Factors influencing technology and knowledge transfer: Configurational recipes for Sub-Saharan Africa☆

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A B S T R A C T

General studies on technology and knowledge (T&K) transfer to developing countries have often adopted methods that yield inconsistent results. Traditional quantitative methods, alone, have limitations in their ability to account for complex interaction between variables. This article adopts configurational recipes, using fuzzy set qualitative comparative analysis (fsQCA) to supplement the analysis. This research carefully and systematically selects responses from experts and practitioners in the construction industry in Ghana. The results reveal two configurational recipes for high quality of T&K transfer: effective industry institutions, education effectiveness, and less congestion of firms; and joint presence of high government policy incentives, effective industry institutions, and education effectiveness. This study extends significantly the existing literature regarding T&K transfer in developing countries in general and in Sub-Saharan Africa (SSA) in particular.

1. Introduction

Through foreign direct investment (FDI), foreign firms can transfer technology and knowledge (T&K) to host country firms in developing countries, such as those in Sub-Saharan Africa (SSA) (Lim, 2001; Osabutey, Williams, & Debrah, 2014). A developing country needs considerable effort to fully absorb and implement new T&K, because such inflows and domestic abilities to use them interact in complex ways (Pack & Saggi, 1997). SSA countries should rely on foreign T&K inflows for development (Osabutey & Debrah, 2012). On this issue, Dunning (1998) and Caves (1996) agree that what influences knowledge-intensive FDI is mainly production cost-related factors, quality and skill of professional elements of labor, competitiveness of related firms, quality of local infrastructure and institutions, and macro-economic policies in the recipient countries. In particular, human resource development (HRD) institutions and specialized clusters (e.g., science and industrial parks) are important for the attraction of multinational corporations (MNCs)/FDI that have T&K transfer potential. However, the problem for developing countries, such as those in SSA, is that they lack well-developed knowledge economies and cannot compete because low-cost production paradigms and high-end industries trap them (Doner, 2009). Dunning (1998) and Caves (1996) assert that the availability of knowledge-related assets such as product,

process, and managerial technology, influences strategic asset-seeking MNCs (Grosse, 1996), specially within markets that allow geographical distribution of such assets.

Although the international T&K transfer literature originates decades ago, studies seemingly ignore SSA. Theories that explain why the overwhelming evidence that T&K transfer in the region is low remain scarce. Considering that developing economies generally have weak institutions (Khanna & Palepu, 2006; North, 1990), the SSA perspective may contribute to an understanding of the wider developing country context and should explain why FDI enhances T&K transfer in some countries but not in others. However, the literature examines knowledge transfer within firms (Mansfield, Romeo, & Wagner, 1979; Teece, 1977) and through alliances, joint ventures, and acquisitions (Bresman, Birkinshaw, & Nobel, 2010; Inkpen, 1995). Much of the knowledge transfer literature concentrates on MNC subsidiary absorptive capacity (Minbaeva, Pedersen, Björkman, Fey, & Park, 2003). This empirical work often focuses on manufacturing to the detriment of other sectors, such as the construction industry.

Many developing countries, including countries in SSA, pursue import substitution industrialization policies soon after independence, because of suspicions about foreign investors (Dupasquier & Osakwe, 2006) and restricted FDI-linked inflow, which creates incapable, technically inefficient, and uncompetitive local firms (Lall & Pietrobelli, 2002). Round about the same period, East Asian countries remarkably embrace FDI (Saggi, 2002; Stiglitz, 1996). Hong Kong and Singapore develop large and competitive industrial sectors, creating tax havens and liberalizing trade. Singapore develops an all-encompassing industrial policy using FDI significantly for T&K transfer and skills development (Lall &

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Pietrobelli, 2002). Despite inevitable and prevalent foreign participation in construction in developing countries (Raftery, Pasadilla, Chiang, Hui, & Tang, 1998), construction industry's T&K transfer in SSA remains scarce. This study attempts to fill this gap.

Essentially, this study aims at building theory from practical cases (Lewin, 1945), using the views of construction industry experts and practitioners in Ghana to evaluate T&K transfer in a developing country. This article explores these factors through a single research question: Which key factors would influence effective T&K transfer in the construction industries in SSA? Following Eisenhardt (1989) and recognizing necessary new perspectives, the analysis focuses on a case study area where existing theory on T&K transfer is woefully inadequate.

The rest of the article's structure is as follows. Section 2 reviews relevant theoretical perspectives and empirical literature. Section 3 describes the research methodology, and Section 4 reports and analyses the findings. Finally, the article discusses implications and conclusions.

2. Theoretical and empirical literature review

To attract foreign investments, host countries offer and justify incentives such as tax holidays and subsidies, because of the expected positive externalities (Eapen, 2013). FDI's major contribution to economic growth derives from "its role as a conduit for transferring advanced technology" (Lim, 2001, p. 3) to the recipient developing country. Productivity gains in host country firms credit foreign presence (Driffield & Love, 2007). Although this FDI inflow is important for developing countries, Agosin and Machado (2005) note that countries must seek benefits, such as T&K transfer, if they seek to counterbalance FDI's crowding out effects on domestic investment. However, a growing literature suggests that the presence of foreign firms does not automatically lead to host country firm productivity gains or T&K transfers.

In Ghana, for example, FDI negatively affects the productivity of local firms (Walkirch & Ofosu, 2010). On Africa, Haddad and Harrison (1993) question why foreign firms generate positive spillovers in some developing countries but not in others. In line with such mixed results, Lim (2001) observes a positive correlation between FDI and growth and argues that FDI-led T&K transfer contributes to economic growth in developing countries. However, foreign firms' presence in SSA has not shown significant T&K transfers (Haddad & Harrison, 1993; Osabutey et al., 2014; Walkirch & Ofosu, 2010). The pertinent need to explore what factors could influence T&K transfers in SSA and developing countries requires contextualization. The article therefore looks at germane T&K transfer factors from the literature and earlier exploratory studies.

2.1. Technology transfer and knowledge transfer

Product technology requires the effective transfer of underlying knowledge (Sahal, 1982). The construction industry integrates both technology transfer and knowledge transfer, and Abbot (1985) rightly suggests that T&K transfer depends on the recipient's ability to use knowledge to innovate. The transfer encompasses physical assets, knowledge, and human capabilities that enhance efficient organization of a construction project and services. Embodied and disembodied knowledge are the most important building blocks (Barrett & Sexton, 2004). Embodied transfer occurs through imports and replication of building designs, equipment, materials, and software for various design and construction methods. Disembodied transfer consists of human skills, which require effective human resource management/development (HRM/D) programs and systems.

2.2. Technology and knowledge transfer factors

Governments targeting FDIs, in line with development objectives, could enhance T&K transfer. The FDI literature suggests that host country firms should target quality FDI. The term "quality FDI," often refers to high value-added FDI with positive linkages and spillover effects (Borensztein, De Grigorio, & Lee, 1998). This article, therefore, builds on Dunning (1998) and Caves (1996), to deduce that institutions, the quality and quantity of local firms, the human resource management/development (HRM/D), and the general policy framework should also influence the quality of T&K transfer.

International business research cannot focus only on industry conditions and firms' capabilities without paying attention to institutions (Peng, Wang, & Jiang, 2008). Most developing economies have weak governance regimes with inadequate disclosure and fragile contract enforcement (Khanna & Palepu, 2006). Institutions, therefore, influence a country's economic growth rate (Makki & Somwaru, 2004; Roberts & Greenwood, 1997). This article also argues that institutions and FDI-linked T&K transfer influences economic growth. The interaction between cross-functional and cross-cultural entities from domestic and international sources can enhance the innovative capacity of firms. Dysfunctional institutional frameworks such as formal and informal norms may affect the T&K transfer. In high-context cultures in SSA, for example, the socio-cultural pillar becomes central to understanding learning and T&K transfer. Weaknesses in infrastructure in Africa curtail rational approaches to experiential learning (Kamoche & Harvey, 2006). Consequently, learning, a function of educational systems, and cultural arrangements can also influence T&K transfer.

Wahab, Rose, Uli, and Abdullah (2009) observe that the literature in the 1970s focuses on the economic international trade model of T&K transfer (Bessant & Francis, 2005). A decade later, the emphasis shifts toward effectiveness of technology for economic development. The 1990s highlight the significance of organizational learning (OL) and knowledge management (KM) systems (Figueiredo, 2001). Later, the literature shows T&K transfer models drawing on knowledge-based views (KBV) and OL (Daghfous, 2004). HRM/D practices that accentuate employee's ability and motivation can also contribute extensively to T&K transfer (Minbaeva et al., 2003). Although the majority of existing literature does not link such relationships to T&K transfer to host country firms, the same logic applies. Therefore, T&K transfer should encompass a conscious effort by local firms in particular, to acquire, store, create, disseminate, and improve upon or add onto knowledge, which relates to the KM concept. Knowledge transfer is, arguably, a subset of KM and social relations/HR, in line with the earlier HRM/D element. This article, therefore, accepts that the HRM/D and KM/OL systems within local firms can influence the T&K transfer process. This idea emphasizes that the literature cannot ignore firm-level responsibility because T&K transfer can be a strategic issue. Particularly, Erkelens, Van Den Hoof, Huysman, and Vlaar (2015) emphasize the importance of organizational learning at the strategic level. Therefore, despite the grounding of this study within institutional theory, the strategic dimension could have links with organizational learning theory.

Borensztein et al. (1998), Caves (1996), Dunning (1998), and Osabutey et al. (2014) all suggest that quality and quantity FDI has the potential to influence T&K transfer. Their studies also reveal that the institutions, the quality and quantity of local firms, the human resource management/development (HRM/D), knowledge management/organizational learning (KM/OL), and the general policy framework all influence T&K transfer.

In respect of the development of the construction industry and T&K transfer, many authors emphasize the importance of government policy (Carrillo, Robinson, Anumba, & Bouchlaghem, 2006; Ofori, 2002). Kwok and Tadesse (2006) note that foreign firms could either enhance transparency or contribute to increased corruption. Corruption (an institutional phenomenon) can influence effective T&K transfer through FDI. The factors emerging from the literature hypothesize relationships between potential firm/institutional factors and quality T&K transfer (Table 2).

3. Method

3.1. The strategic context of the construction industry in Ghana

This study selected the construction industry as the empirical focus because this industry uniquely provides complex linkages to other sectors of a country's economy and has the potential to stimulate other sectors (Ofori, 2002). Studies of T&K transfer factors specific to the construction sector could arguably have similar linkages to other sectors. Ofori (1994) also observes that technology transfer plays a significant role in technology development in the construction industry and requires country-specific policies and approaches hinging on continuous technology transfer planning and monitoring.

The construction industry has been the fastest growing industrial sector (Sutton & Kpentey, 2012), where foreign firms undertake the majority of large scale projects. The large numbers of small and medium-sized local construction firms have resource and capability deficiencies and are therefore often not eligible for major government contracts (Assibey-Mensah, 2009). The majority of host country construction firms generally lack finance, equipment, human capital, and technologies to undertake complex modern projects. Governments focused primarily on infrastructure development and not on T&K transfer and capacity building. The majority of local firms are still developing and have deficiencies in the efficient application of modern T&K. Governments are responsible for a large part of construction projects; therefore, they would implement T&K transfer policies (Osabutey et al., 2014) if they understood its importance.

3.2. Data and measurement

This study draws on questionnaire responses from expert construction professionals and practitioners (profiles in Table 1) and on the factors that would influence T&K transfer in a SSA context, using the construction industry in Ghana as a case study. Data collection involved a structured face-to-face survey questionnaire which allowed respondents to discuss the reasons behind their ranking. These surveys gave valuable qualitative insights for this study. This research surveyed local and foreign firm professionals who worked in construction (both consulting and contracting) firms operating in Ghana. The professionals had at least ten years of construction project experience and were organizational decision makers with substantial local and international industry knowledge and significant private, government, and donor-funded foreign and local project experiences. The research develops profiles using industry knowledge, professional bodies' membership, and construction related ministries' lists. This study collected the data between September and December 2010.

Out of sixty-six carefully pre-selected respondents, thirty-eight useable responses were from professional/technical construction practitioners with civil engineering, geodetic engineering, mechanical engineering, electrical engineering, quantity surveying/procurement, urban planning, architecture, and construction management and

economics professional backgrounds. They all belonged to either a local and/or international professional body.

The analysis used a multi-point questionnaire drawing on T&K transfer factors from the literature and previous exploratory studies. The questionnaire includes a five-point Likert scale (1—strongly disagree, 2—disagree, 3—neutral, 4—agree, 5—strongly agree) to evaluate the quality of T&K transfers and the quantity of T&K transfers, separately with constructs, their measurement items, and reliabilities as in Table 2.

Using literature and a previous qualitative study, the analysis examines the dependent variable, quality of T&K transfer, with respect to five constructs and fourteen measurement items as in Table 2. This study uses the terms quality and quantity to measure the relationship between the quality/quantity of a variable and T&K transfer. This selection builds on the literature which refers to high value-added FDI and/or FDI with positive linkages and spillover effects for the domestic economy as quality FDI (Borensztein et al., 1998). Table 2 indicates that the quality of T&K transfer (dependent variable) depends on the quality of FDI but also the quality (caliber) of local firms participating in the industry. Such local firms should have effective HRM/D and KM systems. The independent variables are congestion of firms, which depends on quantity of foreign and local firms and policies that regulate the industry; government policy incentives, which depend on quality of government development policies, ensuring incentives outweigh costs to encourage foreign firms; effective industry institutions, which depend on relevant industry associations and professional bodies; and education effectiveness, which has links with quality of education and government policies (particularly those that have a link to human capital formation).

3.3. Qualitative comparative analysis

The study first applies multivariate regression analysis technique using quality of T&K transfer as a dependent variable and the four factors as independent variables. Following suggestions by Woodside (2013), this study then conducts contrarian case analysis to detect the existence of asymmetric situations.

Table 1
Profile of construction industry practitioners.

Professional consultants and practitioners working for local firms [engineers (14), architects (5), planners (2), quantity surveyors/procurement specialists (7)],	28
professional consultants and practitioners working for foreign firms [engineers (3), architects (1), procurement specialists (2), construction management specialists (1), construction business development manager(1)]	8
Construction professionals who are executives of construction-related public sector organizations [quantity Surveyor by profession (with tender review responsibilities) and civil engineer by professional (with policy and planning responsibilities)	2
TOTAL	**38**

Table 2
List of constructs and measures.

Constructs	Measurement items (five point-Likert scale)	Reliability (Conbrach's alpha)
Quality of T&K transfer		0.79
	Quality of FDI/MNCs	
	Quality of local firms	
	Effective local firm HRM/D	
	Effective local firm KM	
Congestion of firms		0.88
	Quantity of FDI/MNCs	
	Quantity of local firms	
	Government T&K development policies (Quantity)	
Government policy incentives		0.75
	Quality of government development policies	
	Incentives to encourage foreign firm T&K transfers	
	Foreign firms will transfer if incentives outweigh costs	
Effectiveness of industry institutions		0.77
	Effective and relevant industry associations	
	Effective and relevant professional bodies	
Education effectiveness		0.64
	Quality of local education	
	Quality gov.'t policies effectively implemented	

Table 3
Descriptive statistics and correlation matrix of 5 key factors.

Variable	Mean	Standard deviation	Quality of T&K Transfer	Congestion of firms	Government policy incentives	Effectiveness of industry institutions	Education effectiveness
Quality of T&K transfer	4.2	0.49	1				
Congestion of firms	3.4	0.84	−0.01	1			
Government policy incentives	4.3	0.53	0.34[*]	0.13	1		
Effectiveness of industry institutions	4.4	0.56	0.13	0.04	0.06	1	
Education effectiveness	4.8	0.36	0.48[**]	0.12	0.12	0.19	1

[**] Correlation is significant at the 0.01 level (2 tailed).
[*] Correlation is significant at the 0.05 level (2 tailed).

The study also notes that the ability to account for complex interaction between variables limits traditional quantitative methods (Ganter & Hecker, 2014). This study therefore supplements statistical analysis with configurational recipes by applying fuzzy set qualitative comparative analysis (fsQCA) to analyze the interconnection among these factors. Unlike multiple regression analysis, fsQCA uses fuzzy logic and Boolean logic (Ragin, 2009) and is more suitable for detecting asymmetric relationships and complex situations (Woodside, 2013). First, fsQCA calibrates the data from 0.0 to 1.0, where 0.0 means full non-membership and 1.0 means full membership, suitable to semi-qualitative data in this study. Second, fsQCA provides different causal recipes which consist of Boolean combinations of antecedents. These causal recipes indicate sufficient conditions leading to the outcome variables. Having a relatively small sample size (n = 38) made multiple regression inappropriate. For the calibration of variables, this study follows the transformation process from Wu, Yeh, Huan, and Woodside (2014). For a 5-point Likert scale, for example, this analysis set 5 as the threshold for full membership (fuzzy score = 0.95), 1 as the threshold for full non-membership (fuzzy score = 0.05), and 3 as the cross-over point (fuzzy score = 0.50). The minimum cases to consider a solution is 2 and the consistency level thresh-hold is 0.90.

4. Results

4.1. Research findings

This section presents the results on the factors that influence T&K transfer. Table 3 produces a correlation matrix for the 5 key variables that this study identifies. Notable is the strong and significant positive correlation between the quality of T&K transfer and government policy and education effectiveness. Government policy should influence quality and quantity of local and foreign firms to encourage foreign firms to transfer and should ensure that the educational system is producing requisite human capital needs with ideal absorptive capacity to enhance T&K transfer.

However, a step-wise linear regression analysis using quality of T&K transfer as dependent variable and other four factors as independent variables results in a bivariate relationship between education effectiveness and quality of T&K transfer ($R^2 = 0.232$, Beta = 0.482, p = 0.02). To detect the existence of asymmetric relationships between the predictors and the dependent variables, Table 4 illustrates the occurrence of contrarian cases that run counter to the main effect between quality of T&K transfer and government policy incentives. Table 4 reports a quintile analysis of T&K quality and government incentive policy. Table 4 also indicates 8 cases which have high government policy but low quality T&K transfer and 4 cases which have low government policy but high quality of T&K transfer (4 + 8 = 12, or 12/38 = 30% of the total cases). Following Woodside's (2013) call for new thinking in analyzing such data sets, this study applies fuzzy set qualitative case analysis. FsQCA 2.5 software provides three solutions regarding the sufficient configurations for quality of T&K transfer, including a complex solution, an intermediate solution, and a parsimonious solution. In this case, the complex solution and the intermediate solution yield the same outcomes. Table 5 presents the solutions regarding the causal link of the four factors: namely congestion of firms, government policy incentives, effective industry institutions, and education effectiveness to the quality of T&K. Filled solid (black) circles indicate the presence of a condition and unfilled (white) circles indicate the negation of causal conditions, whereas empty cells point to the absence of a condition.

The solutions 1 and 2 in Table 5 show two solutions leading to high quality of T&K transfer with sufficient consistency (≥0.90) and high coverage (0.65). Solution 1 states that professionals recognize that effective industry institutions, education effectiveness, and less congestion of firms are members of the set "high quality of T&K transfer." Solution 2 indicates that joint presence of high government policy incentives, effective industry institutions, and education effectiveness achieves 92% consistency for all firms with high-quality T&K management and transfer with a unique contribution of 21%.

These results reveal two configurational recipes for high quality of T&K transfer: effective industry institutions, education effectiveness, and less congestion of firms; and joint presence of high government policy incentives, effective industry institutions, and education effectiveness. Therefore, both solutions represent sufficient sets of conditions of the outcome. This result means that effective T&K transfer depends on government policy incentives, effective institutions, education effectiveness, and significantly ensuring less congestion of firms. Parsimonious solutions yield two solutions with overall solution coverage of 0.87 and consistency of 0.84. They suggest that absence of the congestion of firms or presence of government policy incentives leads to high scores of the quality of T&K transfer, indicating these factors as core conditions. The other two factors (effective industry institutions and education effectiveness), which do not appear in the parsimonious solutions, are peripheral conditions (Fiss, 2011). This study also analyzed the negation of quality of T&K transfer, which yields no meaningful solutions. Effective industry institutions and education effectiveness are necessary conditions because they appear in both solutions.

5. Discussion

The literature review reveals that FDI negatively affects productivity of local firms in Ghana (Walkirch & Ofosu, 2010). The findings reveal that low T&K transfer could owe to the absence of requisite government policies and a poorly regulated industry. Firm influx and composition suffer from deregulation, creating congestion. To enhance T&K transfer, the industry needs less congestion of firms (both foreign and local). The term "less congestion" is relative and not absolute; congestion of firms should not focus entirely on the numbers, but should be relative to other factor conditions, the state of development of the industry, and the interlinkages to other sectors. Optimal quality and quantity of foreign and local firms require strategic government policy to enhance T&K transfer potential (Carrillo et al., 2006; Chatterji, 1990; Ofori, 1994).

This study's findings also affirm the importance of quality FDI (Borensztein et al., 1998) and quality of local firms (Caves, 1996; Dunning, 1998). Good HRM systems (Minbaeva et al., 2003) support the transfer process. This article's findings relate to the fact that HRM systems in host country firms are also important (Osabutey et al.,

Table 4

Percentile group of quality of T&K transfer /percentile group of government policy incentives cross tabulation.

Count		Percentile group of government policy incentives					
		1	2	3	4	5	Total
Percentile group of quality of T&K transfer[a]	1	4	0	1	2	2	9
	3	1	7	1	4	0	13
	4	4	0	4	0	0	8
	5	0	0	2	0	6	8
		9	7	8	6	8	38

[a] No cases for 2 generated

2014), and conclude that the absence of good HRM/D systems among host country firms could also explain poor T&K transfer in Africa. Altogether, these findings indicate that quality local firms should have ingrained supportive HRM/D and KM systems to enhance the quality T&K transfer. Weak institutions could also be responsible for low and poor T&K transfer in SSA. Ineffective industry associations, professional bodies, and educational systems could also explain poor T&K transfer.

6. Conclusion and implications

The study has investigated factors that could influence T&K transfer in a developing country, specifically in a SSA setting such as Ghana. This study's unique application of fsQCA reveals that the four contextual factors that could influence T&K transfer are less congestion of firms (foreign and local), government policy incentives, effective intermediate industry institutions, and educational effectiveness. Quality of T&K transfer and management depends to a large extent on having quality foreign and local firms. Although this conclusion is logical, and therefore not significantly new, the results emphasize the importance of quality FDI and agree with Borensztein et al. (1998). The importance of effective education and government policy incentives is also consistent with a significant portion of the literature.

This article significantly extends the works by Dunning (1998) and Caves (1996) that refer to quality of infrastructure and institutions, emphasizing that, in developing countries, effective industry and professional bodies could influence the transfer process. This article also contributes to the theory remarking that, even though organizations need to learn, this process has to take place within the context of institutional factors. Consequently, the findings on SSA context inform and enhance organizational learning theory. This article's most significant contribution to the literature is the demonstration that the enhancement of T&K transfer in host developing economies requires less congestion of firms. The article also distinctively evaluates quality and quantity of both foreign and local firms as constituent parts of effective T&K transfer.

The present study uniquely brings together factors that explain both inter-firm and intra-firm T&K transfer justifying why T&K transfer is relatively low in some developing countries. The literature points to a lack of integration of varied sets of researched antecedents, neglecting causal interdependence between contributing factors. To further the understanding of these complex patterns of causal interrelationships, this study applies fsQCA to a carefully selected sample of construction industry professionals. The results show configurations of contextual factors that lead to quality T&K transfer in developing countries and find evidence of complementary relationships between these factors. This study goes beyond the examination of factors in isolation to validate the usefulness of fsQCA for studying T&K transfer, demonstrating that recipes are more important than a single factor.

Although the sectors and countries in this study limit the results, the analysis sets the basis for further research in other developing countries. Future studies can include additional factors such as stage of development, sector or industry knowledge intensity, and cultural factors. A differentiated analysis of diverse industries and countries could provide richer insights about industry- and country-specific differences. Even though the unique linkages between other sectors and the construction industry could make the present findings relevant across sectors and subsectors, future studies should evaluate comparative multi-sector studies. Future studies should also explore how type of T&K can influence the quality of T&K transfer.

Broadly speaking, applying fsQCA to the study of T&K transfers offers a judicious complement to both context-rich qualitative research that examines small numbers of cases and quantitative studies that validate simplified relationships. Supplementary application of fsQCA to the field of T&K transfer, therefore, holds great potential to advance the understanding of the subject in much neglected regions, such as SSA.

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Table 5

Sufficient configurations for quality of T&K transfer.

Solution	Causal conditions				Raw coverage	Unique coverage	Consistency	Solution coverage	Solution consistency
	Congestion of firms	Government policy incentives	Effectiveness of industry institutions	Education effectiveness					
1	○		●	●	0.45	0.07	0.93	0.65	0.93
2		●	●	●	0.59	0.21	0.92		

Note: Filled circles indicate above threshold levels of respective conditions, whereas unfilled circles indicate negative conditions. Large circles indicate core conditions; small ones, peripheral conditions. Blank cells represent "do not care" conditions.

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