Transferring Collective Knowledge: Teaching and Learning in the Chinese Auto Industry

Background information

• International Transfer Of R&D Capabilities in the Chinese Auto Industry

• Information About the Cases
  o Shanghai-VW
  o Delphi-China
  o PATAC
  o Beijing Jeep
International Transfer Of R&D Capabilities in the Chinese Auto Industry

Many MNEs are transferring R&D capabilities to their joint ventures in the Chinese auto industry. The significant technological, cultural, and managerial distances between the source and recipient organizations creates potential for substantial inter-partner learning.

When China’s auto industry opened to foreign investors in the early 1980s, its R&D capability in the passenger car sector was weak. State owned enterprises (SOEs) in this sector initially produced trucks rather than passenger vehicles. SOEs undertook low R&D (R&D spending was less than 1% of revenue) and long platform upgrade cycles (more than 20 years).

The auto industry is a considered a pillar industry by the Chinese government and industrial policy gives strong emphasis on developing indigenous R&D capabilities. The approval guidelines for foreign MNEs to establish joint ventures in the Chinese auto industry contain key provisions concerning technical development. The venture must have an internal technical center that is capable of developing future generations of products. Moreover, the products of the venture must reach 1990s global technological levels quickly. Industrial policy makers gave strategic guidelines for developing indigenous R&D capabilities: (1) vehicle OEMs should take 5% to 10% of total reinvestment for their tech centers; (2) R&D spending should reach 2% to 3% of sales; and (3) key component suppliers should apply 10% to 20% of their reinvestment to set up their R&D facilities and technical centers. The government provides financial and taxation support for joint R&D projects among business groups.

MNEs have recognized the potential of the car market in China since the early 1980s. AMC-Jeep and VW were the first MNEs to enter. They took cautious attitudes about local infrastructure and markets, and established simple vehicle assembly facilities with little local content or local knowledge. The commercial success of VW in the late 1980s and early 1990s evoked an inflow of foreign investment in the vehicle OEM and supplier sectors. In order to earn approval to enter China, MNEs now must commit to bring in modern product/process technologies and develop R&D capabilities at their local operations.

In the auto industry, R&D projects involve many different levels of difficulty. The most extensive R&D activity is the development of a new platform, which includes styling, redesign of power train and key subassemblies and components. This kind of project usually costs more than a billion dollars for each platform and needs production volume exceeding a million vehicles a year to recover the R&D costs. Obviously, this is not a feasible starting task for the recipient firm to work on. And, in reality, MNEs from the industrialized countries have no intention to hand over knowledge of this kind of activity to their partners in LDCs. However, China’s demand for R&D capability transfer does not necessarily conflict with the long-term vision of MNE investors. As competition becomes more global, firms must quickly develop new products that suit local tastes and regulations. Transferring R&D capabilities to operations close to local markets then becomes beneficial.

Most R&D activities in the LDCs are at the end stage of the R&D cycle, with tasks such as adapting designs to local markets, validating the capabilities of local suppliers, and ensuring that designs meet quality, safety, and environmental requirements. Most joint R&D tasks between local recipients and the multinational source firms in the Chinese auto sector limit themselves to recombining local knowledge with the MNE’s general knowledge, that is, to carry over an existing platform developed by the MNE and modify the style, adjust dimensions, and
parameters of some components based on local customer taste, driving conditions, and
government regulations.

This type of task requires coordination among functional groups such as marketing,
analysis, design, prototype, validation, and production, and often contains substantial collective
knowledge. These tasks can expose the recipients to many R&D routines and different stages of
the R&D process. For instance, the design adaptation/localization process ranges from extending
the length of the car to re-designing the exterior and interior. GM-Shanghai, for example, made
over 600 engineering changes to tailor Buick Century to meet Chinese driver preference, road
conditions, and local gasoline quality.
Information About the Cases

1. Shanghai-VW

Shanghai-VW, a joint venture among Shanghai Automobile Industrial Corporation (SAIC), Bank of China, China Automobile Industrial Corporation (CAIC), and Volkswagen AG (VW), has a total employment of 10,000 and total registered capital of 2.3 billion RMB (277 million US dollars), in which VW has a 50% share. Its annual output reached 200,000 cars in 1999 and took over 60% of the market share in China’s mid-size car sector. The initial joint venture contract has a 25 year duration, while the partners are willing to extend the contract for another 25 years.

Shanghai-VW started its production in 1985 with a single product, Santana, which was an out-dated model even at the time of introduction in China. However, due to the huge market demand and lack of sizable competitors in the local market, Shanghai-VW enjoyed high market share and above-normal return without re-introducing any new car model until the mid-1990s. During the early years of Shanghai-VW, the venture devoted most effort to localizing component production, improving production management and quality, and reducing cost. In 1995, Shanghai-VW passed the QS9001 qualification. Its local content of production increased from less than 5% in 1985 to over 90% in 1997.

From the beginning of Shanghai-VW, both Chinese and German sides have had a clear vision of the importance of training the local engineering and technical force. Soon after Shanghai-VW was established, the German partner took the lead in developing and supervising training programs. A training center was developed with German investment of 1.63 million German marks and Chinese investment of 2 million RMB. This training center has been refurbished and improved over the past few years. It is now the highest quality training facility in China’s auto sector, with training capabilities for product, manufacturing, and R&D. The classes include CAD, exterior modeling, manufacturing technologies, automatic control, automotive electronics, engineering analysis, and network information systems. The training center has sent 10 Chinese instructors to the training department of VW for training. By 1998, 1,060 Chinese personnel from Shanghai-VW had received technical training from the training center. Shanghai-VW’s overall long-term training plan includes areas such as professional training, general training, project-focused training, on-the-job training, qualifying exams, leadership training, and overseas training (Lu, 2001). In addition to the in-class training, based on the technology transfer agreement, for every key technical collaboration projects between the Chinese and German partners, Shanghai-VW sends engineering and technical personnel to related VW engineering or manufacturing units for on-the-job training.

In mid-1990s, as more multinational auto manufacturers entered China through joint ventures, the local market competition heated up, which threatened Shanghai-VW’s market dominance in the mid-size car sector. After almost ten years’ of single product operation, Shanghai-VW realized that it was time to introduce new generations of products. In 1997, the modified model of Santana and a Santana 2000 were introduced. The major work development of Santana 2000 was done in VW-Brazil. However, Chinese engineers in Shanghai-VW participated heavily in the exterior styling design of this car model.

As China’s entry into WTO approached, Shanghai-VW realized that product development cycles must significantly shorten, and the cost for new product launching must
reduce. This new challenge has led Shanghai-VW to initiate a ten-year plan for developing local R&D capabilities. The goal is to bring the local R&D capabilities to a higher level in order to achieve concurrent design and multiple-project R&D. As a first step, Shanghai-VW invested 0.8 billion RMB (about $US 100 million) to expand its technical center to include prototyping and testing facilities that are indispensable to the vehicle development. At the next stage, taking the joint development of the Chinese version of Passat, a popular compact car initially developed in Germany as a learning platform, Shanghai-VW engaged in a large-scale knowledge transfer campaign, which involves Chinese personnel from plant floor to top management, including 765 persons or 1,660 person-months of overseas training. The major R&D work on the Chinese version of Passat is in exterior and body extension. The major design work and technical validation is done in Germany by German engineers, Chinese engineers from Shanghai-VW participated in design proposal stage. Some state-of-art CAD tools, such as dynamic structural design are used in the Passat project. There are 450 R&D-related personnel in Shanghai-VW, whereas in VW AG there are over 8,000. Shanghai-VW plans to increase the R&D-related personnel to 1,000 over the next 4 or 5 years.

2. Delphi-China

Delphi Automotive Systems is the world’s largest auto supplier. It established a representative office in Beijing in 1994, while Delphi was still part of the General Motors Corporation. Since then, Delphi has established 9 joint ventures and 3 wholly owned enterprises in China. The main purpose of these operations is to supply to the Chinese operations of its OEM customers, such as GM-North American operation and GM-Opel. By the end of 2000, Delphi’s overall investment in China exceeded 400 million US dollars, while its total sales also reached 400 million US dollars. The products in its Chinese operations range from electronic instruments and batteries to brakes and steering systems. In 1999, the holding company of all Delphi’s Chinese operations was established in Shanghai.

Delphi has been developing its Chinese business based on five principles: (1) long-term cooperation (2) active technology transfer, (3) localization of design and production, (4) internationalization through exporting, and (5) serving multiple OEMs. In order to better transfer technologies and localize design, Delphi cooperated with Tsinghua University, a leading university in China, and established Delphi-Tsinghua Institute (DTI) in 1996 in Beijing. DTI offers a large range of technical and managerial training programs, such as ISO/QS quality systems, lean manufacturing, automotive engineering, leadership, human resources, project management, and corporate culture. The trainers of DTI include professors from Tsinghua University, Peking University, Chinese Academy of Science, and experts from Delphi Automotive Systems. By June of 2000, DTI has provided training for over 8,000 person-weeks for more than 200 customers. DTI serves as “the premier training center in China, bridging industry, government and academia to meet their needs.”

Besides DTI, Delphi also uses other mechanisms to transfer technologies and capabilities to its Chinese operations. Depending on the need of individual operations, some of Delphi’s China operations invite foreign experts to be managers and trainers in China, some send Chinese engineers and managers for overseas training in Delphi’s various divisions around U.S., and some use both approaches. Delphi Parker-Shanghai, which produces electric harnesses, adopted an all-American managerial team at the beginning. Every functional unit was headed by an American manager, who was also responsible to mentor his/her Chinese successor. In about six
months, half of the American managers finished their mentoring job and transferred their leadership to Chinese successors. Now, Chinese nationals fill almost all mid and low-level managerial jobs. Delphi-Energy, which produces engine accessories, emphasizes training in China. By contrast, Delphi-Steering Systems, which produces steering systems and half shafts, has sent all of its Chinese engineers and managers to its home base in Saginaw, Michigan for on-the-job training, ranging from 3 months to over a year. Similarly,

3. PATAC

General Motors entered China in 1997 with five principles: (1) GM is committed to China for the long term in a relationship that benefits GM, China and the Chinese people, (2) GM is involved in the production, distribution, design and testing of vehicles, (3) GM is actively engaged in technology exchange programs needed to develop the Chinese automobile industry, (4) GM is committed to fostering the managerial and professional skills of its local Chinese employees, and (5) GM ensures its operations in China are globally integrated to secure the highest quality, services and products for the Chinese market. Based on the fourth and fifth principles, GM not only set up two manufacturing joint ventures, but also a R&D joint venture – Pan Asia Technical Automotive Center (PATAC), which is a US $50 million, 50-50 automotive engineering and design center joint venture between GM and Shanghai Automotive Industry Corporation (SAIC). The goal for establishing PATAC is to develop and expand China’s automotive engineering and design capabilities while serving as an advanced technical center for the region. Acting as a fully separate business entity from its parents, PATAC offers a comprehensive range of design, analysis, and testing services, including computer-aided five-axis exterior model making, simulated road testing, and engine emission testing. Its facilities are available to all automotive companies in China and the Asia-Pacific region. PATAC has about 250 employees, including 160 engineers, designers, scientists and technicians. Many of these professionals have been drawn from auto manufacturers in the area. However, the Center also hires overseas trained personnel to incorporate technical advances.

In June 1999, PATAC unveiled its first small-size concept car, Qilin, representing a major accomplishment for automotive design in China. Qilin was designed to demonstrate the full range of design and testing capabilities offered by PATAC. Soon after the completion of Qilin project, the same team of R&D personnel engaged in a localization R&D project based on an existing small-size car, Corsa, which was developed originally in Europe. The localization R&D involves tasks such as redesign of heating and air conditioning system, plus modification of engine control systems to fit the local road and fuel conditions and meet local regulations. The localized Corsa, named Sai-ou, and was launched for production in 2001.

4. Beijing Jeep

Beijing Jeep Corporation Ltd (BJC) is a 58-42 joint venture between Beijing Auto Work (BAW) and Daimler-Chrysler. BJC employs 8,200 personnel, in which about 10 managers and engineers are expatriates from Daimler-Chrysler. Before the formation of BJC, its Chinese partner had been producing an off-road vehicle without major design change from 1964 to 1984. Developing a new generation of off-road vehicle that suits the Chinese market was an urgent task for BAW, and was a key provision in the joint venture contract that created BJC. After the formation of the BJC, a team of Chinese engineers was sent to the tech center of AMC in Detroit, with a plan to use the platform design of the American partner’s CJ-7 to develop an off-road
vehicle platform suited to the Chinese market. However, the design effort failed. According to the Chinese R&D manager, the failure was due to the lack of capability of the engineers to assimilate the vehicle design.

In 1988, BJC developed an off-road vehicle based on an existing truck platform from AMC, but ended at the concept stage. Four years later, BJC took on another round of R&D effort. This time, it spent 15 months and $US 2.8 million and utilized Chrysler’s core platform design and R&D process. This effort again ended without commercialization because the design could not meet with the market and cost requirements, but the engineers agree that this R&D project gave them invaluable experiences in R&D management and the understanding of core technologies of the platform on which they would base their modified design.

From 1984 to 1996, BJC made multiple efforts to develop the next generation off-road vehicle with the help of the American partner and other foreign design companies. Although the task goal was not fulfilled, BJC accumulated experience in vehicle design and R&D project management. The most valuable outcome of these efforts, according the R&D manager of the CP, is an experienced R&D team that can take on different functions of an R&D project. In articulating the content of the experience, this manager pointed out that it is the “stream of thought” in managing R&D processes, and the understanding of what design content of the original foreign product needs to be modified with the recombination of local market, supplier, and technological knowledge to generate a commercially viable product for the local market.

After a 12-year “learning period”, BJC launched a new vehicle design project in 1996. This time, BJC adopted an advanced R&D management process to control timing, budgeting, and personnel movement, with the help of its American partner and other foreign design companies. The R&D project started from market research, and then entered into concept design stage with the concurrent collaboration among product design, quality control, finance, purchasing, and manufacturing departments. The design was proven and the first prototype vehicle was assembled and tested by the end of 1999. The formal production date was projected for 2002. Although the time taken for this round of R&D is long compared to current Western standards (2 to 4 years for new vehicle design), considering the amount of indigenous knowledge and managerial content that have been embedded into the new product and the extent of experience gained by the design team, this project was a major breakthrough for BJC.

During the first 16 years of BJC, although the Chinese partner had a clear intent for acquiring R&D capability, the joint management of the joint venture failed to formulate a systematic strategy on training R&D personnel. At the beginning of the joint venture, three types of overseas training were used. The first type is overseas on-the-job training of teams of design managers and engineers with specific design projects, which can either for entire vehicle design or component design. The number of Chinese engineers in each training team ranges from 3 to 10, with the length of each training section span from 3 months to over a year depending on the size of the project. The second type of training is overseas formal engineering education but, in BJC’s history, only eight Chinese engineers have received a one-year college-level engineering training from the General Motors Institute (now, Kettering University). The third type of training involves sending individual engineers or managers to work full time as resident-engineers in the home base of the American partner for as long as a year. Eight Chinese employees have received this type of assignment. In recent years, though, overseas training has fallen rapidly.