Compact organizational space and technological catch-up: Comparison of China's three leading automotive groups*

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ABSTRACT

This study examines why compact organizational space may matter for technological catch-up, through a comparison of China's leading automotive groups. The comparative analysis demonstrates that the Shanghai Automotive Industry Corporation (SAIC) surpasses its two local rivals in terms of technological capabilities partly because the firm has managed its organizational space in close connection with intensive growth strategies at the group level. SAIC has greatly benefited from compact organizational space in building technological capabilities, as it encourages the mobilization and integration of internal resources and promotes group-wide synergy for an effective internalization of acquired assets.

"[I]n the next century, our nation's position in the international economic order will be, to a large extent, determined by the position of our nation's large enterprises and groups."

– Wu Bangguo, former Vice Premier of China[1]

1. Introduction

Does compact organizational space matter when latecomer firms are trying to build in-house technological capabilities? Here, I use the term *compact organizational space* to conceptualize the organizational climate of a business group, whose affiliated firms maintain close proximity through active interactions, collaboration, and resource-sharing for group-wide common goals.

The majority of the latecomers with global recognition are business groups (Colpan and Hikino, 2010). In the context of developing countries, the business group is often understood as an institutional means to technological catch-up (Lee, 2006), beyond an organizational form emerging as a passive, firm-level response to the underdeveloped market environment (Khanna and Palepu, 2000). Successful East Asian latecomers, in particular, have demonstrated that market entry into capital and knowledge-intensive sectors can be managed successfully under the business group structure, which offers critical advantages in organizational learning, internal-resource mobilization, and market-risk management (Amsden, 2001).

Leading market performers in China are also multi-unit enterprises (Lee and Jin, 2009). A catch-up motivation underlies the emergence of Chinese business groups, although they differ from their East Asian predecessors, in terms of less diversified business domains and dominant state ownership (Keister, 2000). China's automotive sector offers a good example. The sector's major constituents were once state-owned enterprises (SOEs) with single manufacturing plants, but have become business groups as a result of their catch-up strategy, involving various knowledge and efficiency-seeking activities (Nam, 2011).

The business group, however, should not be seen to guarantee improved technological capabilities, as it is a means to technological catch-up, not the catch-up itself. An effective use of the

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[1] Quoted in Nolan (2001), p. 17.

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tool depends largely on the capacity of those who utilize it. So far, the organizational transformation of China's leading automakers into multi-unit enterprises has been spurred by international joint ventures (IJVs) and intra-industry mergers, expanding their organizational space dramatically. This may suggest that internal resources and skills that can be utilized to enhance in-house technological capabilities are dispersed across multiple sub-operational units. Accordingly, mobilization or integration capacity for such internal resources at the group level may have arisen as a crucial determinant of overall technological performance.

Despite the plausibility of this scenario, the literature is sparse on the topic. Most studies that explore similar hypotheses focus on Japanese or Korean cases, which differ from their Chinese counterparts in several key characteristics. In addition, many analyses of Chinese industries or business groups have different foci, highlighting government policy or foreign direct investment (FDI) as primary determinants of cross-firm performance variations, while largely neglecting firm-level managerial practices. This study is motivated to fill this gap.

2. Theoretical framework and method

2.1. Proximity and compact organizational space

As mentioned earlier, the term *compact organizational space* is used to describe the degree of proximity among affiliates of a business group. By "proximity," I primarily mean geographical and organizational proximity, although the concept can extend to include cognitive, institutional, and social dimensions (Boschma, 2005). The potential contribution of compact organizational space – or geographical and organizational proximity among group affiliates – to technological catch-up at the group level is hinted at in the literature.

Geographical proximity – or "the extent to which multiple collaborating actors can have daily face-to-face relations without prohibitive costs" (Capello, 1999, p. 357) – can facilitate access to knowledge and spread of best practices at the group level. Face-to-face interactions can raise the efficiency of organizational learning or technology transfer substantially, as knowledge is by nature tacit and non-codifiable. Geographical proximity may also generate unintended knowledge spillover from local labor pooling. However, geographical proximity is not sufficient for effective inter-organizational learning. Certain organizational ties are essential, since relational capital, knowledge, and other intangible assets, if substantially territorialized, are often available to the insiders only (Kirat and Lung, 1999). Also, automatic sharing of such assets among different sub-operational units of a business group should not be assumed (Amsden and Hikino, 1994).

Organizational proximity refers to the situation where organizations belong to the same relational space or share a common reference space or knowledge base (Torre and Gilly, 2000). In general, organizational proximity enhances inter-organizational learning, as it tends to expand collective capacity for knowledge transfer and integration (Burmeister and Colletis-Wahl, 1997). In a multi-unit enterprise setting, the same term may be understood as "the proximity between employees of a multi-plant firm who identify with each other as a result of belonging to the same firm and of their knowledge of firm-specific routines" (Schamp et al., 2004, p. 609). If a business group includes quasi-independent sub-operational units, such as IJVs, its organizational proximity may be challenged (Nam, 2011).

2.2. Hypothesis

My main hypothesis is that compact organizational space benefits business groups as a promoter of technological catch-up, as it can blur the boundaries across group affiliates and can reduce costs of mobilizing internal resources and internalizing external resources.

Once a firm established access to external knowledge or capabilities, what matters next would be their effective utilization, in combination with other internal complementary assets. In particular, the key to successful catch-up is creating a mutually reinforcing, interactive circle among the three components of technological capability – production, project execution, and innovation capabilities (Amsden and Hikino, 1994). A main limitation of China's IJV model is that the IJVs, despite their contribution to increased local production capability, have constrained the channel through which the increased production capability can be utilized to nurture project execution and innovation capabilities (Nam, 2011). A recent case study of China's outward FDI demonstrates that an effective relaxation of the constraint would require a consistent and careful firm-level strategy, beyond public interventions such as industrial policies (Nam and Li, 2013). In this context, I focus on the potential role of compact organizational space as one effective relaxer of the constraint, particularly when the firm is a business group.

2.3. Method

To test my main hypothesis, I conduct a comparative case study of China's three leading automotive groups: the Shanghai Automotive Industry Corporation (SAIC), the First Automotive Works (FAW), and the Dongfeng Motor (DFM) Group. The rationale for the method is that these three firms differ in terms of in-house technological capabilities and organizational space characteristics, while sharing some key aspects which I want to control for.

More specifically, SAIC, FAW, and DFM are similar in the following four respects. First, all three firms are China's oldest automakers, with over a half century of vehicle-manufacturing history (Table 1). Second, all have achieved comparably high economies of scale. As of 2012, their aggregate passenger vehicle market share reached 58%, and each of the three firms has already developed a passenger-vehicle production capacity exceeding two million units a year. Third, the Chinese central government has picked these three firms as major beneficiaries of its automotive policy and has treated them preferentially in a comparable manner. Finally, all three firms have used the IJV arrangement to access advanced vehicle-manufacturing technology.

On the other hand, the three firms have adopted different growth strategies, particularly in the ways to manage their

Table 1
Overview of China's big three automakers.

	SAIC	FAW	DFM
Ownership	Shanghai Municipal Government	Central Government	Central Government
Annual passenger vehicle production in 2012 (units)	4.2 million	2.4 million	2.5 million
Passenger vehicle market share in 2012	26.9%	15.6%	15.9%
Year of establishment	1958	1953	1964
First year of mass production of modern passenger vehicles	1985	1990	1992
Own passenger-vehicle brands	Roewe, MG	FAW, Xiali, Haima	Fengshen

Source: Data from Fourin (2013) and each firm's official website.

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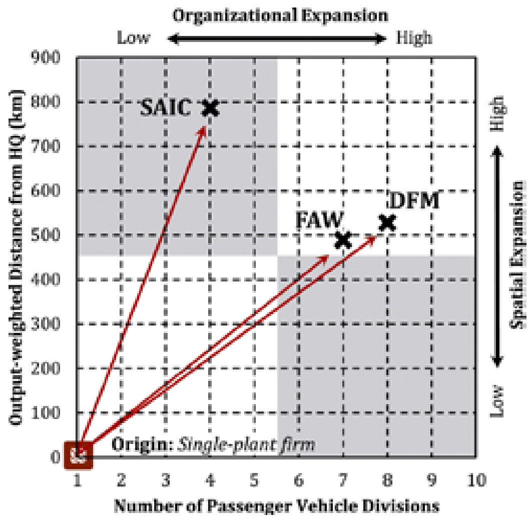

Fig. 1. Growth patterns of the three automakers, as of 2012.
Source: Created by author. Output data from Fourin (2013).

production space. In brief, SAIC has maintained relatively compact organizational space, compared with FAW and DFW, although it has coordinated relatively dispersed production bases in spatial terms (Fig. 1). SAIC has expanded its production space beyond Shanghai's city boundary primarily through extending its pre-existing IJV partnership with General Motors (GM), while FAW and DFM have grown mainly through domestic merger and acquisitions (M&As) and/or new IJV partnerships, embracing increasingly diverse constituents in a geographically isolated fashion.

In addition, several indicators suggest cross-firm variations in technological capability (Table 2). First, SAIC has developed more comprehensive in-house capabilities for planning and engineering than the other two, which lack, in particular, full platform engineering and/or digital engineering capabilities. Second, SAIC has built a greater pool of research and development (R&D) resources. In 2009, for example, SAIC spent on R&D more than FAW and DFM did collectively, showing much higher R&D intensity, and employed more engineers with graduate degrees. SAIC is also surveyed to show lower R&D dependence on external automotive consultancies than FAW and DFM. Third, SAIC has equipped its central R&D center with a more complete set of test and validation hardware. Finally, SAIC has demonstrated shorter cycles of new vehicle development. In 2010, for example, SAIC introduced 14 passenger-vehicle models to the market, while FAW and DFM introduced 11 and 9 models, respectively.

Considering all these indices, a recent detailed technical report on China's automotive industry by Warburton et al. (2013) places SAIC, benchmarked at 70% of Volkswagen (VW), over any other Chinese automaker, in terms of in-house technological capabilities. This report even concludes SAIC to be the only Chinese automaker with "genuine product development capability" (Warburton et al., 2013, p. 61). In contrast, FAW and DFM, benchmarked at 40% of VW, even fall behind Chery, Geely, and Great Wall – relatively small volume producers that have been largely excluded from main beneficiaries of China's automotive policy.

2.4. Data collection

Primary data for this study is from 25 in-depth interviews, which I conducted in the winter of 2008 and the summer of 2009. Each interview is based on open-ended questionnaires and lasted up to 2 h. My interviews primarily targeted mid-high level managers and

Table 2
Comparison of in-house technology-development capacity, 2012.

	SAIC	FAW	DFM
Planning and engineering			
+ Full platform engineering	Yes	No	No
+ Systems engineering	Yes	Yes	Yes
+ Digital engineering	Yes	Yes	Some
+ Supplier management	Yes	Yes	Yes
+ Parts and systems evaluation	Yes	Yes	Yes
R&D resources and personnel			
Total R&D expenditures, 2009 (millions of RMB)[‡]	8912	4187	2782
+ R&D intensity, 2009(%)[a,‡]	2.6	2.0	1.0
+ % of engineers in group employees, 2010[‡‡]	14.7	13.8	9.7
+ % of graduate degree holders among engineers	33	30	(n/a)
+ Reliance on outside consultants (high–mid–low)	Low	Mid	Mid
+ In-house engine development	Yes	Yes	AVL[c], T Engineering AB[d]
Test and validation hardware			
+ Performance simulation	Yes	Yes	Yes
+ Engine test beds	Yes	Yes	Yes
+ Emissions test equipment	Yes	Partial	Yes
+ Engine calibration	Yes	Yes	Yes
+ Climatic chambers	Yes	Yes	(n/a)
+ Crash test facilities	Yes	Yes	Yes
+ Wind tunnel	Yes	No	No
+ Rolling road	Yes	Yes	(n/a)
+ Component durability testing	Yes	Yes	Partial
+ Shaker rigs	Yes	Yes	Yes
+ Noise, vibration, and harshness (NVH) test	Yes	Yes	Yes
+ Test track	Yes	Yes	Yes
Other performance			
+ New product introduction, 2010[b,‡]	14	11	9
+ New introduction of own brand models, 2010[‡]	4	5	2
+ China New Car Assessment Program (C-NCAP) crash test score	47.1	47.9	45.3
+ Euro 4 compliant engine	Yes	Yes	Yes

Source: [‡]Computed from Fourin (2013); [‡‡]Computed from CATARC (2011); All the other information from Warburton et al. (2013).
[a] Total R&D expenditures divided by sales revenue.
[b] Includes vehicle models newly launched or subject to full model change in 2010.
[c] Australian automotive consultancy
[d] Swedish engineering company, in which DFM acquired majority stake in late 2012.

engineers of China's five major automotive groups[2] and their IJVs,[3] but two of the 25 interviewees were China's public officials with extensive knowledge of national and local automotive policy and four were local journalists or consultants well informed on the Chinese automotive sector. To minimize individual bias, I only used the information, which is either triangulated by multiple interviewees or confirmed by published sources. I also depend on secondary sources and personal communications with the interviewees, for more recent data and information.

3. Literature review

3.1. Chinese business groups

Business groups are more prevalent than other multi-unit hierarchies throughout the world (Ghemawat and Khana, 1998). A

[2] SAIC, FAW, DFM, the Guangzhou Automotive, and the Beijing Automotive.
[3] SVW, SGM, PATAC, Dongfeng-Honda, FAW-VW, Guangzhou-Honda, Guangzhou-Toyota, and Beijing-Hyundai.

business group differs from a conventional multidivisional firm (M-form) in that it consists of multiple *legally independent* business entities under a unified management structure at the top level, governed by a dominant family or firm (Colpan and Hikino, 2010). A business group is often interpreted as an institution that reflects the growth path of latecomers, distinguished from that of market leaders, particularly from the West (Lee, 2006). In contrast to the Chandlerian growth path (Chandler, 1990), many leading market performers from the developing world have broadened their business scope by covering a wide range of industrial sub-sectors having *weak*, rather than *strong*, technological ties (Leff, 1978; Amsden, 2001). A primary reason is that such diversification strategies have helped latecomers manage market entry to more profitable industrial segments through the intra-group financial subsidization and the group-wide sharing of the generic segments of knowledge and skills (Amsden and Hikino, 1994). Accordingly, diversification is often considered a key characteristic of typical business groups (Chang, 2006).

Chinese business groups are distinguished from their East Asian counterparts in terms of dominant state ownership and well-focused business domains (Lee and Kang, 2010). Both characteristics are the legacy of China's socialism and planned economic system. In particular, provincial ownership has been more prevalent than central ownership among Chinese major business groups. In 2001, for example, around 70% of the 2710 Chinese large business groups were under the full or partial control of provincial or comparable municipal governments (State Statistics Bureau, 2006). This is because the social division of labor principle was implemented at a provincial level in China, while it was coordinated at the central level in the former Soviet economic bloc (Granick, 1990).

The prevalence of locally controlled SOEs played a dualistic role in China's reform process. On the one hand, the large pool of locally controlled SOEs was a blessing, as they tended to have clearer financial incentives and higher monitoring capacity than centrally controlled SOEs (Walder, 1995). The "M-form" structure at the national level – where each sector is composed of multiple SOEs – also offered substantial advantages in making China's market transition smoother and more successful, compared with the unitary or "U-form" structure widespread within the former Soviet Economic Bloc – where each sector is dominated by a single SOE (Qian and Xu, 1993). On the other hand, too many locally controlled SOEs sharing the same business domains raised inefficiency problems, as their intra-regional orientation forced them to be operated at a sub-optimal scale. Accordingly, China's post-reform corporatization drive emphasized the reduction of cross-regional and inter-firm functional redundancy (Child, 2001).

Modern Chinese business groups emerged in the mid-1980s as a result of a series of economic reforms aiming at industrial rationalization (Keister, 2000). China's central government strategically guided large SOEs' organizational transformation through spinoff, M&A, and joint venture arrangements, as it saw the business group as a primary organizational device for economic catch-up, essential to nurturing local firms with global presence (Hahn and Lee, 2006). In conjunction with the goal of industrial rationalization, *intra-industry* M&As were conceived as particularly crucial to promoting economies of scale at the sectoral level and to reshaping regionally fragmented domestic markets in a more integrated fashion. Such an intra-industry orientation of the asset reconsolidation regime tended to encourage China's leading SOEs to develop well-focused business portfolios, moving away from diversification.

Lacking in-house technological capabilities and managerial skills, however, Chinese SOEs may confront a challenge with their multi-unit operations in generating group-wide synergy (Lee and Woo, 2002). While typical M-form organizations, where internal divisions with substantial managerial autonomy compete with one another, may work for firms with strong proprietary knowledge assets (Chandler, 1977), the centrally coordinated firm structure, which enables the internal sharing of group-wide generic project execution skills, may be more suited to firms lacking such internal technological assets (Amsden, 1989). Unfortunately, many Chinese SOEs, lacking competitive proprietary technologies, operate their M-form hierarchies without effective central monitoring (and thus coordination) mechanisms (Steinfeld, 1998). How to raise synergy at the group level remains a challenge for China's state-owned sectors.

3.2. China's automotive sector modernization

The Chinese state has strategically guided its automotive sector to a sequential evolutionary path, where local original equipment manufacturers gradually develop competitive brands and technological capabilities to become global players. At the center of the strategy are the strict FDI regulations requiring a foreign automaker to establish an IJV in partnership with local firms, in exchange for its access to China's domestic market. This IJV requirement is intended to facilitate the transfer of advanced foreign technology to local automakers (Gallagher, 2006). The central government has treated FAW, DFM, and SAIC preferentially for their IJV operations over other domestic firms, in terms of access to foreign exchange reserves and subsidized credits.

Improving efficiency, as well as seeking technology, has held priority in China's automotive policy. In the early stage of China's auto sector modernization, the low efficiency prevailing in the sector was a problem of great urgency. In 1991, for example, over 110 automakers were producing integrated vehicles in China, but their average annual production capacity was no higher than 7000 units per firm (CATARC, 1992). This production scale was far from the industry's conventional minimum efficient scale, which is around a quarter million units a year. A decade later, the state-led rationalization drive for the automotive sector became apparent, aiming to create an oligopolistic market structure through intra-industry M&As[4] and controlled market entrance.[5] This industrial rationalization move has facilitated operations of local firms at larger scales (Chu, 2011). Between 2000 and 2012, for example, the local automaker's average annual production increased from 17,527 units to 246,407 units, and the collective annual passenger-vehicle production by the three largest automakers grew 18 times, from half a million units to 9 million units (Fourin, 2013).

Despite such visible achievement, China's automotive policy tended to incentivize *extensive*, rather than *intensive*, growth (Huang, 2002). The central government initially picked national winners primarily based on market shares while neglecting efficiency aspects. To maintain high status in the national pecking order, those state-selected firms had to remain large. With this policy incentive and under the soft-budget constraint, many local firms have expanded output capacity through new IJV partnerships or domestic mergers, with little consideration of potential synergy in terms of efficiency or technological capabilities. Accordingly, larger operation scales have not necessarily translated into higher efficiency or technological capabilities.

Another challenge that China's automotive sector confronts is a low spatial agglomeration (Sit and Liu, 2000). China's former planned economic system is mainly responsible for this problem, as it permitted substantial inter-provincial redundancy in industrial investment (i.e., low spatial clustering of a particular sector at the

[4] For example, China's 2004 Automotive Industry Development Policy encourages M&As between automakers, each of which has a market share of under 10%.

[5] Since 2004, China's central government has required a new market entrant to make a minimum total investment of RMB2 billion and an initial R&D investment of RMB half a billion.

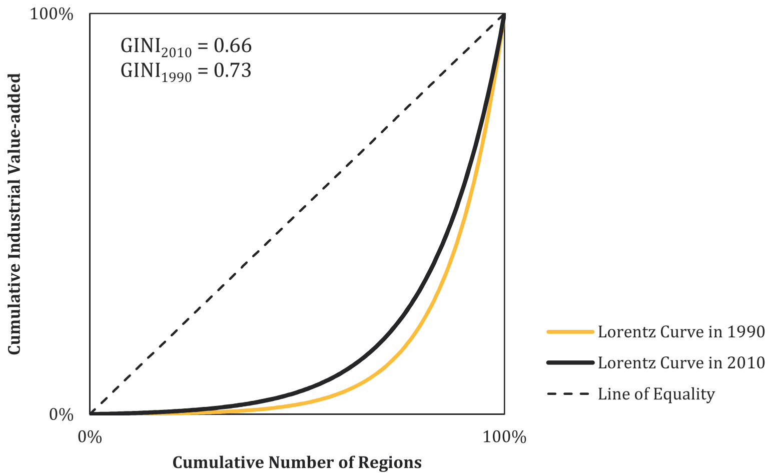

Fig. 2. Spatial Gini coefficients for China's automotive sector, 1990 and 2010. *Note*: The spatial Gini coefficient is a spatial application of the original Gini coefficient concept, computed from the following equation: GINI $= \sum_i^n \sum_j^n |y_i - y_j| / 2n^2\mu$, where y_i, μ, and n denote the value-added for the automotive industry in region i (rovince or equivalent municipality), the mean regional value-added in the national automotive sector, and the total number of regions, respectively. Its range is also between 0 (perfect equality) and 1 (extreme inequality).
Source: Author's calculation from CATARC (1991, 2011).

national level). The post-reform period witnessed a more obvious coordination failure of cross-regional investment in the automotive sector, as local authorities tended to exercise their increased political influence (thanks to Beijing's decentralization drive) to keep or further expand local automotive production bases (Huang, 2002). For this reason, intra-industry asset reconsolidations, targeting sectoral rationalization, led to the scale-up of each automaker on average but not necessarily in a spatially integrated fashion. In fact, spatial Gini coefficients of China's automotive industry declined from 0.73 in 1990 to 0.66 in 2010, suggesting an increased spatial dispersion of vehicle manufacturing bases at the national level during the period (Fig. 2).

4. Comparative case study

This section provides a detailed case study of China's three leading automotive groups, focusing on their growth strategy and its outcome. Drawing upon this empirical evidence, I discuss how compact organizational space has affected their technological catch-up performance.

4.1. SAIC Group

SAIC is an SOE under the direct control of the Shanghai municipal government. Its history dates back to 1958, when its precursor Shanghai Automotive Assembly Plant (later restructured as the Shanghai Tractor and Automobile Corporation, or STAC) was founded. In 1959, STAC produced its first passenger vehicle model, Fenghuang SH760, re-branded into Shanghai SH760 in 1964. SH760 was essentially a reverse-engineered imitation of the 1956 Mercedes 220S, produced to meet local demand from elite public officials (Posth, 2006). SAIC continued to produce this model until 1991, without significant technological upgrades. Between the mid-1970s and the late 1980s, the model's mean annual production volume was 3000–5000 units, making SAIC a leading passenger-vehicle producer even before operating its first IJV.[6] In terms of overall firm scale, however, SAIC was much smaller than FAW and DFM due to its small production capacity for commercial vehicles, the then-leading market segment in China.[7]

SAIC's current status as the industry's leader was firmly established after its successful IJV partnership with VW. When Shanghai-VW (SVW) was established in 1985, SAIC's own technological capability was extremely weak, as suggested by the continued production of the dated SH760. SAIC's decrepit assembly plants and old-fashioned equipment reflected highly labor-intensive procedures, a far cry from modern vehicle-production technologies. Absence of competitive local parts suppliers made the problem even worse (Thun, 2006).

The solid coalition between VW and the Shanghai municipal government formed in the late 1980s contributed to a substantial improvement in such preexisting conditions, unsuited for the local volume production of VW vehicles. In the first place, the Shanghai government showed a consistent and powerful leadership in initiating a localization drive at the municipal level (Harwit, 1995; Thun, 2006).[8] The localization drive package – consisting of localization tax, subsidized credit, and tight monitoring system – relaxed SVW's foreign exchange reserve constraint and solved the coordination failure problem between SVW and its primary suppliers. VW also responded to the localization drive through active technology transfer. VW introduced modern production technologies to the Shanghai plants and provided SVW employees and primary parts suppliers with extensive on-the-job training and technical assistance.

SAIC's pivotal IJV partnership, however, has gradually shifted from SVW to Shanghai-GM (SGM), as its catch-up agenda placed increasing emphasis on indigenous technology development over import substitution (Nam and Li, 2013). In 1997 SAIC and GM founded a vehicle-assembly IJV *SGM* and a separate engineering

6 In 1980, for example, SAIC produced over 5000 units of passenger vehicles, when China's total passenger vehicle output was only 5418 units (CATARC, 1988, 2007).

7 In 1985, passenger vehicles accounted for less than 2% of China's total vehicle production (CATARC, 1994).

8 However, this strong inward orientation of SAIC's growth strategy does not always coincide with national interests, as it often meant national efficiency loss. For example, Shanghai's decision to develop a new parts supply base within its administrative boundary was clearly against Beijing's preference for expanded sourcing from preexisting supply bases, such as those in Guizhou Province (Huang, 2003).

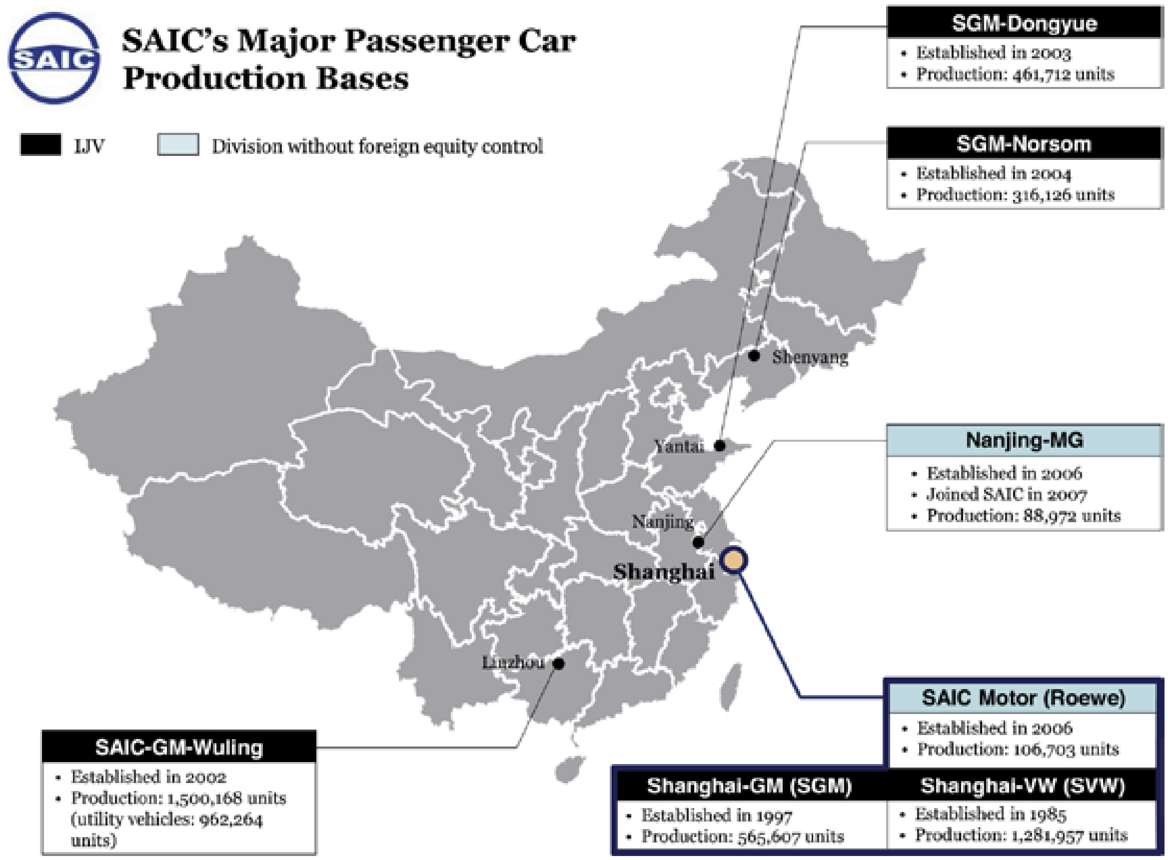

Fig. 3. SAIC's major passenger car production bases in Mainland China, 2012.
Source: Created by author; Data from Fourin (2013) and SAIC's official website.

IJV *the Pan Asia Technical Automotive Center* (PATAC) in Shanghai. SAIC and GM converged on these IJV partnerships for different motivations. SAIC expected multiple IJV partnerships would help draw more concessions from multinationals through competition, while GM wanted to team up with the local market leader to catch up with the market shares of earlier entrants (Nam, 2011). In return for several second mover advantages[9] that SGM was expected to enjoy, GM promised greater commitment to local technology development, symbolized by PATAC, the largest single FDI project dedicated to automotive R&D in China. The SAIC–GM partnership has extended to operate multiple assembly bases, such as SAIC–GM–Wuling (SGMW), SGM-Dongyue, and SGM-Norsom. These extended SAIC–GM partnerships have more firmly established SAIC's market-leading position.

In 2006, the SAIC Group restructured its internal organization to form SAIC Motor. A primary motivation for this restructuring was effective mobilization of internal resources for independent vehicle development, an idea that had been abandoned since production of SH760 ceased in 1991. In addition to IJVs, foreign asset acquisition and overseas investment were initiated to support the project (Nam and Li, 2013). By 2005, for example, SAIC acquired Rover's engine and platform technology, and a 51% equity stake in Korea-based Ssangyong Motor. In 2007, SAIC merged with the Nanjing Automotive Group (NAG), which acquired the MG brand and technology from the bankrupt MG Rover Group. SAIC intensively adapted acquired MG and Rover technologies for its earlier independent vehicle lineups.

4.1.1. *SAIC–GM partnership as key growth driver*

At present, the SAIC Group operates four major passenger-vehicle manufacturing divisions – SVW, SGM, SAIC Motor, and SGMW – in five locations – Shanghai, Nanjing, Liuzhou, Yantai, and Shenyang (Fig. 3). The SAIC–GM partnership has played a dominant role in SAIC's increased production space. SGM is operating multiple production bases beyond Shanghai, such as the Yantai-based SGM-Dongyue and Shenyang-based SGM-Norsom plants, in contrast to SVW's Shanghai-centered organization and production structure. SGMW is an independent triad IJV partnership among SAIC, GM, and Liuzhou Wuling Motor, which is not under SGM's direct control. Besides IJV divisions, SAIC Motor has also expanded its manufacturing base beyond Shanghai by controlling a 100% stake in Nanjing-MG seated in Jiangsu Province.

Shanghai remains SAIC's dominant command center, despite the firm's expanded production space. One aspect that distinguishes SAIC from FAW and DFM is that its spatial expansion was not accompanied by the group's increased organizational space. Most notably, it was the preexisting organizational ties between SAIC and GM that drove SAIC's trans-boundary growth, such as SGM-Dongyue, SGM-Norsom, and SGMW (Table 3). SAIC's acquired Nanjing operation is an exception, but this division has been under the full control of SAIC Motor, leaving its ex-owner, Jiangsu

[9] Through SAIC's mediation, SGM took advantage of infrastructure built on SVW's localization efforts. For example, SGM shared SVW's primary local sourcing partners and hired SVW-trained local employees.

Table 3
Major passenger vehicle divisions of the SAIC Group.

SAIC divisions	Equity ownership structure		
	SAIC	Foreign	Others
SVW	50%	VW: 50%	–
SGM (HQ & Jinqiao plant)[a]	51%	GM: 49%	–
SGM-Dongyue	25%	GM: 25%	SGM: 50%
SGM-Norsom	25%	GM: 25%	SGM: 50%
SGM-Wuling	51%	GM: 34%	Liuzhou Wuling: 15%
SAIC Motor	100%	–	–
Nanjing-MG	100%	–	–

Source: CATARC (2012).
[a] On December 4, 2009, SAIC and GM agreed on the transfer of SGM's 1% equity from GM to SAIC, which would make SAIC the majority shareholder of the former 50–50 IJV.

Province, largely out of current management. Accordingly, SAIC's initial backbone organizational structure – SVW, SGM, and SAIC Motor – has undergone little change even after the group's dramatic external growth.

The municipal ownership primarily incentivizes SAIC's Shanghai-centered organic growth. The Shanghai government has strategically coordinated SAIC's production network within its municipal boundary so that a large fraction of the related socio-economic impact resides locally (Huang, 2003). Accordingly, SAIC's core organizations, production facilities, and primary sourcing partners are located near the group's HQ. In addition, SAIC had disadvantages in acquiring domestic assets outside its home region, compared with centrally controlled FAW and DFM.[10] Conflicts among the interested parties were typical in massive intra-industry mergers in China's state-owned sectors, as losing control over a local industrial asset meant a shrunken tax base for the relevant local authorities. Such conflicts were often too difficult to be dealt with at the municipal level, without being orchestrated by the central government.

4.1.2. Coexistence of vertical and horizontal resource-sharing channels

Strategic considerations, beyond boosting production volume, underlie SAIC's current production space. For example, utilizing preexisting manufacturing facilities to meet rapidly growing market demand was the main reason SGM chose Yantai and Shenyang as backup production bases to Shanghai, which faced limited land reserve for further capacity expansion. SGMW is also seated in Liuzhou to utilize the existing production facilities of Liuzhou Wuling Motors for the production of Wuling utility vehicles. SAIC's Nanjing operation was intended to create synergy with Nanjing-MG, sharing a common technology base inherited from the MG-Rover Group.

One advantage from SAIC's Shanghai-centered solid organizational ties is promoted horizontal knowledge flows. As multinationals strictly control IJV-mediated knowledge spillover channels, the IJV's effectiveness as a catch-up device depends on how effectively to relax constraints put on such channels (Nam, 2011). The expanded R&D functionality of SAIC-affiliated IJVs[11] and extended collaboration between SAIC Motor and PATAC[12] suggest that SAIC has relaxed the constraints more effectively than others. Behind this outcome are strong relational assets between IJV partner firms, which have functioned as "boundary spanners" (Depner and Bathelt, 2005). These assets have strengthened through a series of joint projects over the last decade, and improved relational assets have, in turn, further extended their collaboration.

These relational assets, however, have not been created automatically. Instead, behind them are SAIC's extensive, strategic efforts. A bottleneck emerged when SAIC wanted to develop its own vehicles. A SAIC Motor engineer commented:

> What SAIC lacked most is not particular technologies, to which we have already established fairly good access through market transactions. It instead is knowhow or a system necessary to create such technologies.[13]

The SAIC management viewed lacking mutual dependence in terms of core competency as a main limitation of the IJV-based catch-up model. This diagnosis led SAIC to initiate alternative asset-seeking activities beyond IJVs, such as overseas investment. A SAIC manager remarked:

> Multinationals gave us technology, but without access to their skills that made it possible. Thus, we have explored alternative opportunities from overseas investments, such as acquisition of Rover technologies or the majority stake in Ssangyong Motor. SAIC Motor engineers are working closely with ex-Rover and Ssangyong engineers for upcoming Roewe models. I expect that the success of our Roewe project will help us extend R&D collaborations with GM and VW, not the other way around.[14]

Complementing IJVs with overseas investment turns out to be effective in leveraging IJV partners toward extended R&D partnerships. A senior engineer from GM-China commented:

> Roewe 550/750 demonstrates that SAIC has already developed substantial vehicle development capability. ... Regardless of our China strategy, SAIC ultimately will find a way to get what it demands from us now. ... In this situation, it would be wise to expand and upgrade the existing SAIC–GM alliance, as SAIC wants; and the stronger alliance with SAIC would in fact not be against GM's benefit, either. We need help from SAIC for our global business as much as SAIC needs from us.[15]

This strategic choice exemplifies SAIC's firm-level effort to build relational assets with IJV partners, which is rarely found in other local automakers.

Increased recognition of potential synergy between IJV partner firms is another advantage from SAIC's deepened, rather than widened, organizational ties. A series of SGM's capacity-expansion projects, for example, have offered GM a good opportunity to learn more about SAIC's hidden competencies, such as the ability to make profits through compact-vehicle production (Muller, 2010). The same GM-China interviewee commented about SAIC's low-cost manufacturing capability, which can be an asset for GM's global strategy:

> It is no secret that we are not good at making profits on compact vehicles, but our Chinese partners have shown themselves to be competitive low-cost manufacturers. SGMW's utility vehicle, for example, was designed only at a quarter of the cost required to develop a new vehicle in the U.S. In my view, GM needs to learn this knowhow to increase its global market share, as solutions for the Chinese market would also work for other emerging markets.[16]

[10] Interview #4.
[11] In May 2011, for example, SGM introduced the first of its locally developed, own-brand sedans (Baojun 630) to the Chinese market, earlier than any other Sino-foreign joint venture.
[12] When PATAC was newly established, it was fully devoted to engineering support for SGM. But now around 10% of PATAC's business is related to SAIC Motor's new vehicle-development projects (Interviews #18 and 20).
[13] Interview #20.
[14] Interview #19.
[15] Interview #2. Excerpted from Nam and Li (2013), p. 24.
[16] Interview #2.

Recognition of this potential synergy underlies the recent extension of the SAIC–GM partnership to India, beyond the Chinese national boundary (Nam and Li, 2013). Increased mutual dependency has upgraded SGM to an increasingly effective vehicle for mutual learning.

Horizontal knowledge spillover from IJVs to SAIC's non-IJV affiliates has also taken informal channels. Most notably, SAIC has greatly benefited from regional labor pooling – an outcome of its Shanghai-centered organizational growth. SAIC Motor, for example, has hired a substantial number of engineers, as well as shop-floor workers, who have work experiences with SVW, SGM, PATAC, or other IJVs, to take advantage of their knowledge and skills for its indigenous technology development.[17]

SAIC has developed close intra-group ties, as well as cross-firm ties with IJV partners. For example, the SAIC Group embraces two independent brand lineups (Roewe and MG), but there is no evidence of internal competition between them. This is one key aspect that distinguishes SAIC from typical Western multidivisional firms. Weak motivation for internal competition can be found in the unified channel of SAIC's indigenous technology development. At present, SAIC Motor is fully responsible for the group's own-brand vehicle business, and coordinates other group affiliates for group-wide independent technology development projects, encouraging intra-group information and resource sharing.

Also, SAIC's internal rotation policy has played a role in controlling motivations for internal competition. Under the rotation system, each division's top management develops a stronger sense of belonging to the SAIC Group, rather than to the division. It is not even rare for SAIC managers to have overlapping memberships in multiple SAIC divisions (Thun, 2006). Several practices seem to represent SAIC's efforts to expand monitoring and coordination capacity at the group level. SAIC's divisional managers, for example, are expected to report daily financial and operational details to the group's HQ, and their performance is evaluated by HQ delegates on an annual or semi-annual basis. SAIC has also offered group-wide workshops and training programs regularly to promote inter-divisional interactions at all employment levels.[18]

All of the facts mentioned above evidence SAIC's internal hierarchy, where the strict top-down management system and the cross-divisional horizontal resource sharing channels coexist. Such a group governance system has given SAIC a substantial advantage in being the local technological leader. SAIC Motor has successfully integrated various technological assets from multiple channels (e.g., IJVs and overseas investment) to develop 14 independent passenger-vehicle models based on nine platforms by the end of 2011 (Table 4). For those projects, SAIC has mobilized key engineers from multiple divisions to form group-wide project teams. For example, each year around 40 Ssangyong Motor engineers were transferred to SAIC's Shanghai R&D center to work on the Roewe C200 project, a four-wheel drive sports utility vehicle launched on the market in January 2011 (Nam and Li, 2013). Since 2007, the SAIC Group has also operated an intranet-based common knowledge base system to encourage group-wide sharing of knowledge such as drawings and technical notes (Nam and Li, 2013). The R&D resource integration has been under way between SAIC Motor and Nanjing-MG since 2009.[19]

4.2. FAW Group

FAW is China's oldest automaker, established in 1953. Changchun, the capital of Jilin Province, was strategically chosen as home for the centrally controlled SOE, as this remote northern city inherited substantial industrial assets from the Japanese-controlled Manchurian State and was close to the Soviet Union, the then-major technological source of the Chinese auto industry.

FAW began production of its first vehicle *Jiefang CA10* in 1953. This light truck with a loading capacity of four tons was a clone of the Soviet ZIS 150 model. For this project, FAW relied upon the Soviets for core vehicle technologies and substantial engineering support. Over the following three decades, Jiefang CA10 was the only vehicle model that FAW mass-produced, and its cumulative output total reached 1.3 million units, the then-world's record for that vehicle segment (Lee et al., 2006). In 1987, FAW launched its second generation Jiefang model (CA141), with a loading capacity of five tons, after a six-year development and production preparation period. Jiefang CA141 was developed in-house by the Changchun Automotive Research Institute (CARI), which is currently part of the FAW Group.

FAW also has a longer passenger-vehicle manufacturing history than any other local automaker. As early as 1958, FAW produced its first sedan, *Hongqi*. This vehicle project, begun in 1957 on the order of the central government, was initiated to serve top central government officials. Like SAIC's SH760, the initial Hongqi sedan (CA72) was a reverse-engineered imitation of Chrysler's C69 model, introduced in the United States in 1955. Until their production was discontinued in 1984, the cumulative output total of the old Hongqi and its variations was only 1549 units (Lee *et al.*, 2006). The Hongqi lineup was revived in 1993 based on Audi technologies, but its production volume remains minimal.

Since 1990, FAW has expanded its passenger-vehicle production capacity through IJV partnerships and domestic mergers (Fig. 4). In 1990 FAW established its first IJV with VW, and since then FAW-VW has remained FAW's largest passenger-vehicle operation. In 2012 FAW-VW produced 1.3 million units of Audi and VW brand vehicles. Tianjin-FAW-Toyota, an IJV with Toyota founded in 2002, is FAW's second largest passenger-vehicle division, selling around half a million Toyota vehicles in 2012. Besides this Tianjin-based division, FAW and Toyota operate Sichuan-FAW-Toyota under a separate IJV arrangement. This operation has two manufacturing plants, in Chengdu and Changchun.

In addition to the IJVs, the FAW Group has three sizable non-IJV affiliates. Two of them, FAW-Xiali and FAW-Haima, were affiliated with FAW through mergers with the Tianjin Automotive Group (TAG) in 2002 and with the Hainan Automotive Group (HAG) in 1998, respectively. FAW-Xiali produces licensed Daihatsu and Toyota compact sedans with the Xiali brand, and FAW-Haima manufactures Haima-branded vehicles based on Mazda technologies. FAW Car is also the group's key non-IJV division. In 2012, FAW Car produced a total of 79,124 units of own-brand models based on imported technologies; among them, 72,452 units were the Besturn lineup and the other 6672 units were the new Hongqi sedan and the Oley lineup.

4.2.1. Domestic mergers as key growth driver

For a long period, FAW led the local automotive sector as the oldest and largest automaker. Since the 1980s, however, FAW's leadership in the sector has been seriously challenged by DFM (commercial vehicles) and SAIC (passenger vehicles). The symptom of FAW's weakening market position appeared in the early 1970s, when the firm's growth slowed down visibly though it was still producing more vehicles than others. FAW's initial production capacity (30,000 units per year) doubled by 1971 but remained approximately the same for the following decade (Chen et al., 2008). During the same period, FAW's technology development was also stalled. Until the second generation Jiefang was introduced in the market in 1987, FAW continued to produce the original Jiefang trucks and Hongqi sedans, developed in the 1950s.

[17] Interview #20.
[18] Interview #19.
[19] Interviews #19 and 25.

Table 4
Details of SAIC's own brand model development projects, 2011.

Brand	Vehicle models	Market debut	Platform		Base technology
			Code	Type	
Roewe	W5	January 2011	C200	Four-wheel drive (4WD) layout for SUVs	Ssangyong
	AP13	December 2011	AP13		(n/a)
	350	April 2010	S16	Front-wheel drive (FF) layout for mid-sized sedans	Rover
	450	December 2008	(n/a)		
	550	July 2008	W261		
	750	March 2007	W161		
	BP21	June 2010	(n/a)		
	750H	September 2010	W161		
MG	5Z	June 2009	W261	Front-wheel drive (FF) layout for compact-sized sedans	Nanjing-MG
	7Z	September 2009	W161		
	3Z	September 2008	(n/a)	Front-wheel drive (FF) layout for compact-sized coupes	Nanjing-MG
	TF	June 2009	Rover TF		
Wuling	Hongguang	September 2010	CN100	Utility vehicle	SAIC–GM–Wuling
Baojun	630	May 2011	Delta 2	Compact sedan	GM (Excelle)

Source: Compiled from Interview #19, Zhang (2009), Yamamoto (2011), and personal communication.

Clinging to the glorious past, the FAW management has focused on production capacity expansion to retrieve market leadership. The main drivers of FAW's output growth were the IJV partnership and domestic merger, which increased the group's organizational space substantially. FAW-VW and FAW-Toyota, the two IJVs accounting for over three-quarters of FAW's total passenger-vehicle production, are located distant from each other due to their different origins. In contrast to FAW-VW initiated by the FAW HQ, FAW-Toyota succeeded to Tianjin-Toyota, an IJV originally established between TAG and Toyota in 2000. FAW took over part of TAG's stake in Tianjin-Toyota when they merged in 2002, but the IJV's Tianjin-based operations, remote from the group's HQ, remain intact.

FAW's two sizable non-IJV operations are also located far from FAW's home base for similar reasons. One is FAW-Xiali, which was part of TAG until 2002. FAW-Xiali produces own-brand compact

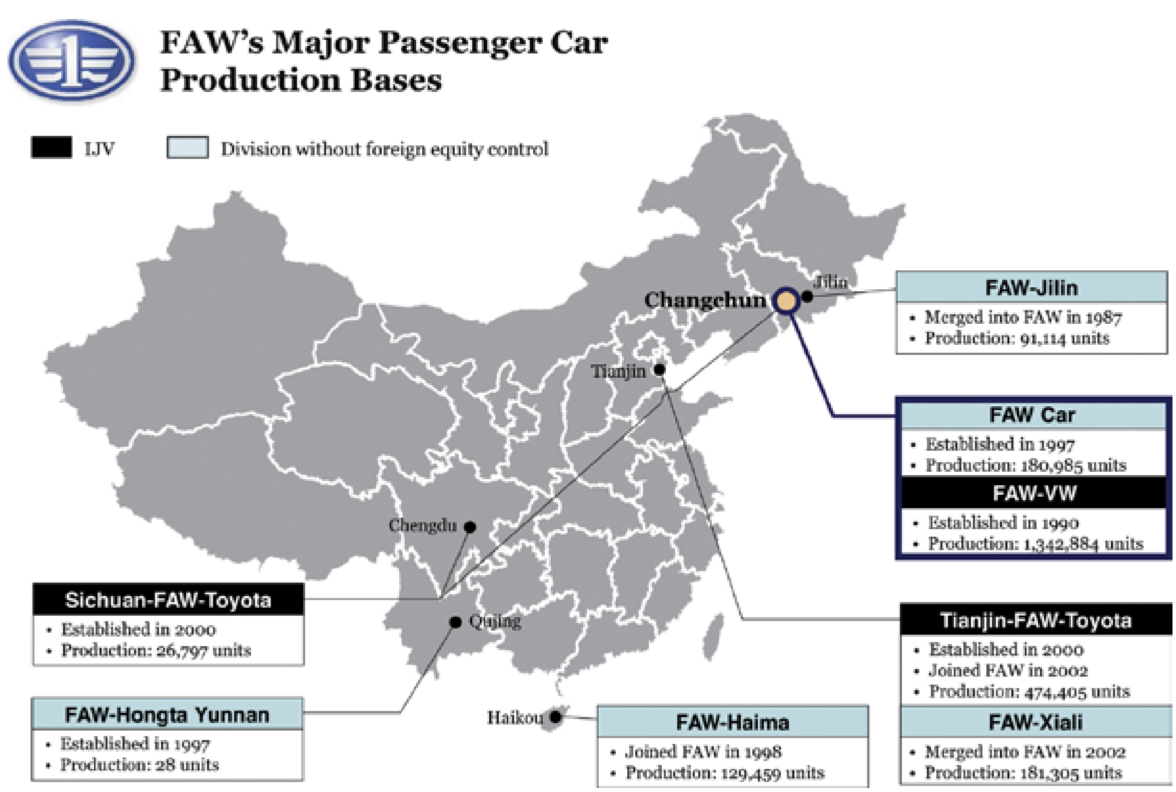

Fig. 4. FAW's major passenger car production bases in Mainland China, 2012. *Note*: Some commercial vehicle volume may be included in the passenger vehicle production volume statistics.
Source: Created by author; Data from Fourin (2013) and FAW's official website.

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Table 5
Major passenger vehicle divisions of the FAW Group.

FAW divisions	Equity ownership structure		
	FAW	Foreign	Others
FAW-VW	60%	VW: 30%; Audi: 10%	–
FAW-Toyota (Tianjin)	20%	Toyota: 50%	FAW-Xiali: 30%
FAW-Toyota (Sichuan)	50%	Toyota: 50%	–
FAW-Xiali[a]	48%	–	Tianjin Automotive: 32%; Public: 20%
FAW-Haima	49%	–	Hainan Automotive: 49%; Hainan Gov't: 2%
FAW Car[b]	53%	–	Public: 47%
FAW-Jilin	100%	–	–
FAW-Hongta	51%	–	Yunnan Hongta Group: 30%; Yunnan Light Vehicle: 19%

Source: CATARC (2012); firm websites.
[a] FAW-Xiali was listed on the Shenzhen Stock Exchange in 1999.
[b] FAW Car was listed on the Shenzhen Stock Exchange in 1997.

sedans based on licensed Daihatsu and Toyota technologies, and possesses Tianjin-based self-contained organizational capability. The other is Hainan-based FAW-Haima, which was affiliated with the FAW Group in 1998. The predecessor of FAW-Haima is Hainan-Mazda, an IJV established in 1992 between HAG and Mazda, but Mazda fully liquidated its equity by late 2006. At present, HAG and the Hainan provincial government jointly hold a 51% equity stake in FAW-Haima (Table 5).

FAW's growth has involved substantial organizational and spatial expansion at the same time. A former FAW engineer commented:

> You may better understand the FAW Group, when seeing it as a bundle of different firms rather than a whole. I spent my entire career in Changchun, where FAW's matrix operations are located. During a long period of my career, many of FAW's current affiliates, such as the Tianjin and Hainan Automotive, were independent firms controlled by different local governments, and had developed varied culture, conventions, and technology bases. Coordinating this historic legacy in favor of the center's strategy would be challenging.[20]

Now the FAW Group manages a large number of functionally overlapped divisional units throughout the nation, whose inter-divisional organizational ties are rather loose. Even after the mergers, each passenger-vehicle operation tends to remain as its own rather than as part of the FAW Group. For example, FAW-Xiali and FAW-Haima still exist as quasi-independent affiliates under the significant managerial influences of their ex-equity holders. FAW's mergers are primarily aimed at capacity expansion itself, and the FAW HQ has showed little effort to reform the group's governing structure, required to raise group-wide synergy.

4.2.2. Loose alliance of multiple local business groups

Several factors have contributed to weak organizational ties among FAW's group affiliates. In the first place, both TAG and HAG, affiliated with the FAW Group through mergers, were sizable local SOEs with strong identities of their own. The Tianjin and Hainan governments still have substantial influence over the management of FAW-Xiali and FAW-Haima, respectively, as principal stakeholders. This regionally fragmented group governance system has been left largely unchanged, primarily due to the lack of FAW HQ's strategic concerns about the merger, beyond inflating the group's gross output level. In this situation, spatial dispersion was a clear disadvantage, as it further weakened the group HQ's monitoring and coordination capability. In addition, central ownership has tended to further disincentivize horizontal resource sharing among divisions. Divisional managers, transferred from the group's HQ, often viewed other group affiliates as competitors rather than as members of the same FAW family because they tended to regard their careers at FAW as stepping stones to climbing the hierarchical ladder within the central government or the communist party.[21] Their political promotion is by and large indexed with their management records in FAW divisions.

Technologies adopted for own-brand vehicles may well evince FAW's situation, where the absence of compact organizational space hinders increased access to external strategic assets from being translated into increased technological capability. As of 2012, three FAW divisions produced 11 passenger vehicle models without using foreign brand names (Table 6). First, FAW Car produced the Hongqi sedan, upgraded from its original 1953 version, and the Besturn and Oley lineups under the FAW brand. All these models are built on dated foreign vehicle platforms, whose powertrain components are selectively replaced by newer technologies. The redesigned Hongqi, for example, was built on the outmoded Audi 100 platform fitted with the Chrysler-licensed CA488 engine (Lee et al., 2006). The Besturn and Oley lineups also adopt the Mazda 6 platform and the VW Jetta Mark 2 platform, respectively, both of which are generations behind the industry's global technological standards. Second, FAW-Xiali introduced four Xiali-brand compact sedans, based on dated Toyota technologies. The Xiali division carried out only minor local adaptation tasks for the licensed Daihatsu and Toyota models, and discretionary modifications of the licensed technologies were constrained largely by the licensing arrangement. Finally, FAW-Haima built three sedan models with the Haima brand, at least two of which were based on previous generation Mazda platforms.

Adherence to such a traditional "mix and match" vehicle-development architecture questions what exactly IJVs and mergers have brought to FAW in its technological catch-up trajectory. One may find little difference in terms of organizational distance, whether FAW's affiliates existed as different firms or as one group. FAW's independent vehicle-development projects have also been conducted at division levels, without involving active cross-divisional resource-sharing or collaboration. Each of FAW's three independent brand divisions has its own research and engineering department: FAW Car depends on the group's main engineering arm *CARI*, FAW-Xiali has its own technical center in Tianjin, and FAW-Haima operates independent R&D facilities in Haikou, Shanghai, and Zhengzhou. However, little evidence shows that such R&D resources dispersed throughout multiple divisions to create synergy have been effectively mobilized and integrated at the group level. In particular, the leadership of FAW Car as the commanding center of the group's independent technology development is virtually invisible, contrasting to SAIC Motor's role for the SAIC Group. Even under one roof of the FAW Group, FAW Car, FAW-Xiali and FAW-Haima still depend on their former foreign technology licensers for base product and production technologies, as they did before the mergers.

[20] Interview #10.

[21] For example, Jiang Zemin (ex-President of China), Li Lanqing (ex-First Vice Premier), Zou Jiahua (ex-Vice Premier), He Guangyuan (ex-Minister of Machine-Building and Electronics Industry), Lu Fuyuan (ex-Minister of Commerce), Rao Bin, and Chen Zutao (Both Rao and Chen are ex-Chairmen of the China National Automotive Industrial Corporation) all served FAW in the middle of their political careers (Chen et al., 2008).

Table 6
Own-brand passenger vehicles produced by the FAW Group.

Brand	Vehicle model	Vehicle class	Base technology	Units sold in 2012
FAW	Hongqi (New)	Full size/luxury	Audi platform; Chrysler engine	127
	Besturn B50	Standard	Mazda 6 platform fitted with VW technology	54,599
	Besturn B70	Standard	Ford CD3 platform for Mazda 6	17,853
	Oley	Compact	VW platform for Jetta Mark 2	6545
Xiali	Xiali	Compact	Daihatsu Charade (licensed production)	144,462
	Vizi (Vitz)	Compact	Toyota (licensed production)	171
	Vela	Compact	Toyota (licensed production)	871
	Weizhi	Compact	Older Toyota Yaris platform	39,514
Haima	Haima M2	Compact	Mazda 2 platform	21,173
	Familia	Standard	Mazda 323 platform	61,630
	Haima 3	Standard	Adopted in-house-developed HA-VIS 1.8 engine	182

Source: CATARC (2012); Interview #23; Fourin (2013).

4.3. DFM Group

In 1964 the Chinese central government established the Second Automotive Works (SAW), the matrix of the current DFM Group, in Shiyan, a small town in Hubei Province. Shiyan was not well suited for large-scale industrial production, as it was located in an inland mountainous area where road and railway access was limited. This locational disadvantage, however, was a main reason Shiyan was initially chosen as the home for SAW. The increased international political tensions in the 1960s (e.g., outbreak of the Vietnam War and deterioration of Sino–Soviet relations) pushed Chinese political leaders to consider building an alternative automotive production base in a natural fortress like Shiyan, safe from potential external military attacks. A group of FAW engineers were transferred to Shiyan for the SAW project. It was 1978 – over a decade later – when SAW finally began to produce a light truck model *Dongfeng EQ140*.

Dongfeng EQ140, developed by CARI, was initially planned to replace FAW's dated Jiefang CA10 model, but the central government transferred the model to SAW for actual production (Chen et al., 2008). SAW paid substantial attention to product differentiation and post-sales services to offset its late market entrance and broaden its market shares (Byrd, 1992). Such a market penetration strategy, combined with a more technologically advanced product, helped SAW take over the market-leading position from FAW in 1986.

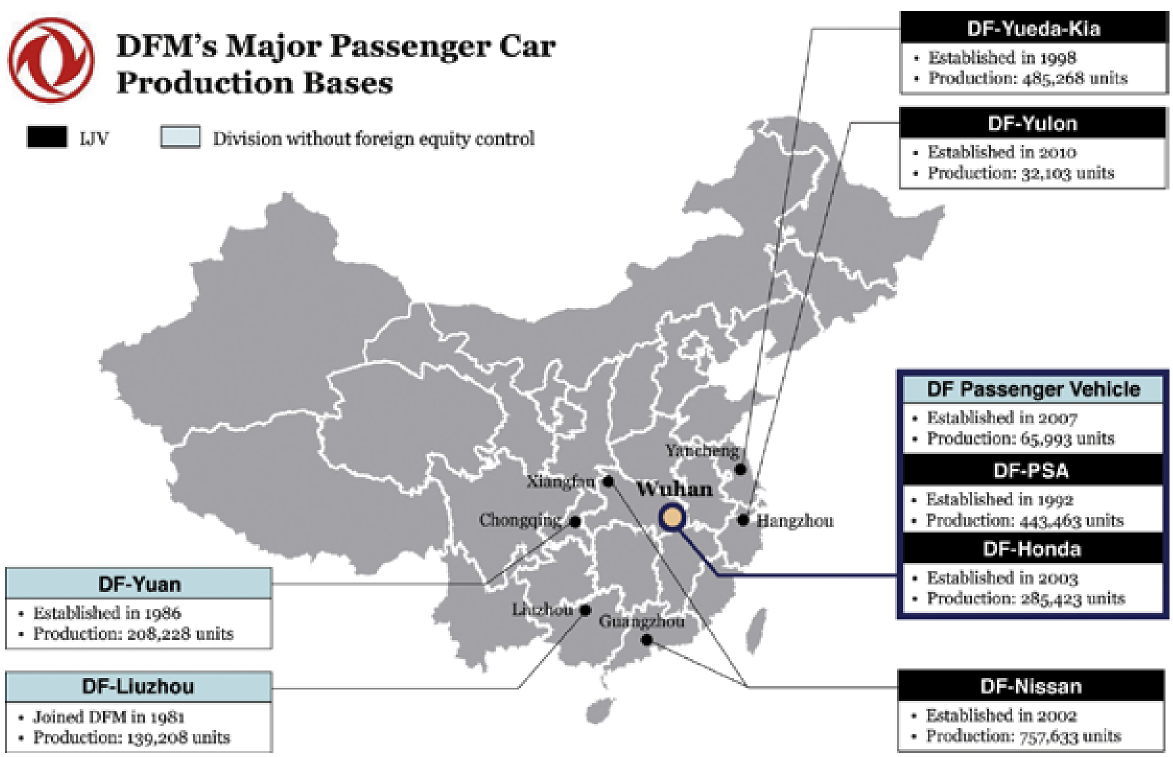

Fig. 5. DFM's major passenger car production bases in Mainland China, 2012. *Note*: Some local-branded minibuses are included in the passenger-vehicle production volume statistics.
Source: Created by author; annual output data from Fourin (2013); other information from DFM's official website.

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Table 7
Major passenger vehicle divisions of the DFM Group, 2012.

DFM divisions	Equity ownership structure		
	DFM	Foreign	Others
DF-PSA	50%	PSA: 50%	–
DF-Nissan	50%	Nissan: 50%	–
DF-Honda	50%	Honda: 50%	–
DF-Yueda-Kia	25%	Kia: 50%	Jiangsu Yueda Group: 25%
DF-Yulon	50%	Yulon: 50%	–

Source: CATARC (2012).

The initial form of the DFM Group appeared in 1978 as an SAW-centered but rather loose alliance[22] of nine local auto producers located in four provinces – Hubei, Sichuan, Guangxi, and Guangdong (Byrd, 1992). Their cooperation was carried out such that member firms assembled SAW-provided knocked-down kits under the Dongfeng brand. In 1981, the Chinese central government formalized the alliance as an independent business group. As DFM's key labor power and functional organizations were inherited from SAW, the group was initially headquartered in Shiyan. However, disadvantages of the location – such as the low transport accessibility, limited land reserves, and weak human resource pool – became a huge burden when DFM pursued its organic growth in the post-reform period. Accordingly, DFM's group HQ, after being relocated twice, is now settled in Wuhan, the capital of Hubei Province.

Since the early 1990s, DFM has adopted modern vehicle-production technologies through IJVs, which account for over 80% of the group's passenger-vehicle production volume (Fig. 5). DFM's oldest assembly IJV is DF-Peugeot Citroën (PSA), established in 1992. As of 2012, DF-PSA produced over 0.4 million units of Peugeot- and Citroën-brand vehicles. In 2002, DFM established two IJVs. One is DFM's biggest IJV DF-Nissan; the other is DF-Yueda-Kia, where DFM, Jiangsu Yueda Group, and Kia Motor have equity stakes. DF-Nissan, which operates two manufacturing bases in Xiangfan and Guangzhou, sold over three-quarters of a million units of Nissan-brand vehicles in 2012, and DF-Yueda-Kia sold nearly half a million units of Kia-brand vehicles in the same year. DF-Honda, established in 2004, developed an annual production capacity of a quarter million units of Honda-brand vehicles by 2012. DF-Yulon, DFM's youngest IJV with the Taiwanese Yulon Group, was established in 2010.

There are also three non-IJV affiliates. The Dongfeng Passenger Vehicle Company (DFPVC), established in 2007, is the center of DFM's own-brand passenger vehicle development, while DF-Yuan and DF-Liuzhou focus on commercial vehicle production.

4.3.1. New IJV partnerships as key growth driver

The primary driver of DFM's growth is the IJV partnerships, as evidenced by the fact that DFM's major passenger-vehicle divisions are all assembly IJVs (Table 7). Due to its origin as a loose alliance of nine state-owned automotive plants, DFM had already developed a substantially decentralized group-governing structure at the division level. DFM's IJV-based, spatially disintegrated organizational growth tended to further strengthen this structure, as IJVs in China's automotive sector exist as quasi-independent business entities (Nam, 2011).

A strong motivation to achieve rapid *extensive* growth underlies DFM's IJV-based, spatially fragmented organizational expansion. In early periods of China's auto sector modernization, DFM was particularly concerned about its relatively small operation scale in the passenger-vehicle segment,[23] compared with SAIC and FAW. The small operation scale may mean that DFM could be the first if any of the Chinese Big Three should be replaced by other high performers on the list of the state's primary preferential policy targets. This concern pushed DFM to place capacity expansion over any other strategic goal, leading to heavy reliance on IJVs for growth. DFM's current M-form structure lacking central coordination functions has emerged as a result of this growth strategy.[24]

4.3.2. Bundle of firms with weak organizational ties

Like most other Sino-foreign assembly JVs, DFM-affiliated IJVs also lack in-house technology development capabilities. Each of DFM's four assembly IJVs operates an internal engineering department, but its functionality is limited to secondary engineering support for local assembly operations, such as minor local adaptation of foreign technologies or vehicle safety testing.[25] This circumstance has seriously constrained DFM's IJV-based technological catch-up, as is the case for other IJV operators. In this situation, DFM has further treated IJVs as outsiders without showing strategic efforts to change their behavior, which contrasts to SAIC's experience. The result is the strengthened legacy of "bundle of firms with weak organizational ties," and adherence to their pre-IJV vehicle development architecture.

At present, the DFPVC leads DFM's independent vehicle-development projects as a hub organization. Its first visible achievement was Fengshen S30, DFM's first own-brand modern passenger vehicle, introduced in May 2009. The primary motivation for the Fengshen S30 project was to demonstrate DFM's increased independent vehicle-development capacity, in compliance with the 2004 automotive policy.[26] It is questionable, however, whether this own-brand model truly represents DFM's improved technological capability. Most notably, Fengshen S30 was largely independent of DFM's IJV experience, as commented by a DFM manager.

> Our current vehicle-development capacity is largely irrelevant to IJVs. Foreign firms want to produce and sell their cars in China but are not serious about local R&D. Our IJV partners have shown little interest in offering help for our independent vehicle-development projects, and thus we have excluded this possibility, placing more emphasis on the application of our own vehicle-development architecture. I do not see a high chance of change in this respect, at least in the near future.[27]

In fact, this project adopted a so-called "mix-and-match" strategy, one of China's typical vehicle-development formulae (Table 8). The base technology for Fengshen S30 is the PSA-licensed platform for Citroën ZX, whose production in Europe had already ceased in 1998. To compensate for the dated powertrain technology, DFM separately acquired a production license for the engine developed for the Peugeot 307 model, which was produced in Europe between 2001 and 2008, and sourced newer transmissions from Aisin and PSA. These separately outsourced powertrain components and other key parts were then fitted onto the platform.[28] The overall and detailed vehicle designs were outsourced to an

[22] Here, I use the term *loose alliance* to emphasize that SAW initially functioned as the DFM Group's HQ but the other eight sub-operational units were endowed with substantial managerial autonomy.

[23] In 2002, for example, DFM's passenger vehicle output volume was only 132,419 units, less than half of SAIC's (390,513 units) or FAW's (326,882 units). *Source*: Computed from Fourin (2013).

[24] Interview #21.

[25] Multiple firm interviews confirmed that DF-PSA R&D Center (in Wuhan), DF-Nissan R&D Center (in Guangzhou), and DF-Honda Development Center (in Wuhan) were all engaged in minor local adaptation work.

[26] Interviews #21 and 23.

[27] Interview #21.

[28] Some key parts were outsourced from other global suppliers including Bosch, Lear, and Delphi (Wang, 2009).

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Table 8
Details on Fengshen S30.

Vehicle class	Base technology*	Engineering sources, etc.**	Units sold in 2012***
Compact (sedan)	• Platform: Citroën ZX • Engine: 1.6 L N6A gasoline (Peugeot 307) • Transmission: Aisin 4-speed AT (automatic) or PSA 5-speed MT (manual)	• Production: DFPVC • R&D: DF Automobile Engineering Research Institute & Technical Center (DFM HQ) • Design outsourced to the Italdesign-GiugiaroS.p.A. (Turin, Italy)	25,453

Source: * Firm interviews; ** Wang (2009); ***Fourin (2013).

Table 9
Summary of comparative analysis.

	SAIC	FAW	DFM
Growth path to business group			
+ Primary motivation	Both intensive and extensive growth	Extensive growth	Extensive growth
+ Primary growth driver	Extension of preexisting SAIC–GM partnerships	Merger with TAG and HAG	Establishment of IJVs with new foreign partners
Compact organizational space			
+ Geographical proximity	Neutral[a]	Lacking	Lacking
+ Organizational proximity	Secured	Lacking	Lacking
Technological catch-up performance			
+ HQ's monitoring capacity	Strong	Weak	Weak
+ Capacity for knowledge integration	Strong	Weak	Weak
+ Capacity for mobilizing and sharing internal resources	Strong	Weak	Weak
+ Collaboration with IJV partners	Strong	Weak	Weak
+ Architecture for own-brand vehicle development	In-house renewal of adopted base technology	Mix-and-match	Mix-and-match

[a] Secured for central management function, but lacking for production function.

Italian automotive engineering consultancy *Italdesign*. The primary tasks performed by the DFM HQ and DFPVC in the S30 project were production engineering and manufacturing, respectively. Substantial in-house capability for these tasks was developed from DFM's three-decade-long commercial-vehicle manufacturing experience, with little relevance to its IJV-based catch-up outcome.

Spatial dispersion has also dampened DFM's IJV-based learning, causing further isolation of each IJV operation. Due to its central ownership, the local government (whether for Hubei Province or for Wuhan City) has had only limited degrees of direct influence over DFM's management, and accordingly, the group's organizational growth and localization strategy are not confined to a specific locality. A low degree of spatial clustering is a clear disadvantage when the group's organizational distance is already substantial, as it makes internal coordination and management at the group level more challenging. It also rules out positive externalities from geographical agglomeration, such as labor pooling, which often functions as an effective horizontal spillover channel.

A brain drain caused by DFM's managerial rigidity has made the situation even worse. A strong socialist legacy, for example, survives in DFM's standardized seniority-based wage system, where wage margins are narrow among employees engaged in similar tasks. Recently, DFM has been losing its skilled labor and talented engineers to other firms located outside its home base, partly due to its limited ability to offer attractive incentive packages.[29] The DFM management recognizes this problem, but little change has been made to the system to avoid potential resistance from current employees, who are strongly against high wage differentials.

[29] For example, a Chinese journalist told me about a DFM engineer with 20 years of experience, who moved to SAIC with a compensation package four times higher than the one he received at DFM (Interview #23).

4.4. Comparison of the three firms

Despite the common evolutionary path from a single-plant firm to a giant business group, each automaker has developed dissimilar organizational space with a distinctive growth mechanic (Table 9). SAIC has extended its existing partnership with GM for growth, maintaining compact organizational space. SAIC's increased production space does not undermine Shanghai's status as the group's commanding center, and group affiliates have developed a strong identity as SAIC family. In contrast, FAW's dependence on domestic mergers for growth has entailed substantial spatial *and* organizational expansions. Those merged with FAW have remained quasi-independent operations with strong self-identities, allowing ex-owners to control substantial stakes even after the mergers. DFM's IJV-driven growth has also increased organizational space substantially. The DFM Group has operated as a bundle of independent firms rather than one organic body, as each IJV is designed as a legal business entity independent of the group's internal hierarchies. Spatial isolation has further contributed to such low interdependency among the group affiliates.

In several aspects, SAIC's growth strategy has proved to be effective in enhancing in-house technological capabilities. First, close inter-organizational ties – the SAIC-GM partnership, in particular – have paved the way for upgrading SAIC's once assembly-specialized IJVs into more comprehensive ones that include in-house R&D functionality, as evidenced by *Baojun 630*, jointly developed by SAIC and GM. Such relational assets have functioned as effective boundary spanners, which promote knowledge transfer through IJVs.

Second, SAIC's Shanghai-centered growth encouraged horizontal knowledge spillovers, driven by regional labor pooling and inter-firm labor mobility. Although multinationals have minimized the possibility of unwanted horizontal spillovers, SAIC has actively utilized human resources who have work experience with IJVs. Inter-firm labor mobility, particularly between IJVs and non-IJV affiliates, is higher for SAIC than for FAW and DFM, as that involving SAIC has shown a strong intra-regional orientation, and SAIC's management has been more flexible and active in seeking local talent.

Finally, active knowledge-sharing among SAIC affiliates has promoted the group-wide absorptive capacity. SAIC's acquisition of external assets was driven by strong and clear asset-seeking motivations, and it was followed by group-wide systematic internalization efforts. SAIC has successfully integrated its own technological capability, developed through IJV partnerships and acquired Rover technology, with the core competencies residing within Nanjing-MG (MG brand and product designs) and Ssangyong Motor (independent vehicle-development and engineering capabilities) under a series of joint vehicle-development projects. Multi-divisional project teams are prevalent within SAIC, and they have spurred mutual learning and knowledge-sharing at the group level. The intranet system, through which any project team can access SAIC's intellectual assets by authorization level, has further assisted intra-group interactions.[30]

In contrast, FAW and DFM have failed to incorporate division-specific assets at the group level. In the first place, these firms have shown weak motivations to restructure their preexisting group governance for closer inter-divisional collaboration. In addition, relatively new group affiliates have preferred to remain alone, not as part of the group governance, due to their strong self-identities. A result is adhesion to traditional "mix-and-match" vehicle-development architecture – a dated platform fitted with multi-sourced components. In other words, external growth in these two groups, where compact organizational space is missing, has not necessarily translated into improved technological capabilities, suggesting the path of extensive growth.

5. Conclusions

Since the mid-1980s, the three firms studied have accumulated a substantial pool of internal resources that can be exploited to expand their in-house technology development capacity, through IJVs or domestic mergers. Such resources, however, exist in disintegrated forms and are dispersed throughout multiple sub-operational units. Therefore, how effectively such resources can be mobilized in an integrated fashion matters in spurring technological catch-up at the group level. As highlighted throughout this study, compact organizational space has functioned as one crucial determinant of such integration capability.

The SAIC management, on the one hand, has sought the group's overall growth while maintaining compact organizational space. SAIC's spatial expansion has not created serious barriers to creating group-wide synergy, as increased production space has been managed well by compact organizational space. Deepened, instead of widened, IJV partnerships have functioned as effective boundary spanners between SAIC and its IJV partners. Inter-firm labor mobility, promoted by spatial clustering and managerial flexibility, has substantially reduced institutional constraints to IJV-mediated knowledge spillovers. Also, acquired operations have been valuable additions to SAIC's pre-existing technological capabilities, through intensive knowledge-sharing and integrating efforts. On the other hand, FAW and DFM have pursued extensive growth with little effort to sustain compact organizational space. With recent rapid output growth, both firms have developed a quasi-M-form structure, where each affiliate is spatially and managerially separated from other parallel operations. Accordingly, strategic assets residing within sub-operational units have not been mobilized effectively at the group level.

This difference partly accounts for an increasing gap between SAIC and the other two groups, in terms of independent technology-development capacity. SAIC has launched 14 of its own-brand passenger vehicle models built on nine in-house-engineered platforms over the last four years. Although acquired Rover platforms were used as base technology for the own-brand lineups, SAIC has added a significant amount of its own in-house technological capability, mobilized and integrated from various sources, so that the dated platforms may be reborn into those matching the contemporary standard technologies. In contrast, FAW and DFM still adopt the traditional "mix-and-match" architecture for their own-brand vehicle development, presenting little evidence of group-wide technological synergy. In the absence of "compactness" in organizational space, the relationship among group affiliates tends to be additive, rather than synergistic. A new affiliate may increase production capacity at the group level, but not necessarily improve technological capabilities.

This study, though focusing on the selected Chinese cases, conveys several broader implications. First, spatial proximity of corporate HQ and R&D functions may matter more than the compactness of entire production space in promoting horizontal spillovers between local firms and their foreign-invested operations. Second, organizational proximity can offset disadvantages from spatial expansion, to a certain extent. Third, compact organizational space may generate valuable relational capital between local and foreign firms that can be crucial in increasing foreign firms' commitment to local technology development. Finally, when a firm has developed a multi-unit organizational structure as an outcome of asset-seeking activities, it needs to pay attention to intra-group organizational space management, critical for an effective internalization of the acquired resources.

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