Towards a knowledge-based view of OEM relationship building: sharing of industrial experiences in Taiwan

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Abstract: This paper addresses issues of knowledge transfer through OEM (original equipment manufacture) sub-contracting in high-tech industries in Taiwan. Major issues explored in this paper include how a firm in Taiwan establishes an OEM relationship with its world-class competitors, how the relationship was maintained, and how knowledge transfer was facilitated under such a relationship.

Findings of our study suggest that the Taiwanese firms deliberately chose to collaborate with their world-class competitors in order to learn from them. Under OEM sub-contracting, knowledge transfer took place in a systematic fashion. The types of knowledge transferred were diverse, and the transferred knowledge influenced profoundly the firms’ operations or even their ways of thinking. Such knowledge transfer enhanced the firms’ absorptive capacity, and could be divided into several phases. Beneficial contexts in which mutual trust developed between the firms and their OEM buyers facilitated the transfer of knowledge. Propositions for further research are proposed.

Keywords: Knowledge; absorptive capacity; OEM-subcontracting; inter-firm knowledge transfer; learning; Taiwan.


Biographical notes: Professor Se-Hwa Wu obtained his PhD in business administration in 1984 at the Graduate School of Business Administration, National Chengchi University, Taiwan. He is currently the Dean of College of Commerce, National Chengchi University. Prior to this position, Prof. Wu founded and served as the Director of Graduate Institute of Technology and Innovation Management, National Chengchi University. A talented researcher, he also serves as consultant for the Taiwan government, member of the board of governors in various management associations in Taiwan, and Director of the Innovation Incubator Center, National Chengchi University. In recent years, Prof. Wu has researched and published on the subject of knowledge and technology management.
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1 Introduction

This is an age of uncertainty [1,2], but also an age of knowledge. Knowledge has become a new source of wealth [3]. The most competitive firms were found to create, reshape knowledge and deliver it to the market fast. They also continually improve upon their products or services, i.e., innovate, through experiments for knowledge transfer [4].

Knowledge as the new source of wealth has spurred interest among researchers in this age of uncertainty. Through years the perspectives researchers adopted to study knowledge as a subject or its management have become increasingly diverse. Such diversity can be reflected by a handful of literature. The perspectives may include pragmatic and epistemological ones e.g., [5-16]. However, despite the diversity of the views adopted, knowledge transfer for creating competitive advantage has not been well understood [5], neither has it in Taiwan [17,18].

Taiwan has been well-known for its 'economic miracle', striving to be a developed country. Specifically, latecomer firms in high-tech industries in Taiwan have been identified to overcome their competitive disadvantages in knowledge and technologies through transferring knowledge and technologies from competitors in advanced countries [19]. Very often, OEM sub-contracting has been found to be the first step which leads to such transfer.

Sad to say, with a few exceptions e.g., [20,21] studies of how high-tech firms in Taiwan initiate OEM relationships to facilitate knowledge transfer with their foreign incumbent companies have rarely been seen [22-24]. Given the success of some of the high-tech firms in Taiwan, e.g., firms in the semi-conductor sector [19], in their overcoming the competitive disadvantages in the world market through OEM businesses, effective patterns of knowledge transfer of these firms have been explored in this research. Such an exploration produced findings which inform current theories of knowledge management, and which have practical implications.

In our study of OEM sub-contracting as a surrogate of knowledge transfer in Taiwan, we have deliberately linked our views with those provided by literature in the issue of absorptive capacity. This has given us an anchoring, theoretical point which has guided our inspecting empirical data. Thus, in our presenting firm characteristics in Taiwan of the process of knowledge transfer through an OEM relationship, the data also shed light on certain aspects of absorptive capacity which has been discussed in the literature.

1.1 Absorptive capacity

Absorptive capacity is a construct which was proposed in the 1990s (see Cohen and Levinthal [25]). It is deemed vital and refers to a capability, which concerns how well a firm can make use of knowledge transferred from outside sources. The basis of absorptive capacity is the volume of relevant knowledge which has been accumulated through time [25,26]. The larger this volume of knowledge, the better a firm can assimilate the knowledge to be acquired. On the contrary, a lack of this volume would result in a firm’s inability to appreciate the value and make use of the incoming knowledge [27].

Since the proposition of absorptive capacity, various researchers have developed different methods of operation which facilitate empirical studies on it e.g., [25,28-30]. In general, these operationalizations have transmitted the idea of similarity and relevance of past knowledge which captures the essence of absorptive capacity. In our study of exploratory nature within the industrial contexts in Taiwan, we proposed to collect a type of qualitative evidence which is indicative of a firm’s possession of absorptive capacity. However, this does not deviate from the idea offered by previous researchers, which is introduced below.

2 Methods

2.1 The scheme for data analysis

In this study, we have dealt with several high-level constructs. We developed a categorizing scheme which helped bound our exploration in the empirical domain regarding these constructs. However, due to the fact that vagueness permeates the whole exploratory journey (cf. Miles and Huberman [31]), the empirical phenomena which were judged appropriate would be used to contribute to the development of the findings.

Knowledge: several aspects of phenomena were treated as knowledge here. These include management systems, e.g., quality control systems, personal skills, e.g., R&D capability, technology, information, shared values and culture, etc. The definition here conforms to Badaracco’s [3].

Absorptive capacity: in our empirical exploration of this construct, we resorted to the perception of the firms and the OEM buyer companies. For example, very often we discovered that the success of the establishment of an OEM relationship lies at these buyer companies’ satisfaction with the relevant capabilities of the Taiwanese OEM-seeking firms. These capabilities are crucial for manufacturing the equipment designated by the OEM buyers, and thus, crucial for maintaining an OEM relationship.

2.2 Data collection and analysis

We adopted a grounded theory-building approach [32] for this study as the theoretical framework has yet to be found to guide our empirical study of knowledge transfer from external sources. Our conclusions are highly context-dependent and were formed based on our data analysis. They would be treated as tentative and offered for cross-validation in future work.

The data collected was qualitative in nature. According to the definition of the International Trade Association, Taiwan, OEM means the manufacturing of components, semi-products, or products under the request and authorization of the OEM buyer. Normally, the manufacturing will have to follow certain designated material,
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specifications, processing procedures, branding or labelling, and have to meet criteria for evaluation.

We carefully selected six firms for our study. As will be seen in the next section, these firms are the leading actors in their industries, respectively. They further had their OEM business exceed at least 50% of the annual sales. This provides a context in which knowledge transfer between these firms and their OEM buyers is frequent. Incidentally, managers of these firms all claimed that the OEM buyers contributed greatly to the transfer of knowledge to these firms, and thus, to these firms’ growth. For each of the firms selected, at least two interviewees, either managers or members of the headquarters of the firms, were chosen for our interviews. The interview questions can be divided into several parts:

1. background information of each interviewee and subject firm,
2. the rationale behind a firm’s establishing an OEM relationship, and the firm’s major OEM buyer companies,
3. types of knowledge being transferred to the firm,
4. how the firms maintained long-term relationships with their major OEM buyers, and
5. consequences of such knowledge transfer.

The two researchers of this study co-conducted interviews with each interviewee. Besides interviews, secondary data about the important background information on these subject firms was also collected. Occasionally, managers were also approached for our interviews of the OEM buyers of our subject firms.

2.3 Subject firms

Six firms were chosen as subject firms for this study. These firms are the leading actors in their industries, respectively. Their innovations which enhanced firm effectiveness very often later became innovations adopted industry-wide. Their position in the industries is briefly described in Table 1. Table 2 presents the subject firms’ innovative behaviours and their impacts on industries. These innovative behaviours come into a range of researchers’ definitions of innovation e.g., [33–35].

Table 1: A brief description of the position of the subject firms in their industries

<table>
<thead>
<tr>
<th>Company Name*</th>
<th>OEM business as a percentage of sales</th>
<th>Industrial Position</th>
</tr>
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<tbody>
<tr>
<td>Apex</td>
<td>50%</td>
<td>The largest IC wafer manufacturer in Taiwan</td>
</tr>
<tr>
<td>Titan</td>
<td>90%</td>
<td>The leading PC manufacturer in Taiwan</td>
</tr>
<tr>
<td>Wise</td>
<td>65%</td>
<td>The largest manufacturer of electrical power supply devices in Taiwan</td>
</tr>
<tr>
<td>Bright</td>
<td>60%</td>
<td>The second-largest manufacturer of computer monitor in Taiwan</td>
</tr>
<tr>
<td>Speed</td>
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<tr>
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* The company names used here are pseudonyms

Table 2: Subject firms’ innovative behaviours and their impacts on industries

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Apex: Apex was established in 1976, and has developed into a conglomerate. In 1997, it was ranked as the eighth largest personal computer company in the world. Far Eastern Economic Review designated Apex in both 1995 and 1996 with ‘the leading enterprise in Taiwan’. With Apex’s R&D efforts, it has obtained over 400 patents worldwide, and has signed bi-lateral technological authorization agreements with Intel, IBM, Texas Instrument, etc. Apex offers a wide range of products, including personal computers, mother boards, computer peripherals, IC products, and multi-media products. In recent years, it also expanded into businesses of consumer electronics, communication products, Internet services, application software, etc.

Titan: Titan was established in 1982 as a computer and peripherals manufacturer. Its growth rate in sales in the 1984–1987 period ranged from 30% to 100%. In 1996, to cope with Titan’s high-rate expansion in size, an organizational change was initiated. Following this change, Titan was divided into three business divisions: portable, system and video. Titan now has three headquarters in Taiwan, Britain, and the USA, respectively, and five manufacturing centres located in Taiwan, Britain, the USA, Chinese Mainland, and Australia. It has also worldwide marketing channels. To operate under such a global framework, a management system of production-marketing called ‘manugistic’ was established. Titan has been famous for its constant innovations, which have been both product-wise and organizational.

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Bright: Bright was established in 1984, a diversified company from Apex. Initially, it was Apex's original equipment manufacturer. In 1989, Apex sought to redefine Bright's business. The business was positioned as a computer peripheral producer. From this point on, Bright began to have the autonomy to pursue its own objectives, and it began to improve its financial performance. In recent years, Bright has expanded into the communication business. It labelled itself as a ‘P (peripheral) & C (communication) expert’. The company is so ambitious that it hopes to ‘integrate resources worldwide under the leadership of its top management team to become a multinational P&C giant’.

Speed: Speed was established in 1971 with power supply devices as its major products. It has emphasized product innovations. Each year 5% of its income has been devoted to R&D. With its dedication in R&D, the time needed from designing to manufacturing a new model has been shortened and standardized. It has been granted with different types of awards by Hewlett Packard, IBM, etc., for its product innovations.

Inte-IC: Inte-IC was established in 1987, invested by the government, Holland-affiliated Philips, and the private sector. The purpose of the government giving birth to it is to help establish the IC industry in Taiwan. It is the first company in the world to offer only original equipment manufacturing for its buyer companies using the most advanced process technology. Its major buyers come from two categories: integrated device manufacturers (IDMs), and IC design houses. It also engages itself in intensive R&D activities in order to create pioneering process technology.

3 Findings

3.1 Brief accounts on knowledge transfer through major OEM buyers

Apex: Apex has engaged itself in original equipment manufacturing for over 13 years. At the outset, Apex chose to conduct OEM business out of growth considerations. As assistant manager Hong put it, ‘OEM is not just about production, but a demonstration of a company’s strength’. Apex carefully selected major computer manufacturers in the world like IBM, Texas Instrument (TI), and Apple as its OEM buyer companies. Under such a ‘growth through OEM’ strategy, the three companies have served as key knowledge sources of Apex in the past ten to 15 years. This strategy has attracted other companies in the information industries in Taiwan to follow.

On the other hand, initially IBM, TI and Apple chose to seek original equipment manufacturers to reduce cost. However, Apex has demonstrated to them its capabilities of R&D and quality control, flexibility in meeting the customer demand, and even its ambition in the search for corporate-wide efficiency through system and cross-function integration. The three worldwide major computer manufacturers decided to collaborate with Apex. Such collaboration, according to assistant manager Hong, enhanced Apex’s capabilities in several respects. Also in retrospection, Hong discovered that Apex gradually has gained a higher speed in catching up with its OEM buyer firms in technologies through its intensive learning from these firms. As the OEM relationships continue to grow, Apex appreciated more and more the value of learning from the world’s major computer companies. Apex could learn from them systematically. The knowledge transferred was multi-dimensional and has turned Apex into a totally different organization from how it was before conducting OEM business.
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Titan: The initiation of Titan's OEM business can be traced back to the early 1990s. Of all the OEM buyer companies Titan has cooperated with, AT&T and Compaq are two companies which contribute significantly to Titan's growth. Titan chose to cooperate with AT&T to increase its profit. AT&T turned to Titan as AT&T's equipment manufacturer because AT&T sought to reduce cost. However, gradually Titan realized that engaging in OEM business brought it chances of increasing its corporate-wide efficiency. As manager Tsai put it, "we wish to integrate very well all our different functions."

The cooperation with AT&T brought Titan a word-of-mouth reputation. Partly because of this, Compaq chose to cooperate with Titan as Compaq's equipment manufacturer. Besides, through the years Titan has established for itself a good control system for product quality, and worldwide marketing channels. Compaq has seen Titan as an attractive partner for collaboration. On the other hand, Titan's cooperation with Compaq has further strengthened Titan's corporate-wide capabilities. This, according to manager Tsai, shortened the technological gap between Titan and its major competitors, e.g., Apex.

Wise: Wise has been famous for its product and process innovations. As mentioned above, it has grown rapidly. In recent years, it started its OEM business under the thinking that it needed to obtain knowledge for its future growth. IBM, Hewlett Packard (HP), and 3Com had been Wise's OEM buyer companies. On the other hand, at the start, the three companies decided to collaborate with Wise to reduce the cost of operation. Further, they took into account Wise's capabilities in R&D, production and quality control, flexibility in meeting customer demand, and its OEM experiences. They wished to establish long-term relationships with it.

As manager Chen put it,

"The key to building up an OEM relationship lies at your own R&D capabilities ... Indeed, leading companies in the world took into account various things before they decided to engage in an OEM relationship. Among these various things, for example, your production capabilities, your quality control, your flexibility in meeting different customer needs, and so on, and so forth, are very important."

Furthermore, both Chen and Vice President Lee all stressed that the more a firm learns from its OEM buyer company, the more that firm can enhance its organization-wide efficiency, which may include production capabilities, quality control, the logistic system which supports a manufacturing project. That firm can attract even more opportunities for OEM businesses. Here we had an indication, though not overt, that a firm's absorptive capacity helps it learn from its OEM buyer companies, that learning further strengthens its absorptive capacity.

Bright: During the interviews, managers of Bright identified its two major OEM buyer companies, i.e., IBM and Hewlett Packard (HP), due to the two companies' contributions to its sales. Bright's collaboration with IBM is a special case. Bright has been an Apex-affiliated firm. During Apex's collaboration with IBM, Bright also engaged in such OEM relationships with IBM. However, Apex simply assigned Bright manufacturing duties when they exceeded Apex's manufacturing capability.

On the contrary, Bright chose to collaborate with HP in order to grow. HP used five criteria in the selection of an equipment manufacturer, i.e., technology, quality, response, delivery and cost. Bright was seen as being able to meet the five criteria, and was
selected by HP. As manager Huang of the R&D Department put it, 'Take an example, we have a very good capability in responding to HP's requirement. Companies in Japan and South Korea cannot even compete with us'. Further, as the range of Bright's capability was enhanced, manager Huang admitted that Bright could pick up more information or knowledge from external sources in a shorter period of time.

Speed: Speed's major OEM buyer companies include IBM, HP and Intel. Sales growth and the long-term prospect have been the key contributing factor in Speed's engaging in OEM business. On the other hand, in his negotiation with Speed's three OEM buyers, manager Cheng of the Sales Department recalled, 'Corporate size, reputation, product quality, manufacturing capability, and so on were the factors that these large companies considered in their selection of an equipment manufacturer'. Almost as we have been told in previous firms, Manager Cheng admitted that Speed's collaboration with its OEM buyer companies enhanced a wide spectrum of capabilities. The more it has learned, the better products Speed could offer to its customers, and the more efficiently Speed's organization operates. Cheng also pointed out that Speed's knowledge processing speed has increased through the learning process.

Inte-IC: Inte-IC purposefully chose to cooperate with Philips, Fujitsu, Intel, in order to upgrade its technological level and improve its competitive position. On the other hand, the three companies chose to use Inte-IC as their IC wafer manufacturer because of Inte-IC's high technological level. The technological level is manifested in two aspects: yield rate and efficiency.

It can be observed that a loop has been formed. Inte-IC's technological level gave it the chance to collaborate with leading IDMs in the world. Such collaboration further contributed to the upgrading of its technological level. Inte-IC has been very satisfied with such a self-reinforcing loop. According to the general manager's special assistant Hsue, "Philips provided the know-how of manufacturing process, and methods of organizing the process to us. They also helped us set up our quality control systems. Besides, we obtained their patents. With all the support, we had a very good technological position to start our own IC manufacturing business. Now in certain areas, our technological level even surpasses theirs."

3.2 Phases of knowledge transfer

During the process of knowledge transfer, the six firms transferred a wide diversity of knowledge from their major OEM partners. With such a diversity, the knowledge transfer can be said to be conducted in a deliberate manner not just for the sake of the OEM projects per se, but also for the long term growth of these six firms.

Through time the diversity of knowledge can be observed to be transferred from a certain OEM buyer through different phases. OEM is about production. Thus, knowledge on production would be the first to be transferred, e.g., production methods, management of manufacturing process. The production capability would be the first to be improved. Very often, knowledge on activities combined with production was also transferred as part of the 'knowledge transfer package'. These activities include product design and testing, quality control, personnel skills in manoeuvring machines and in conducting these activities.

The transfer of knowledge on the production-related activities sometimes happened after that of knowledge on production. It could be seen as the second-phase transfer. For
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example, in the early stage of Apex’s collaboration with IBM, managers of Apex discovered that through time it could not keep up with the demand on product quality set up by IBM. Apex decided to renew its production system in order to gain efficiency and product quality. Such a renewal was guided and assisted by IBM. Similar phenomena can also be seen in Inte-IC’s collaboration with Fujitsu. As the diversity of types of product Inte-IC manufactured for Fujitsu increased, Inte-IC requested Fujitsu to provide guidance on material management.

The transfer of knowledge may go into the third phase [36–39]. For example, in order to keep up with Apple’s demand on quality, Apex reengineered its organization. In order to keep up with IBM, Apex acquired ideas on organizational innovation and reshaped its values. The remarks below signified such reshaping, and also signified the importance of IBM to Apex’s growth.

“...In the past, Apex did not need to stick rigorously to the problem of product quality. They thought the problem of ‘time to market’ was much more important. However, after the collaboration with us, IBM asked them to put a lot more weight on product quality. Why? IBM has a wide range of products. The quality of the products they make had to be consistent with all our products,”

said manager Lan of IBM.

Assistant manager Hong of Apex also said with smiles that:

“I found IBM has put into practice all kinds of new and fancy ideas that you can find in textbooks. If you had the chance to work with a partner like that (IBM), who also has a lot of world-class experts and customers, you’d really learn a lot. You’d learn something you can’t get elsewhere.”

Similar cases can also be seen in Titan, Wise and Speed. Titan acquired marketing planning capabilities from Compaq. Wise reshaped its organizational values to focus on quality after its collaboration with IBM. Speed acquired managerial skills, e.g., skills of personnel management, in its collaboration with IBM, HP, and Intel.

3.3 Paths of capability development

The OEM business under the perception of the managers of the six firms can be seen as contributing greatly to these firms’ innovative activities. For example, initially, Apex found it difficult to develop PCs with its own brand name given its technological levels and the lack of acceptance of Apex’s products from the customers worldwide. Apex broke down the R&D activities to focus only on components of a PC, for example, mother boards, or computer peripherals. Through OEM sub-contracting, Apex acquired knowledge to upgrade its product quality in these areas. It further upgraded its corporate values.

Further, through OEM sub-contracting, Apex obtained chances to acquire technology in producing or ‘assembling’ a PC. Coupled with its own R&D endeavours, it started to launch its own-brand PCs. For example, in 1988, its first own-designed mini-computer was launched. However, through years, Apex still put more emphasis on managing and developing its OEM business than its own-brand manufacture (OBM).

Titan had its own OBM business, but the path of technological development is somewhat different. From its establishment, it had devoted efforts to R&D in its own-brand PCs. For example, in 1989, it successfully developed the world’s fastest-speed 386
PCs. However, it faced difficulties in expanding sales volume of its own-brand products worldwide due to the lack of capability in establishing its global logistic system. It started to seek to increase the percentage in the OEM business. Even now, the OEM sales accounts for 90% of the total sales of Titan’s sales. Through years, it has acquired knowledge from its major OEM buyers and has established a manugistic system which operates on a worldwide basis.

Although it seems Titan’s growth path (OBM – OEM) is in reverse direction against Apex’s (OEM – OBM), managers of both firms all claimed that through the firms engaging OEM business, the firms opened up their international vision, and developed their capabilities in monitoring and coping with world changes. For example, Titan dispatched a manager to station in Silicon Valley, USA, in order to monitor the changes in the technology. Titan’s executives in Taiwan can decide if the company would follow a new technological trend and release the information on the catch-up technological trends to its existent and potential OEM buyers.

The other four firms, Wise, Bright, Speed, Inte-IC, so far do not have the ambition to dedicate to promoting or developing own-brand products in international markets. But the managers of the four firms also admitted that through the OEM business, the firms’ capabilities in dealing with world-class actors in their industries have become more and more sophisticated. The firms also obtained an international vision which can keep up with the technological and market changes in the world. Managers of Inte-IC even claimed that its company has built up a very special own-brand, i.e., "OEM brand." In terms of OEM business in IC-chips, and computer memory, Inte-IC's managers feel proud about their agility, quality, and technological levels. They thought Inte-IC should be at the top rank in the world in these three respects.

The six firms, through their efforts in developing OEM business, have obtained more and more orders each year from their OEM buyers. The increase of orders contributed greatly to their annual sales growth. Also, because of the six firms' rapid advancement of the technological levels, their OEM buyers are very willing to ask them to produce new products using the most up-to-date technology.

3.4 Maintaining a steady, long-term relationship

Our empirical study further explored how these different firm cases maintain steady long-term relationships. A range of managers interviewed provided their views. ‘The willingness to learn is the key’, said assistant manager Hong of IBM. On the other hand, manager Lan of IBM provided his remarks on Apex’s performance. He contended that in Apex’s collaboration with IBM, Apex showed commitment to learning and doing things better. IBM was ‘persuaded’ by Apex’s dedication to maintaining a good relationship with IBM. IBM became willing to maintain a long-term relationship with Apex. It provided personnel training and transferred systematically related knowledge to Apex. Managers of Apex were invited to attend IBM’s annual meetings in the USA. Apex learned from IBM just as an intern learns from his/her supervisor. After years of working together, IBM and Apex developed trust in each other. IBM did not intend to change its OEM partner because it did not think other manufacturers could do better than Apex. Further, as both sides engaged in collaboration in a multi-faceted fashion, the cost for switching partners would be high.

All other firm cases also intended to maintain long-term relationships with the world’s major players as these firms’ OEM buyers. The relationships extended at least 5-10 years. Obviously managers obtained through long-term collaboration could be transferred to these firms in the form of knowledge. This has not been done before. The buyer’s decision to set criteria in conducting OEM business is in fact a long-term relationship. This has not been done on a high level. The buyer’s decision to set criteria is not easy to set. In the short term, Inte-IC further improved its OEM business. Inte-IC did not intend to develop OBM business. Its decision is that Inte-IC gives priority to maintaining a long-term relationship with its OEM buyers. Inte-IC as the criteria. Howev-

4 Discussions

4.1 Knowledge transfer and evaluation

Again and again, we saw that subject firms form OEM relationships with respective industries. However, the intention to learn from these knowledge sources for the benefit of the subject firms' development is not easy. The criteria are set up for selecting the OEM business. Even now, the OEM buyers are very willing to ask them to produce new products using the most up-to-date technology.

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for years. Obviously managers of these firms saw a range of benefits which can be obtained through long-term collaboration with these players. Technology or knowledge to be transferred to these firms is a very important dimension, if not the most important, among these benefits. Almost all managers of these firms also stressed the importance of trust between the manufacturer and the buyer in keeping the relationship long-lasting. Manager Tsai of Titan said that building a relationship is one thing, maintaining it is another. The buyer’s decision to form a relationship may be quite ‘rational’ in the sense that criteria are set up for selecting the manufacturer. For example, Compaq set up the reputation in conducting OEM in the past, and the capabilities in quality control and marketing as the criteria. However, as the collaboration began, Titan tried various ways to keep the collaborative relationship steady, even though its performance was still evaluated annually. Through time trust was built and both parties would aim at maintaining a long-term relationship. Once trust emerged, switching partners would not be easy. Titan could grow side by side with the key player in the world.

For Inte-IC, OEM business is its core business. Assistant Hsue claimed that because Inte-IC did not intend to develop its own brand, its OEM buyers would not feel threatened, worrying their manufacturer would one day turn a competitor. It could manufacture the products with the most up-to-date technology. But no other manufacturer could do better. Thus, Inte-IC’s position in OEM was not easily challenged in the short term. Inte-IC further sought to establish long-term trust between it and its OEM buyers.

Speaking overall, would the position of the high-tech industries in Taiwan in conducting OEM business be challenged by other countries? From the data, at least in the short run, these firms' managers did not think so. For example, managers of both Speed and Wise provide similar points. Through time Taiwan developed very good expertise in conducting OEM. With OEM the growth of Taiwan’s high-tech industries keep pace with the latest development of, for example, electronic and computer technology. Manager Cheng of Speed provided his metaphor: ‘The gear of the growth of Taiwan’s high-tech industries is well matched with that of the growth of the leading technology’.

4 Discussions
4.1 Knowledge transfer and absorptive capacity
Again and again, we saw strategic initiatives, e.g., the quest for sales growth, had our subject firms form OEM relationships with worldwide leading companies in their respective industries. However, such an initiative has also been found intertwined with the intention to learn from these buyers. The OEM buyer companies served as important knowledge sources for the subject firms. The learning from these buyer companies contributed to the subject firms’ continuous improvement of their innovative capabilities [25,40-43].

Given the firm cases illustrated here, the relative importance of using leading companies in the world as sources of knowledge as opposed to other sources may be questioned. This has not been directly dealt with in this study. However, the importance of using OEM buyers (especially the world’s leading companies as the OEM buyers) as the source of knowledge was well-demonstrated in our findings. This can be observed in several aspects.
First, the collaboration with the world’s leading companies led to organization-wide changes, as can be seen in the case of Apex, or substantial improvement of organizational functioning, as can be seen in the six firms. Second, the learning took place throughout a long time frame, and in a systematic fashion. Third, the knowledge transferred was multi-dimensional, and affected profoundly the firms’ operations, or even ways of thinking. Finally, the collaboration with the world’s leading companies further provided the firms with a global vision. The firms equipped themselves with capabilities of interacting with industrial players in the world, and thus, started to stretch their influences over other regions in this world.

Following the knowledge transfer comes the enhancement of absorptive capacity (or possibly the transfer of knowledge and the enhancement of absorptive capacity can be conceptualized as two things iterated through time). In our subject firms’ collaboration with their OEM buyers, we saw preliminary evidence for the continuous improvement of absorptive capacity through knowledge transfer from carefully selected major OEM buyers. This is summarized in Table 3. Table 3 also summarizes major OEM buyer companies of the subject firms.

Table 3 The subject firms’ major OEM buyer companies and the preliminary evidence for the iteration between absorptive capacity and knowledge exchanges

<table>
<thead>
<tr>
<th>Firms</th>
<th>Major OEM buyer companies</th>
<th>Preliminary evidence for the iteration between absorptive capacity and knowledge transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apex</td>
<td>World’s leading computer manufacturers, e.g., IBM, TI, Apple, etc.</td>
<td>1. It was evaluated against several criteria including capabilities of R&amp;D and quality control, flexibility, and quality of system and cross-function integration before it could form OEM relationships with IBM, TI, Apple, etc.; 2. Enhancing organizational capabilities through knowledge transfer; 3. Shortening the technological gap between it and its OEM buyers has sped up; 4. Through time, more production duties were assigned from each of its major OEM buyers, and these buyers were keen to have Apex manufacture new products with the latest technology; 5. Acquiring a global vision.</td>
</tr>
<tr>
<td>Titan</td>
<td>World’s leading computer manufacturers, e.g., AT&amp;T, Compaq, etc.</td>
<td>1. It was evaluated against several criteria including the reputation in conducting OEM business, capabilities of quality control and marketing before it could form an OEM relationship with Compaq; 2. Enhancing organizational capabilities through knowledge transfer (the technological gap between it and Apex shortened); 3. Through time, more production duties were assigned from each of its major OEM buyers, and these buyers were keen to have Titan manufacture new products with the latest technology; 4. Acquiring a global vision.</td>
</tr>
</tbody>
</table>
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Table 3 The subject firms' major OEM buyer companies and the preliminary evidence for the iteration between absorptive capacity and knowledge transfers (continued)

<table>
<thead>
<tr>
<th>Firms</th>
<th>Major OEM buyer companies, e.g., IBM, HP, 3Com, etc.</th>
<th>Preliminary evidence for the iteration between absorptive capacity and knowledge transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wise</td>
<td>World's leading internet product manufacturers, e.g., IBM, HP, 3Com, etc.</td>
<td>1. It was evaluated against several criteria including capabilities in R&amp;D, production and quality control, flexibility in meeting customer demand, and its OEM experiences before it could form OEM relationships with HP; 2. Enhancing organizational capabilities through knowledge transfer; 3. Through time, more production duties were assigned from each of its major OEM buyers, and these buyers were willing to have Wise manufacture new products with the latest technology; 4. Acquiring a global vision.</td>
</tr>
<tr>
<td>Bright</td>
<td>World's leading computer manufacturers, e.g., IBM, HP, etc.</td>
<td>1. It was evaluated against five criteria, i.e., technology, quality, response, delivery and cost, before it could form OEM relationships with IBM, HP, etc.; 2. Enhancing organizational capabilities through knowledge transfer; 3. Picking up more information or knowledge from outside sources through the learning process in a shorter period of time; 4. Through time, more production duties were assigned from each of its major OEM buyers, and these buyers were willing to have Bright manufacture new products with the latest technology; 5. Acquiring a global vision.</td>
</tr>
<tr>
<td>Speed</td>
<td>World's leading computer manufacturers, e.g., IBM, HP, Intel, etc.</td>
<td>1. It was evaluated against several criteria including corporate size, reputation, product quality, manufacturing capability before it could form OEM relationships with IBM, HP, Intel, etc.; 2. Enhancing organizational capabilities through knowledge transfer; 3. Its knowledge processing speed has increased through the learning process; 4. Through time, more production duties were assigned from each of its major OEM buyers, and these buyers were keen to have Speed manufacture new products with the latest technology; 5. Acquiring a global vision; 6. Creating an &quot;OEM brand&quot; for attracting more OEM business.</td>
</tr>
</tbody>
</table>
Table 3  The subject firms' major OEM buyer companies and the preliminary evidence for the iteration between absorptive capacity and knowledge exchanges (continued)

<table>
<thead>
<tr>
<th>Firms</th>
<th>Major OEM buyer companies</th>
<th>Preliminary evidence for the iteration between absorptive capacity and knowledge transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inte-IC</td>
<td>World's leading IDM, e.g., Philips, Fujitsu, Intel, etc.</td>
<td>1. It was evaluated against several criteria including yield rate and efficiency from OEM relationships with Philips, Fujitsu, Intel, etc.; 2. Enhancement of organizational capabilities through knowledge transfer; 3. Its technology level could surpass Philips; 4. Through time, more production duties were assigned from each of its major OEM buyers, and these buyers were keen to have Inte-IC manufacture new products with the latest technology; 5. Acquiring a global vision; 6. Creating an 'OEM brand' for attracting more OEM business.</td>
</tr>
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</table>

As can be seen above, throughout the six firms studied, certain absorptive capacity was all equipped prior to these firms' establishing an OEM relationship. Such capacity also satisfied the OEM buyers so that they wished to collaborate with these firms. This has demonstrated the importance of an initial level of absorptive capacity before a relationship is initiated for knowledge transfer.

Subsequently, organizational capabilities were all claimed to be enhanced by the subject firms due to the exchanges of knowledge. By definition, such enhancement brings about enhancement of absorptive capacity as well. From certain firms we even obtained protocol indications for the enhancement of absorptive capacity through knowledge transfer. For example, Apex's shortening of its technological gap with its OEM buyer companies has sped up; both Bright and Wise's information processing capability was improved; and Inte-IC's technological level surpassed its knowledge source (Philips). In light of the findings here, we could claim that absorptive capacity and knowledge transfer form a self-reinforcing loop. A similar perspective has been hinted by Powell, et al. [44].

4.2 Phases of learning

Based on our findings above, we could temporarily propose a categorization in which different types of knowledge were transferred sequentially through different phases. Knowledge on production would be the first to be transferred after the OEM contracting agreement was reached. Following the knowledge on production came production-related knowledge. This may include knowledge on product design, testing, quality control and process management. Further, to meet the demanding criteria set up by the OEM buyer, the firm might sense that simply to increase the efficiency of production may not be enough, but the way in which members in the firm thought about the OEM relationships needed to be reshaped. Corporate values were thus reshaped. In order to achieve organization-wide effectiveness, a better marketing intelligence system, better skills on marketing and material management would also be needed. In this manner, the
knowledge on these diverse areas flowed into the firm from its major OEM buyers through time like ripples expanding. Figure 1 provides a metaphorical representation of ripples of the type of capabilities enhanced through the firm’s knowledge transfer endeavours.

Figure 1 Ripples of the type of capabilities enhanced under knowledge transfer activities

Values, marketing intelligence, capabilities of marketing, material management, etc.

Capabilities of product design, testing, quality control & manufacturing process management

Production capability

Our findings are basically consistent with previous research on learning via OEM contracting in East Asian countries e.g., [20,21,45]. We did see firms develop from a phase of simple learning to that of complex learning, supported by a variety and complex structure of knowledge transferred. However, Hobday proposed that latecomer firms in East Asia went through a technological transition from simple assembly to incremental improvements and process development to both process and product R&D. He recognized that own brand development followed OEM sub-contracting. This may not be the case (see also [19]). For example, in our firm cases, Titan refocussed its business from developing own brand products to OEM. Possibly Hobday’s OEM to OEM phase as a representation of simple to complex learning may not be adequate. Using the variety and the complex web of knowledge being transferred to represent simple vs. complex learning may be more adequate.

4.3 Benign contexts for knowledge transfer

As discussed above, the six firms deliberately chose leading companies in the world as their partners for learning. Supposedly, these companies very often were their own world-class competitors, e.g., IBM as Apex’s competitor. Regardless of the competitive relationships, through time we saw ‘rigidity’ in these OEM relationships. That is to say, once an OEM relationship was built, gradually both parties, i.e., the firms and the buyers,
sought to maintain long-term connections. The OEM relationship later became a strategic alliance.

In order to go through the threshold of building an OEM relationship with the leading companies in the world, the firm provided data which persuaded them for collaboration. We would claim that an initial level of absorptive capacity is necessary for such relationship building. Later, mutual trust developed through reciprocity between the firms and the OEM buyers for a period of time. That mutual trust gradually transformed into the initiative for long-term relationship building. However, given the importance of trust in maintaining an OEM relationship between high-tech firms in Taiwan and the world’s leading companies, it is generally neglected in the literature. This may be due to the fact that the literature in the past very often aimed to search for commonalities across countries in a large region, e.g., East Asia, and has a higher level of analysis e.g., [19-21,46]. Country-specific characteristics are thus ruled out.

From the governance structure point of view, this move is also a move toward a hierarchy end of the ‘market-hierarchy’ spectrum [47-49]. Under such a cooperative framework, knowledge transfer was found to be intensified. This does provide supportive evidence for the arguments proposed by earlier researchers e.g., [23,50] that a governance structure closer to the hierarchy end of the ‘market-hierarchy’ continuum better supports inter-firm knowledge transfer than any other alternative type. Further, a range of researchers proposed that firms build up networks to exchange information so that uncertainty can be reduced [51-53] also e.g., [54-56]. They claimed Williamson’s transaction cost theory to be limited in its explanatory power. Here, we propose that mutual trust could serve as the driving momentum for maintaining inter-firm relationships. Our findings seem to contribute to the theory on inter-firm networking.

4.4 Outcomes of the transfer of knowledge

Based on our findings above, we developed an intuition that variety and quantity of knowledge acquired would gradually transform into firm effectiveness.

Based on the findings here, we obtained indications as to the fact that variety and quantity of knowledge exchanged brings innovativeness. The innovativeness results in effectiveness, e.g., profitability or growth. The six firms’ growth has been knowledge-based.

5 Propositions and Implications

Thus, speaking overall, the three major themes, which evolved from our data analysis, can be proposed here. They are highly dependent on the contexts chosen for this study, and are associated with each other. The first one regards the self-reinforcing iteration between absorptive capacity and knowledge transfer. The second regards the phases of learning supported by the variety and the quantity of knowledge transferred. The third regards the fact that the development of mutual trust maintained an OEM relationship and further intensified knowledge transfer. A conceptual representation of the association of the three themes can be seen in Figure 2.

5.1 Practical implications

Based on our findings three propositions can be suggested. Proposition 1: In OEM contracts, there is an immediate implication with the development of absorptive capacity. Proposition 2: In OEM contracts, the development of absorptive capacity is affected by the phases of learning. Proposition 3: In OEM contracts, the absorptive capacity of the OEM buyer will be positively transferred.

An immediate implication with Proposition 1 is that OEM companies should control until its collaboration becomes willing to cooperate. When an OEM type of business is involved, they would have to be inspired by the strategy of 'place, they would have to be for themselves a certain level across which OEM relations exchange rationale. We did firm’s absorptive capacity.
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Figure 2 A conceptual representation of the association of the three emerging themes

OEM Relationships in High-Tech Industries
as a General Context

Absorptive capacity

Mutual trust

Three-Phases learning

1st Phase

High

Low

2nd Phase

High

Low

3rd Phase

* The slope does not represent the reality.

Based on our findings three propositions are offered for further investigation in order to build a model of technological learning in Taiwan.

Proposition 1: In OEM contexts, knowledge transfer will be positively associated with the development of absorptive capacity.

Proposition 2: In OEM contexts, firm learning would be transformed from simple to complex learning as the diversity and the quantity of knowledge transferred increased.

Proposition 3: In OEM contexts, development of mutual trust between a firm and an OEM buyer will be positively associated with the diversity and the quantity of knowledge transferred.

5.1 Practical implications

An immediate implication which results from our study would be, for firms which are inspired by the strategy of 'growth by OEM', under which knowledge transfer takes place, they would have to be competent learners. That is to say, the firms should create for themselves a certain level of absorptive capacity so that they could reach a threshold across which OEM relationships with foreign competitors could be formed under the exchange rationale. We did have supportive evidence for such an effort in creating a firm's absorptive capacity. For example, Apex did put emphasis on issues of quality control until its collaboration with IBM. It had to re-shape its shared values so that IBM became willing to cooperate with Apex.

When an OEM type of structure is initiated for knowledge transfer, based on our findings here, the effectiveness of the firms could become knowledge-based.
Secondary implications could be that, for example, adequate sources of knowledge, e.g., the leading counterparts in the world, should be carefully selected and built up for the firm to acquire the knowledge needed to support the innovative behaviours. Further, through time, the firm should seek to obtain trust from its OEM buyers so that the variety and the quantity of knowledge transferred may increase for it to enter a different phase of learning.

5.2 Implications for future research

Several points for further research would result from our research limitations. Firstly, we are aware that the limited number of the subject firms studied may preclude any ‘safe’ extrapolation of the findings with confidence to other firms in differing industries. Generally speaking, future studies would be needed in order to support the findings here.

Secondly, in our study an entry level was explored of establishing an OEM relationship with leading companies in the world. We also explored an important factor, i.e., trust, which helped maintain that relationship. What we have not explored is how our subject firms might be able to follow their western counterparts in the respect of R&D so that an own-brand can be created worldwide. Having said this, we bear in mind that two of the firms, Speed and Inte-IC, did not have this intention at all. Is it necessary that the high-tech firms in Taiwan aim to create their own brands to market in the world? Our intuition would be that developing own-brand products for selling in the world market may turn the knowledge source into the competitor. Substantial marketing expenses will need to be invested. If not, how would the firms maintain their competitive advantage in OEM so that, for example, newly emerging countries in East Asia [20] would not thrive to be major competitors in the future? Or will there be strategies which help avert the dilemma of losing external knowledge sources while creating own-brand goods? These questions need further investigation.

Thirdly, in our study we have not provided accounts of how the knowledge transferred was transformed into sources of firm innovations. In the future, this route of enquiry may be important. Specifically, the future study could focus on whether a certain type of knowledge transferred, e.g., knowledge on production, is associated with a corresponding type of innovation, e.g., product innovations. Or another interesting question may be under what context will a certain type of knowledge transferred (e.g., production-related) trigger the transfer of other types of knowledge, e.g., human resource management or corporate re-structuring. This route of enquiry may help us gain a better view on the effect of knowledge transfer.

Alternatively, the notion of absorptive capacity may require further examination. Is it measurable? Can a comprehensive measure of it be developed for universal implementation? A measurement of absorptive capacity may help us identify the threshold across which a specific type of governance structure, e.g., OEM or strategic alliance, can be established for the purpose of knowledge transfer.

Finally, it has been found in this study that an inter-firm relationship which moves toward the hierarchy end of the ‘market-hierarchy’ continuum would help knowledge transfer. However, would such moves ever reach the hierarchy end? If so, the patterns of knowledge transfer under that structure can be studied. If not, then obstacles which impede such moves may also be worth studying. Study in this respect may help firms overcome impediments in their endeavours in building a governance structure which facilitates inter-firm learning.
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References and Notes

22 Moreover, in the winter special issue of Strategic Management Journal, 1996, different sources of knowledge have been explored. These include knowledge sourcing through strategic alliances [23], and foreign multinationals [24]. OEM relationships, however, were not included.


36 This process reminds the authors here of notions of bounded rationality discussed in the literature of decision-making e.g., [37-39].


40 Indeed, the decision to learn may not seem to be pre-planned. Rather, it seemed to be emerging through time e.g., [41-43]. During the collaboration with OEM buyers, the firm may gradually see the value of learning from these buyers, and start to increase the interaction with them, as can be seen in the case of Apex. However, the ability to appreciate the value of learning comes also from a firm’s absorptive capacity [25].


Towards a knowledge-based view of OEM relationship building