Vendor-customer relationship for product design — An exploratory study of Indian automotive industry

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Study focuses on the partnership between Indian automotive vendors and vehicle manufacturers for product design activity. A structured questionnaire was developed to collect unit level data. Questionnaire included closed ended questions and the responses were taken on a 5-point scale. Responses (84) were collected from vendor organizations (40). Vendors were clustered into different categories for bringing out their characteristics. The level of involvement of vendors in the product design activity for their customers was investigated. A very low involvement of vendors was observed for this activity and there is a lot of variation with respect to this activity for different Clusters.

Keywords: Customer company, Donor company, FDI, Less developed countries (LDCs), Multinational companies (MNCs), Small and medium enterprises (SMEs), Technology acquisition, Technology adaptation, Vendors

Introduction

For automobile makers world over, trend is to push more and more responsibility into vendor’s plate, with top quality parts reaching the assembly line, just in time and automobile maker almost restricting himself to the role of endorsement by brand. The concept today is for Tier I suppliers to be involved designing complex subassemblies (dashboards, rear axles, seats etc.). Absence of Tier-I sector in India prompted new vehicle manufacturers to bring in their own Tier-I suppliers to set subsidiaries. Since then big vendors (Delphi of General Motors, Visteon of Ford, Denso of Toyota etc.) have set up their base in India. It has, therefore, become imperative for the responding companies achieved significant improvement in project results when vendors participated, compared to similar new product development projects in which vendors were not involved. An empirical study3 probed the adoption of early vendor involvement (ESI) in the product development process. The results reveal that the level of ESI practice is strongly related to higher number of vendor based initiatives, lower product integration, broader vendor scope and a higher proportion of parts purchased.

Bates & Twigg4, while assessing the role of the vendor as a source of component design expertise, identified pertinent issues, which should be considered by both vehicle manufacturers and component vendors, and discuss the potential for knowledge vacuums to be created as a result of injudicious and hasty adoption of outsourcing policies. An important opportunity exists to pro-actively integrate vendors at an early stage in the concept exploration and definition stages of product development5.

In this paper, an attempt has been made to assess the capabilities of Indian automotive vendors and their involvement in the product design for their customer. Characteristics of different clusters of vendors have been brought out using hierarchical
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cluster analysis. Variables related with characteristics of vendors, Donor Company’s attitude and Customer Company’s role have been used as input for the clustering purpose. Four different valid clusters, which are based upon characteristics and type of tie up, have been synthesized.

Materials and Methods

A questionnaire, which included questions related with capabilities of the organizations for adapting technology, involvement of vendors in product design for the customer and customer support to vendors, was developed. Questionnaire was administered through 84 respondents from 44 vendor organizations (Annexure I). Length of experience of the respondents was 16.8 years. Likert five-point scale (very high, high, medium, low and very low) was used for analysis. Data collected was quantified using suitable scale (Table 1). Respondents and affiliated organizations were grouped as hierarchical cluster analysis. Common characteristics of the different clusters of vendors were worked out by analyzing average values of different variables for different clusters. Quantified data collected through questionnaire was further used as input for cluster analysis. Euclidean (straight line) distance and single linkage method has been used in present analysis. Clusters were identified step by step and joined together to arrive at final partition (Table 2).

Results and Discussion

On analyzing the clusters, it was found that in the first Cluster, 33 out of 37 respondents belonged to joint venture type, which acquired technology by partnering with other organizations through equity participation. In second Cluster, 21 out of 24 respondents belonged to the vendor organizations, which acquired technology mostly through license arrangements (technical assistance agreements). These organizations are forward looking and have medium level of technological capabilities. Third Cluster of respondents also belonged to the organizations, which have acquired technology through license arrangements merely to satisfy the condition laid down by the customer company. Fourth Cluster of respondents belonged mostly to joint venture type or FDI type (Foreign Direct Investment, 100% ownership) and is manufacturing proprietary components (spark plugs, tyres, air-conditioners, oil filters etc). These organizations are very much similar to the organizations of first Cluster with the difference that they have higher capabilities for designing components of their own and they involve themselves in designing products for the vehicle manufacturers.

Euclidean distance between Clusters 1 and 4 is 1.48, whereas distance between Clusters 2 and 3 is 1.25 (Table 3). Therefore, Clusters 2 and 3 are very much similar, whereas Clusters 1 and 4 also close to each other. Clusters 2 and 3 are similar because the organizations in both these Clusters are small/medium scale and have acquired technology through license arrangements merely to satisfy the condition laid down by the customer company. Fourth Cluster of respondents belonged mostly to joint venture type or FDI type (Foreign Direct Investment, 100% ownership) and is manufacturing proprietary components (spark plugs, tyres, air-conditioners, oil filters etc). These organizations are very much similar to the organizations of first Cluster with the difference that they have higher capabilities for designing components of their own and they involve themselves in designing products for the vehicle manufacturers.

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Following variables have low or very low mean values for the vendors as mentioned against each variable for Clusters 2 and 3 respectively: i) Capability for adaptation in product technology as per requirements of customer, 0.3, 0.11; ii) Involvement by customer in new product design, 0.14, 0.13; iii) Capability of R&D department for innovating product technology, 0.20, 0.24; and Level of involvement in

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Joint venture organizations having world-class technology, OEMs to vehicle manufacturers (Tier I status), have capabilities for manufacturing sub-assemblies.</td>
</tr>
<tr>
<td>2</td>
<td>Technology acquisition mostly through license arrangements. High capability for developing and adapting manufacturing processes but not for designing components.</td>
</tr>
<tr>
<td>3</td>
<td>Acquired technology only to satisfy their customer company. Technology acquisition through license arrangements.</td>
</tr>
<tr>
<td>4</td>
<td>FDI type organizations having world-class technology. Involved in designing components/products for their customers.</td>
</tr>
</tbody>
</table>

Table 1—Description of scale used

<table>
<thead>
<tr>
<th>Scale</th>
<th>Very high</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
<th>Very low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean value</td>
<td>0.9</td>
<td>0.7</td>
<td>0.5</td>
<td>0.3</td>
<td>0.1</td>
</tr>
<tr>
<td>Range</td>
<td>≥ 0.8</td>
<td>0.6  - 0.8</td>
<td>0.4  - 0.6</td>
<td>0.2  - 0.4</td>
<td>≤ 0.2</td>
</tr>
</tbody>
</table>

Table 2—Identification and description of Clusters

<table>
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</tr>
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<tr>
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</table>

Table 3—Distances between clusters

<table>
<thead>
<tr>
<th></th>
<th>Cluster 1</th>
<th>Cluster 2</th>
<th>Cluster 3</th>
<th>Cluster 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster 1</td>
<td>0.00</td>
<td>1.83</td>
<td>2.43</td>
<td>1.48</td>
</tr>
<tr>
<td>Cluster 2</td>
<td>1.83</td>
<td>0.00</td>
<td>1.25</td>
<td>2.27</td>
</tr>
<tr>
<td>Cluster 3</td>
<td>2.43</td>
<td>1.25</td>
<td>0.00</td>
<td>2.73</td>
</tr>
<tr>
<td>Cluster 4</td>
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<td>2.27</td>
<td>2.73</td>
<td>0.00</td>
</tr>
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designing components for customer company, 0.21, 0.20. Low values of the variables indicate major weakness of organizations belonging to Clusters 2 and 3 for having lower product design capabilities and hence their involvement in designing and developing components for Customer Company is also low.

Organizations belonging to Clusters 1 and 4 have similar characteristics in certain fields as indicated by mean values, respectively, as follows: i) World-class capabilities for developing and adapting process technology, 0.85, 0.80; ii) Active R & D for innovating product/process technology, 0.71, 0.86; and iii) Involvement in product design for customer company, 0.67, 0.83.

**Important Correlations between Variables**

Capability of R&D department for innovating product/process technology has significant correlation with mode of technology acquisition. \((r_{p<0.01}=0.521)\). Strength of R & D departments of the vendors has a very strong positive correlation \((0.521)\) with mode of technology acquisition at 1% level of significance. Organizations with licensing arrangements have weak R & D departments, whereas the organizations with joint ventures have strong base in R & D. In other words, equity participation brings in commitment of the technology providers in the alliance. On the other hand, in case of license agreements, the donor firms provide to-the-point information (know-how only), and that also to a very limited extent.

Following correlations \((r_{p<0.01})\) are significantly related with the mode of technology acquisition: i) Capability for developing and adapting product technology, 0.520; ii) Involvement in design of components for the customer company, 0.509; iii) Extent of acquisition of know-why of technology, 0.323; and iv) Level of gaining technological strength through tie-up, 0.538.

These correlations are significantly related with mode of technology acquisition at 1% level of significance. Most of the vendor organizations, which acquire technology through license arrangements, have lower capabilities for adapting product technologies. Involvement of vendors in design of components for vehicle manufacturers is also significantly related with mode of technology acquisition. Vendors with license agreements have very low capabilities for designing components for the vehicle manufacturers, whereas those with joint ventures or with FDI have high capabilities. Extent of acquisition of know-why of technology is significantly related to mode of technology acquisition. Organizations with license agreements have very low mean value for gaining know-why of technology as compared to joint ventures and FDI type organizations. Level of gaining technological strength through tie-up is also significantly related to mode of technology acquisition. Organizations with license agreements gain low to medium level of technological strength. In fact, organizations of Cluster 2 have medium level of strength as compared to low level for Cluster 3. Organizations of Clusters 1 and 4 (joint ventures and FDI type) have ‘high’ level of technological strength.

**Conclusions**

Only a few vendors are going to retain the Tier-I status in India as the scale of investment is going to be one of the key factors for retaining the same. Traditional Indian small-scale vendors belonging to Clusters 2 and 3 may have to shift to Tier-II status. Extent of involvement of vendors in the new product development and the capabilities of the vendors to adapt and absorb the technology is very low especially for vendors belonging to Clusters 2 and 3. Only a few vendors belonging to Cluster 3 are involved in the product design work and majority of vendors having these capabilities belong to Cluster 4. Hence vendors, especially belonging to Clusters 2 and 3 (with license agreements), need to set up their design center and increase design capabilities so that they have the capabilities for designing the products independently as the customers are going to expect it very much from their Tier-I suppliers.

**Acknowledgements**

Authors are thankful to the organizations that provided data for this empirical research.

**References**

Annexure I—Questionnaire for vendors having technical tie-ups

Please tick the suitable options (Very high, High, Medium, Low, Very low) in the questions below:

1. Do your organization has the capability for making changes/adaptations in product technology as per the requirements of the customer company?
2. Do your organization has the capability for developing process technology for any new component?
3. Whenever your customer company make some changes/alterations in the design of the component, does they consult and involve your organization in the process of redesigning the component?
4. Does the donor company transferred know-why part of the product technology (complete engineering design of the product)?
5. Do you feel that your organization has gained very high technological strength by technology acquisition/tie-up?
6. Please indicate the following capabilities of your organization?
   i) Capabilities of R&D Deptt. for innovating product/process technology.
   ii) Strength of human resources and their commitment to organization
   iii) Innovation culture of the organization
7. Has the engineering design of component (Product technology) been changed/adapted before manufacturing?
   i) Not at all
   ii) In some of the products
   iii) In all the products
   If “YES” then what were the reasons behind changing/adapting the Product Technology?
   i) Local climatic and road conditions
   ii) Raw materials
   iii) To make product cost effective
8. Does your organization involve itself in designing/developing components for the customer company?
   a) YES
   b) NO
   If “YES” then please answer the following
   i) What is the level of your involvement?
   ii) What is the extent of help, which you get from R & D Deptt. of parent organization for this activity?