates close cooperation with particular technical colleges for dual education.

Closer to a German-style solidaristic model is the activity of the Trade-Industrial Chamber of Perm' Krai, which operates like a German local business chamber. Most major firms in the region are members. The Perm' Torgovaya-Promyshlennaya Palata (Trade-Industrial Chamber, or TPP) coordinates training and recruitment for its member firms, surveys its members to determine their future

hiring needs, and develops plan projections that the regional government uses to allocate funded quotas for TVET programs among technical and vocational schools.

Intermediary organizations vary widely. Sectoral or government bodies are most common. In Tambov Oblast, the governor created sectoral associations in six branches (manufacturing; agriculture; construction and housing; transportation; IT; social sphere) to set TVET policy. The clusters are overseen by the Governor's Oversight Council and a Council of Directors of Vocational High Schools. Each cluster has a coordination council. In Ul'yanovsk, the aviation industry formed a cluster council to coordinate training and hiring practices. In Krasnoyarsk the light industry association works with a technical high school to provide education and training for its 10 members. In Samara, the machine-building association created training center for mechatronics at a technical high school and persuaded its member firms and the regional government each to pay half the cost. In Perm' Krai, the giant firm Proton, which manufactures rockets, cars, and other advanced equipment, established a training center serving the needs of industry throughout the region.

In China, we also see a variety of models of consortial and parental arrangements. Some, as in Russia, are in what might be termed strategic industries, such as aeronautical production. For example, the Changsha Aeronautical Vocational and Technical College in 2013 established a "Collaborative Innovation Center for Aviation Vocational Education and Technology." The Center's governing board comprises representatives of multiple aviation firms (defense and civilian), research universities, as well as of vocational-technical educational institutions and defense-related research institutions. This collaborative center has more than 110 organizations as its board members in 2018 and is supported by multiple regional government agencies, including the Vocational and Adult Education Bureau of the Hunan Department of Education, TVET Bureau of Hunan Economics and Information Commission, and the Security Supervision Bureau of the Hunan Aviation Bureau. Multiple firms collaborate on training with Changsha Aeronautical Vocational and Technical College and other colleges, in terms of implementing the contemporary apprenticeship training, constructing employee and TVET faculty training base, conducting joint research and development, and establishing advanced training programs for aeronautical equipment manufacture professionals. The center takes the responsibility of an intermediary organization, providing information and collaboration opportunities to its member organizations, as well as monitoring their commitments to the consortium. For instance, the Center regularly organized board meetings for renewing training contracts, initiating joint research among board members, and evaluating performance of joint training and R&D programs.

We also see industry associations and big firms setting occupational and educational standards for technical schools in their regions and working to align the curriculum with industry needs. Another case, again from a strategic industry, the railroad industry, is from Hunan Province. Here the large SOEs use the Hunan Vocational College of Railway Technology and the Hunan Railway Professional Technology College for training, assessment, and certification of trainees. Both colleges used to be affiliated with the Guangzhou Railroad Bureau since the 1950s and have a long tradition in working with SOEs. The colleges build their major clusters around six sets of occupations in the railway industry, closely following occupational standards set by the leading firms such as CRRC, the largest manufacturer of rolling stock in the world. Other employers, such as Guangzhou Railroad Bureau, use the colleges as their in-house training organizations, allocating annual pre-service and on-the-job training quotas with funding. In addition, both colleges provide entry- and advanced-level technician and engineer examinations on behalf of railway enterprises. They can grant an industry-wide recognizable certificate for trainees who pass these examinations. The colleges also coordinate training for metropolitan rail transportation companies in Changsha. The Hunan provincial government and Zhuzhou city government finance the colleges well, because they are the main focus of vocational training in the province. This makes the colleges' position secure – they provide TVET services for the CRRC and other large SOEs. As China expands its network of high-speed railroads and metropolitan transit systems, the demand for highly skilled technicians is growing rapidly.

There are also cases of consortium-type partnerships in the consumer industry. For example, in Gu Zhen township in Zhongshan city, Zhongshan Polytechnic opened a specialized school for the local lighting industry in 2009, supported by the township government and the lighting industry association. Gu Zhen is a town specializing in decorative lighting design and manufacturing. The township's government invested more than RMB 21 million for land, building, and facilities, and the polytechnic invested RMB 8.5 million for teaching equipment, faculty, and student services. This mixed-ownership school served the skilled labor needs of more than 40 local enterprises, including famous brands such as Kinglong Lighting, Shengqiu Lighting, and Huayi Lighting. Meanwhile, the specialized school also serves small and medium-sized enterprises, by providing on-the-job training for lighting art designers, production line managers, and other professionals. Through this school and other three specialized colleges – the South District Elevator School, Shaxi Textile and Custom School, and Xiaolan School for Logistics industry – Zhongshan Polytechnic works with firms to provide industry-specific training programs for local consumer industries, such as lighting, furniture, elevator equipment manufacturing, textile and custom manufacturing, and hardware manufacturing.

Another partnership in the consumer industry is also from Zhongshan city, in the medical and pharmaceutical industry. In this case, the local government serves the role of intermediary organization, providing both infrastructure and incentive for school-firm collaboration. Zhongshan Torch Polytechnic in 2009 created a multi-firm collaborative workplace training base to serve the Zhongshan Torch High-Tech Industry Zone.<sup>23</sup> The Polytechnic uses this training base as an incubator for local SMEs and for its faculty and students. The industry zone government provides rent-free space, lets firms develop and test new products, and gives students at the Polytechnic practical training and product development experience. The labs in the training base are used for technology development and transfer, both for large and small firms. SMEs often work with faculty from the Polytechnic to test new products or new manufacturing processes in these labs and train students as research assistants. Students can find topics for their thesis projects from their experience in labs and sometimes solve the firm's technical challenges on site. The industry zone and college also encourage spin-offs and start-ups by faculty and students.

The partnership between the Quanzhou Institute of Technology in Fujian Province and the Hengan Corporation is closer to a parental model. Hengan is one of the largest producers of sanitary products in China, employing more than 40,000 and having operations in 15 provinces in China, with an extensive upstream supplier chain. As a large company, Hengan does its own training in-house for its employees through establishing a corporate university and management school for professionals. Over the years, Hengan has developed extensive interests in ensuring uniform and high-quality training for its suppliers. Therefore, in collaboration with the Fujian Province business association for sanitary products and Quanzhou Institute of Technology, it jointly invested in a specialized school providing training in automated production techniques for its suppliers and for servicing online sales. The specialized school provides training for industry-wide skills and allocates its graduates among its 40 board member enterprises. The key to the success of the province-wide association is the fact that Hengan dominates it. The Quanzhou Institute of Technology's governing board serves as the intermediary among the partners. It comprises members of the business association as well as of some 40 individual firms. It works closely with the industry to set training standards as well as to supply skilled workers to the member firms. Not surprisingly, it calls itself an "industry partner-type university."

Still another example from Quanzhou (in Fujian Province, on the eastern coast) is the Quanzhou College of Technology, which serves Hengan and several other sizable manufacturers of sportswear and athletic shoes. The college was jointly established by five large local enterprises on the initiative of the neighboring towns Quanzhou and Jinjiang. The Quanzhou government donated the land, some financing, and financial aid for the students, while the participating firms provided the rest of the funding. Each funding enterprise establishes a specialized school under its name, including Jinlong School of Business, Hengan Intelligent Engineering School, Anta Fashion School, etc. The operating costs are shared between the government and the firms, and the firms and the colleges

jointly determine the curriculum and assessment procedures for graduating students. Since 2016, the Quanzhou College of Technology has administered an Enterprise Dual Baccalaureate degree program. The college recruits 30 to 40 employees from each of the leading regional enterprises, and designs a part-time bachelors degree program for these adult students. The curriculum is based on the “dual education” model, committing firms to providing workplace-based instruction. The Fujian provincial government funds additional enrollment quotas for this dual BA program, and intends to build a critical mass of high-skill labor for local industries.

## Summing up

We should distinguish general factors that motivate firms to enter into partnership arrangements with educational institutions from those that tend to make partnerships deep or broad. With respect to firms’ willingness to forge public-private partnerships in the first place, two elements consistently stand out in our case research. First is the active involvement of government leaders, typically chief executives of regional or local governments. In some cases, a new governor or mayor breathes life into an existing body, such as, in the United States, a state or local workforce development board or an advisory council for a local technical college. In other cases, a chief executive expands existing programs, such as apprenticeships, into new industries or scales them up to cover a broader geographic range (as was the case in Colorado, mentioned above). In still other cases, a mayor or governor forms a new council under his or her immediate supervision to gather business, educational, and other civic leaders with the goal of forming new pathways from training to employment. Often this occurs at the behest of a new elected or appointed chief executive who seeks to win attention for a successful policy initiative.

We do not go so far as to say that active intervention by a political leader is necessary or sufficient for the formation of a public-private partnership for skill development, only that it is a frequent concomitant. Leaders vary in skill and motivation, and may choose to focus their time and effort on any number of possible policy areas. A skillful leader often turns crisis into opportunity, by forging a consensus that “something has to be done” and then supplying that “something” in the form of a policy solution to a recognized problem. A leader may create a new organization – such as a regional economic development corporation – to attract funding from outside, an especially attractive option if the existing organizations are moribund. Such a leader can also induce the cooperation of other local leaders. Of course, one problem with institutional solutions that rely too much on the intervention of a leader is that a successor can quickly dismantle what the predecessor has created or allow it to wither away when the grant runs out. Then the new leader may launch another program with no reference to the previous one.

Second, a history of elite-level cooperation in coping with change can be useful in building new partnership arrangements for skill development. A suitably structured elite network spanning educational, civic, business, and government sectors may enable a locality to adapt and innovate institutionally (Safford 2009; Yakovlev, Freinkman, and Ivanov 2018). Where such a network exists, past cooperation leaves a usable history of mutual trust, cohesion, and a shared conception of the region’s needs. We observed examples of this factor in cases such as Greenville, South Carolina; Chattanooga, Tennessee; and Zhuzhou in Hunan Province. A recent study contrasting the response to industrial decline in two rustbelt cities in the United States – Youngstown, Ohio, and Allentown, Pennsylvania – explores the different structure of elite network relationships, using the difference to explain the difference in the degree to which local leaderships were able to cooperate to seek out new opportunities for economic development after the steel industry declined (Safford 2009). Kathryn Stoner-Weiss made a similar argument, about the differing structure of elite networks, to explain the variation in the relative success of four Russian regions after the regime change in the early 1990 s in averting economic disaster and preserving social stability (Stoner-Weiss 1997). More recently, Andrei Yakovlev has called attention to the importance of elite networks in some

contemporary Russian regions, such as Voronezh and Tatarstan, in fostering regional development (Yakovlev, Freinkman, and Ivanov 2018).

Beyond the question of conditions conducive to firm-school partnerships in general, what factors tend to determine whether partnerships are deep or broad? Each dimension of cooperation poses a somewhat different challenge. Broad partnerships require that multiple competing firms cooperate to expand the pool of available skilled labor from which all can draw, alleviating the problems of poaching and wage competition. The most common form of such consoratial arrangement occurs when firms competing in the same industry and in the same labor market work together with educational partners to establish appropriate training programs to meet their needs. Employers may face problems recruiting sufficient numbers of suitable employees because the current workforce is aging, or because the industry is expanding, or both. Typically through a local industry association or government entity, the employers collaborate to establish new programs for training. In the case of Greenville, South Carolina, for example, the business community and government made a strategic decision to expand the pool of skilled labor for the automobile industry by investing in the county technical college; this meant collectively committing themselves to a strategy for economic development based on high-wage, high-skill labor, rather than the traditional low-wage, low-cost labor of the older textile- and agriculturally based economy. In Waldo County, Maine, companies selling fuel oil delivery service compete for customers, but have begun to cooperate to solve the problem of a shortage of qualified truck drivers. Their association has contracted with the local community college and the local CTE center to provide training and adult education retraining classes leading to commercial drivers' certifications. The association cooperates with the county and state to share the cost of providing equipment, space, and instructors. Here the contributions of the partners are relatively minimal, with the lion's share of the cost being borne by individual participants themselves. For example, in the commercial drivers' course in Waldo County, individuals themselves must pay approximately 5000 USD for the eight-week course. Such partnerships come at relatively low cost to the cooperating employers. The employers agree that collaborating in making a modest contribution to a new program for industry-specific skill development at a local educational institution is preferable to trying to outbid one another individually to recruit qualified employees.

Such broad arrangements tend to be found in territorially delimited labor markets featuring multiple employers in the same industry, none of whom has a dominant market share. In labor markets where there is a leading firm, however, that firm is sometimes willing to play a parental role and to assume a disproportionate share of the cost of investing in training. In this case the problem is one of inducing a firm to commit itself to a deep and sustained partnership with one or more educational institutions. Several patterns typically characterize such arrangements.

First, firms assuming a parental role in partnerships with educational institutions often have – or plan to establish – deep roots in a community and operate with long time horizons. Dense ties to the community make such firms willing to internalize some of the costs of training that would otherwise be borne by schools, government, or individuals. Costly investment goes beyond paying some portion of training costs or donating equipment. It often includes devoting some personnel to serving as trainers at the production site, seconding experienced employees to teach at the partner institutions, and paying stipends to trainees and school-based instructors. Deep partnerships also require that firms maintain a continuing organizational commitment to coordination of curricular content and practical training experiences with the educational partner. This requires a substantial time commitment by the employer. The deep investment ensures that the employer exercises considerable control over the content of the training. To maximize the chances that the firm will realize the benefit of this investment, the firm must be sure that, even if some trainees end up working for other firms, it will have first choice in recruitment. The workplace-based learning component allows the firm to evaluate the qualities of trainees over the period of training, and to offer positions to those it considers best suited to its needs.

In some cases, parental firms even build dedicated training facilities where students can learn to operate complex equipment under the supervision of trainers using the same equipment that is

used on the production floor. Examples of such dedicated training facilities tied to apprenticeship-type training are found in companies such as Southwire, in Carroll County, Georgia, in the United States. Volkswagen operates with such a parental model in many of the countries where it operates, including in Chattanooga, Tennessee, Changchun, China, and Kaluga, Russia. Likewise, in Russia, giant firms such as Progress in Samara Oblast', Aviastar in Ul'yanovsk, and Proton in Perm', all have their own dedicated training facilities. These they use for the practical instruction element of the curriculum at their partner schools. In a few cases, such firms also open up their training facilities for the use of other firms in the region, if there is a cluster of firms in the same industry. We saw another example in the case of the Zhongshan Torch Polytechnic, which created a multi-firm collaborative training base serving the local high-technology industry zone. This facility serves multiple purposes, among them as a small-business incubator, a training platform for students, and a product development and testing facility. This facility serves multiple firms in the city and is directly administered by the government of the development zone. Therefore, for the cluster of firms located in that zone, cooperation among firms and between firms and government is both broad and deep.

Thus our review of the case histories suggests that broad partnerships are more likely to arise when there are multiple firms competing in the same product and labor markets, facing a common shortage of skill, and willing to cooperate through a modest joint investment in new programs for training. Government plays a facilitating role, for example authorizing and funding secondary and post-secondary TVET institutions to serve the needs of the given industry. Investment by firms is typically limited (often individual students pay a substantial share of the cost of training), and is confined to donating equipment, helping to set standards, and in some cases establishing an industry-recognized credential.

Deep partnerships are more likely when a single firm dominates both the product and labor markets in the locality, has long planning horizons thanks to a secure or robust stream of orders, and has deep roots in the community. Then the parental firm, as an extension of a paternalistic relationship to the community, assumes a large share of the costs of training itself. It benefits by acquiring greater control over the content of the curriculum, perhaps tailoring it not only to industry-specific skills but more particularly to firm-specific skills, and by the opportunity to observe the performance of individual trainees over the length of the program and to recruit the most promising. These benefits, as well as the goodwill generated by the contributions to skill development in the area, offset the losses as some of the trainees decamp for jobs in other firms or regions.

Whether the principal collective action problem lies in forging cooperation among rival firms or in inducing deep cooperation between a firm and a school, we find that institutions that can monitor and enforce agreements are essential. As Hoffman and Schwartz write, the role of an intermediary is that of a "translator or liaison between education and industry" (Hoffman and Schwartz 2017, 101). Over and over, our research finds that educators and industry partners initially "speak different languages." Industry defines its skill needs in terms of the competences – both hard and "soft" – required for efficient production. These are formulated in certifications, licensing, and "stackable" skill levels (e.g., Welder I, Welder II, and so on). Educators face state-set graduation requirements, typically defined around credits in particular subjects (Algebra I, Algebra II); in some cases, they may be defined in terms of proficiency standards. Harmonizing vocational standards with educational standards is challenging. Experience shows that it requires time-consuming discussion and bargaining. Intermediary organizations therefore help to facilitate and maintain the partnership, whether they are directly under government or government is one of several bodies represented.

We have emphasized that public-private partnerships at the local level can often overcome some of the market inefficiencies that characterize liberal market economies, by building on the face-to-face ties among government, business, and educational leaders in a given locality. In the case of deep partnerships, a firm with strong ties to the community may choose to internalize some of the external costs associated with skill development in liberal market economy settings, and invest in deep and costly forms of joint training programs with local educational establishments. In the case of broad, consortial arrangements, the ties among rival firms and between them and government, civic,

and educational institutions, may persuade them – particularly if they face a common challenge of recruiting skilled employees – to cooperate in establishing new types of training in partnership with local educational institutions. It is precisely the local nature of such partnerships that enables them to enter into longer-term commitments to investment in skill development. Government can provide funding and encouragement; it can convene participants who would not otherwise come together. It can monitor and enforce mutual commitments. It can offer tax breaks, regulatory and zoning easements, loan subsidies, and other material inducements to partnerships.

Intermediary organizations take many different forms but perform similar functions in public-private partnerships. They can be councils directly under political leaders or operate as industry or business associations. In some cases they are boards and supervisory councils of educational institutions. Such intermediary organizations help to coordinate and align occupational and educational standards, monitor the fulfillment of partners' commitments, and set common goals. These organizational innovations can *create* institutional comparative advantage much in the way that national-level VOC's can, by taking advantage of the complementarity of the partners' interests.

Finally, we would argue that although local adaptations of CME-type partnerships among firms, schools, and governments may not readily scale up, they can scale "out" through learning, by emulation by other localities. For example, the success of the Marlborough, Massachusetts, STEM partnership has already attracted the attention of a number of other school districts in the state; successful skill development models in Kaluga, Russia, have led a number of other regional officials to visit.

Local partnerships for skill development built on institutions linking schools and employers can be engineered to serve multiple types of needs: innovation and skill upgrading for firms and industries; reconciliation of economic and social development goals; sharing the costs, risks, and benefits of cooperation across the divide of labor and capital; and building a community-wide focus on shared interests. It is the very heterogeneity of economic geography of large countries such as China, Russia, and the United States that creates the conditions permitting a variety of skill-oriented school-employer partnerships to arise. However, for the same reason, there is little reason to expect that they will ultimately converge into a uniform national model.

## Notes

1. In the late 1950s, Kenneth Arrow argued that the supply for skill will tend to lag behind the supply of it, both because of the time it takes information about labor shortages and surpluses to diffuse through the society and the slow adaptation by educational institutions to changed demand (Arrow and Capron 1959).
2. [http://www.moe.gov.cn/s78/A02/zfs\\_\\_left/s5911/moe\\_619/tnull\\_1312.html](http://www.moe.gov.cn/s78/A02/zfs__left/s5911/moe_619/tnull_1312.html).
3. *Ibid.*, p. 22.
4. "National Medium and Long Term Education Reform and Development Plan (2010-2020)" [http://www.gov.cn/jrzq/2010-07/29/content\\_1667143.htm](http://www.gov.cn/jrzq/2010-07/29/content_1667143.htm); "Decision on the Acceleration of Modern Vocational Training" [http://tvvet.ac.nz/wp-content/uploads/2015/06/Decisn-of-the-State-Council2014\\_booklet.pdf](http://tvvet.ac.nz/wp-content/uploads/2015/06/Decisn-of-the-State-Council2014_booklet.pdf).
5. [http://www.gov.cn/zhengce/content/2014-06/22/content\\_8901.htm](http://www.gov.cn/zhengce/content/2014-06/22/content_8901.htm).
6. [http://www.gov.cn/zhengce/content/2017-12/19/content\\_5248564.htm](http://www.gov.cn/zhengce/content/2017-12/19/content_5248564.htm).
7. [http://www.moe.edu.cn/srcsite/A07/s7055/201802/t20180214\\_327467.html](http://www.moe.edu.cn/srcsite/A07/s7055/201802/t20180214_327467.html).
8. [http://www.chinazy.org/models/adefault/news\\_detail.aspx?artid=68037&cateid=1471](http://www.chinazy.org/models/adefault/news_detail.aspx?artid=68037&cateid=1471).
9. This was in remarks to the All-Russian Popular Front as part of Putin's election campaign in 2012 (<http://www.newsru.com/finance/29feb2012/pusuppose.html>).
10. President's address to the Federal Assembly, 1 December 2016 (<http://kremlin.ru/events/president/news/53379>).
11. President's address to the Federal Assembly, 12 December 2013 (<https://rg.ru/2013/12/12/poslanie.html>).
12. <http://asi.ru/staffing/dualeducation/>.
13. <https://www.whitehouse.gov/briefings-statements/trump-administration-equipping-american-students-workers-skills-need-succeed/>.
14. <https://www.nytimes.com/2018/07/19/us/politics/trump-worker-training.html>.
15. [https://doleta.gov/oa/data\\_statistics.cfm](https://doleta.gov/oa/data_statistics.cfm).

16. This summary is based on collaborative research with Richard Doner, Michael Rich, and Crawford Schneider.
17. Some of the information on which this summary is based is drawn from interviews with school officials on 28 November 2018.
18. <http://wsww.jff.org/initiatives/pathways-prosperity-network/new-york>.
19. Based on interviews with Volkswagen representatives, government officials, and experts in Chattanooga, Kaluga, Changchun, Beijing, and Wolfsburg.
20. Information from presentation by Ashley Carter, Chief Strategy Office of Careerwise Colorado, at the Fall 2017 Pathways to Prosperity Network Institute, Cambridge, MA, 24–25 October 2017.
21. For example, the state government of South Carolina provides a tax exemption to every employer who hires an apprentice. As a result, the number of apprenticeships in the state has expanded rapidly (<http://www.apprenticeshipcarolina.com/>).
22. For more information about the Russian case, see Remington (2017) and Remington and Marques (2020).
23. The Torch program in China is a national effort to use technology development zones to encourage local industrial innovation, which can then be diffused nationally. It has been in existence for 30 years. Overseen by the Ministry of Science and Technology, it is an example of what Sebastian Heilmann calls “experimentation under the shadow of hierarchy” (Heilmann, Shih, and Hofem 2013).

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