

CHAPTER 5 - FINDINGS AND ANALYSIS: RESULTS FROM DESCRIPTIVE STATISTICS ON THE STRENGTH OF INTERACTIONS (INTENDED UPGRADING EFFECTS) OF LINKAGE COLLABORATION

5.1 Introduction

This chapter is the first of two that analyze the results from the data collected during interviews with representatives of MNC subsidiaries and local suppliers. In this chapter, the data from descriptive statistics is analyzed according to the distribution of the strength of interaction from the linkage collaboration. Chapter 6 analyzes the results from the data obtained through case studies and inference statistics from both MNC subsidiaries and local suppliers. Discussion of the findings from these two chapters and the recommendations flowing from them are presented in Chapter 7.

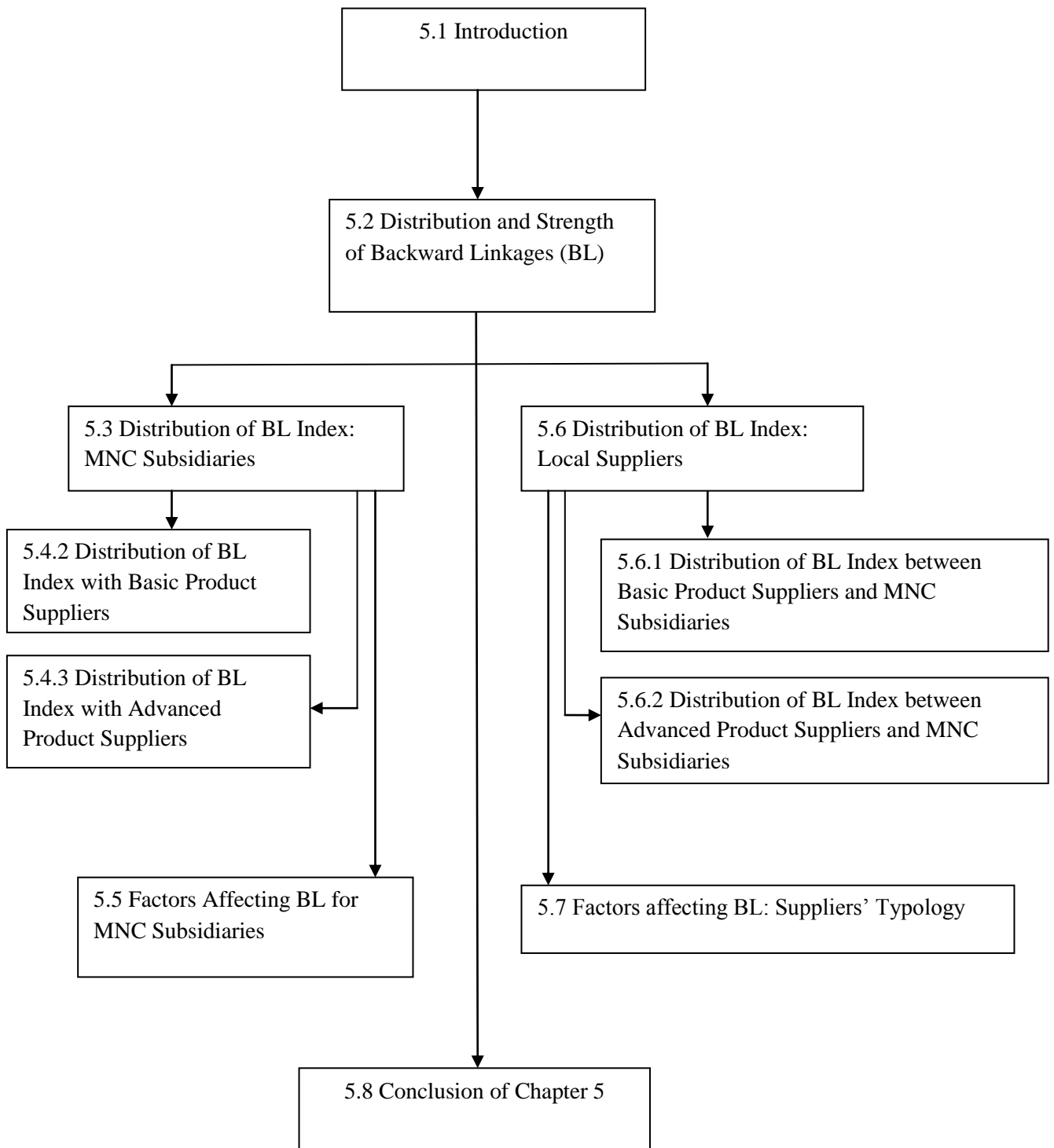
The flow of the study's findings for the descriptive statistics for MNC subsidiaries and local suppliers is given in Figure 5.1.

5.2 Findings on the Distribution and Strength of Backward Linkages

This section describes the backward linkages formed as a result of linkage collaboration between MNC subsidiaries and local suppliers in Malaysia's petrochemical industry. It examines the distribution and strength of the backward linkages in order to assess the influence of MNC subsidiaries in the transfer of technology to local suppliers. To further discussion of the backward linkages, an index (as discussed in Chapter 4) was derived to gauge the strength of linkages formed between MNC subsidiaries and suppliers. In constructing this index, six different categories of backward linkages were used: Product, Process, Innovation, Training, Management and Others. Each of these linkage categories incorporated a subset of categories related to knowledge flows. A

total of 38 potential backward linkages (BL) were used to make up this BL Index (shown in Chapter 2, tables 2.3 to 2.8).

Figure 5.1: Outline of Chapter 5



The BL Index measures the diversity (breadth) and depth of linked activities between MNC subsidiaries and local suppliers. The strength of the interaction between them depends on the diversity of their ties in each category of backward linkages. An index score of 1 implies that the MNC subsidiary provides (or suppliers receive) all the potential linkages listed under the appropriate categories. Nine responses from the MNC subsidiaries and eighteen responses from the local suppliers were used to measure the strength of the interaction and to show the distribution of the strength of the linkages formed in the six categories of backward linkages.

For each of the nine samples of MNC subsidiaries operating in Kertih, Pahang and Pasir Gudang, Johor, respondents were asked to answer questions in regard to the firm's linkage collaboration with basic product suppliers and advanced product suppliers. Their responses were carefully examined in order to verify that the firms did indeed have buyer-supplier relationships with local suppliers in Malaysia. After using the Mann-Whitney test, the result was found to be significant (see Chapter 4 for discussion). There are indeed two sets of local suppliers that are categorized according to the supplier typology discussed in Chapter 2. They are in two categories: 1) basic suppliers, associated with the collaboration specialist and 2) advanced suppliers, associated with the technology specialist of Kaufmann (2000) typology.

5.3 Distribution of Each Category of Backward Linkages Index:

MNC Subsidiaries

This section provides characteristics of the presence of backward linkages formed during the interactions between MNC subsidiaries and local suppliers. Due to the difficulty of obtaining data concerning how long ago the linkages in each category had been made (it takes time to ask respondents for such details, and some did not know when the linkages were forged), a snapshot of the index of backward linkages is used in

analyzing the characteristics of backward linkages in both MNC subsidiaries and local suppliers. Tables 5.1 and 5.2 show the distribution of strength of interactions (the BL Index) between MNC subsidiaries and their basic product suppliers, while tables 5.3 and 5.4 show the distribution of strength of interactions between MNC subsidiaries and their advanced product suppliers. Tables 5.5 and 5.6 show the distribution of strength of interactions between local suppliers (both basic and advanced suppliers) with their MNC subsidiaries.

The results from Table 5.1 to Table 5.6 show that there are interactions between MNC subsidiaries and local suppliers in the petrochemical industry. Previous studies have shown that MNCs engaged in processing natural resources, especially in the petrochemical and mining industries, provide few linkages with SMEs (Battat et al., 1996). In the present study, the relatively small sample of respondents places some limitations on doing inference statistics from the quantitative data gathered. Since little study has been done in regard to the interactions of MNC subsidiaries and local suppliers in the petrochemical industry, and few potential linkages have been discovered between MNCs and local SMEs, this study assumed that a BL Index of more than 0.6 should be considered a strong indication of diversified backward linkages (Iguchi, 2007). Therefore a BL Index of more than 0.6 implies that MNC subsidiaries have been transferring technology and knowledge to the local suppliers, or that local suppliers have been receiving the transfer of technology and knowledge from the subsidiaries.

Table 5.2 shows that the distribution of strength of interactions, or BL Index, between MNC subsidiaries and basic product suppliers is as follows: 44% of MNC subsidiaries have a high BL Index in the Product category, 11% in the Innovation category, 0% in the Process category, 11% in the Training category, 55% in the Others category and

11% in the Management category. Conversely, Table 5.2 also shows that 11% of MNC subsidiaries have no linkages at all in the Product category, 44% have none in the Innovation category, 22% have none in Process, 11% have none in Training, 11% have none in Others and 44% have none in Management. From the results of the distribution of strength of interactions between MNC subsidiaries and basic product suppliers, we can assume that for MNC subsidiaries it is more important to provide basic product suppliers with backward linkages in the Product and Others categories than it is to provide them with linkages in other categories.

Table 5.1: Distribution of Strength of Interactions (BL Index) between MNC Subsidiaries and Basic Product Suppliers (absolute number)

	Product	Innovation	Process	Training	Others	Management
0	1	4	2	1	1	4
$0 < x < 0.2$	1	0	2	1	0	0
$0.2 < x < 0.4$	1	2	2	5	2	0
$0.4 < x < 0.6$	2	2	3	1	1	4
$0.6 < x < 0.8$	1	0	0	1	4	0
$0.8 < x < 1.0$	3	1	0	0	1	1
Total	9	9	9	9	9	9

Table 5.2: Distribution of Strength of Interactions (BL Index) between MNC Subsidiaries and Basic Product Suppliers (%)

	Product	Innovation	Process	Training	Others	Management
0	11%	44%	22%	11%	11%	44%
0 < x < 0.2	11%	0	22%	11%	0	0
0.2 < x < 0.4	11%	22%	22%	55%	22%	0
0.4 < x < 0.6	22%	22%	33%	11%	11%	44%
0.6 < x < 0.8	11%	0	0	11%	44%	0
0.8 < x < 1.0	33%	11%	0	0	11%	11%
Total	100%	100%	100%	100%	100%	100%

Taking a BL Index of more than 0.6 as showing a strong diversified backward linkage, Table 5.4 shows the distribution of strength of interactions (or BL Index) for MNC subsidiaries and advanced product suppliers. The strength of interactions is as follows: 44% of MNC subsidiaries have a high BL Index in the Product category, 11% have a high BL Index in the Innovation category, 11% in the Process category, 22% in the Training category, 55% in the Others category and 22% in the Management category. Conversely, Table 5.4 shows that none of the MNC subsidiaries have any linkages in the Product category, 33% have none in the Innovation category, 33% have none in Process, 11% have none in Training, 11% have none in Others and 44% have none in Management. From the result of the distribution of strength of interactions between MNC subsidiaries and advanced product suppliers, we can assume that for MNC subsidiaries it is more important to provide advanced product suppliers with backward linkages in the Product and Others categories than it is to provide them with linkages in other categories.

Table 5.3: Distribution of Strength of Interactions (BL Index) between MNC Subsidiaries and Advanced Product Suppliers (absolute number)

	Product	Innovation	Process	Training	Others	Management
0	0	3	3	1	1	4
0 < x < 0.2	1	0	1	0	0	0
0.2 < x < 0.4	2	4	2	5	2	0
0.4 < x < 0.6	2	1	2	1	1	3
0.6 < x < 0.8	1	0	1	1	4	1
0.8 < x < 1.0	3	1	0	1	1	1
Total	9	9	9	9	9	9

Table 5.4: Distribution of Strength of Interactions (BL Index) between MNC Subsidiaries and Advanced Product Suppliers (%)

	Product	Innovation	Process	Training	Others	Management
0	0	33%	33%	11%	11%	44%
0 < x < 0.2	11%	0	11%	0	0	0
0.2 < x < 0.4	22%	44%	22%	55%	22%	0
0.4 < x < 0.6	22%	11%	22%	11%	11%	33%
0.6 < x < 0.8	11%	0	11%	11%	44%	11%
0.8 < x < 1.0	33%	11%	0	11%	11%	11%
Total	100%	100%	100%	100%	100%	100%

The distribution of strength of interactions or BL Index by suppliers (both basic product suppliers and advanced product suppliers) with MNC subsidiaries is presented in tables 5.5 and 5.6. Table 5.6 shows the number of suppliers having a BL Index of more than 0.6 as follows: 72.3% (Product), 11.1% (Innovation), 33.4% (Process), 50% (Training), 27.8% (Others) and 11.2% (Management). However, the table also shows that others among these two categories of suppliers have no linkages in the six categories, with details as follows: 11.1% (Product), 38.9% (Innovation), 22.2% (Process), 16.7%

(Training), 5.6% (Others) and 22.2% (Management). From these two tables, we may assume that suppliers believe that they have received more Product-related (72.3%), Process-related (33.4%) and Training-related (50%) linkages than any other categories of linkages.

Table 5.5: Distribution of Strength of Interactions (BL Index) by Suppliers (Basic and Advanced) with their MNC Subsidiaries (absolute number)

	Product	Innovation	Process	Training	Others	Management
0	2	7	4	3	1	4
0 < x < 0.2	0	0	0	0	0	4
0.2 < x < 0.4	0	6	2	2	3	2
0.4 < x < 0.6	3	3	6	4	9	6
0.6 < x < 0.8	3	0	3	4	3	1
0.8 < x < 1.0	10	2	3	5	2	1
Total	18	18	18	18	18	18

Table 5.6: Distribution of Strength of Interactions (BL Index) by Suppliers (Basic and Advanced) with their MNC Subsidiaries (%)

	Product	Innovation	Process	Training	Others	Management
0	11.1%	38.9%	22.2%	16.7%	5.6%	22.2%
0 < x < 0.2	0	0	0	0	0	22.2%
0.2 < x < 0.4	0	33.3%	11.1%	11.1%	16.7%	11.1%
0.4 < x < 0.6	16.7%	16.7%	33.3%	22.2%	50%	33.3%
0.6 < x < 0.8	16.7%	0	16.7%	22.2%	16.7%	5.6%
0.8 < x < 1.0	55.6%	11.1%	16.7%	27.8%	11.1%	5.6%
Total	100%	100%	100%	100%	100%	100%

5.4 Distribution of Backward Linkages Index of Each Category of MNC

Subsidiary

This section provides characteristics of the presence of backward linkages formed in each category of MNC subsidiary and local suppliers. As this study is interested to know the extent of the strength of each category of forms of backward linkage in each MNC subsidiary typology and local supplier typology, the BL Index is first analyzed for each typology. The findings are then used to analyze the set of factors that affect the formation of backward linkages in MNC subsidiaries and local suppliers. The factors affecting the formation of backward linkages in MNC subsidiaries and local suppliers are further discussed in Chapter 6.

Based on the MNC subsidiaries typology presented in Chapter 2, the breakdown of the categorization of the MNC subsidiaries according to ownership structure is as follows: two 100% local-owned firms, three 100% foreign-owned firms and four joint-venture firms. The 100% local-owned firm was formerly a joint venture between Petronas and a foreign firm. The other local-owned firm was also a joint venture until the foreign equity was first diluted and then replaced through a management buyout. Of the 100% foreign-owned firms, one was Japanese, the second, British, and the third, Taiwanese. The joint-venture firms were German-Petronas (60:40 equity), Japanese-German (50:50 equity), Japanese-Petronas (70:30) equity and US-Malaysian (70:30 equity). Five of the firms were located in Gebeng, Pahang while four were in Pasir Gudang, Johor.

The three categorizations of MNCs in this study are based on the assumption in Research Question 1 that the role of subsidiaries in the host country will depend on their mode of entry and their ownership structure. The study aims to compare linkages formed between locally owned producers and their suppliers with those formed between MNCs and their suppliers. It aims to examine whether these linkages with

suppliers vary in accordance with different roles that are in turn determined by the companies' typology. Among the determinants that affect the role of subsidiaries are: 1) *Subsidiary factors*, which include subsidiary typology, autonomy level, sourcing rate, length of operation in the host country and number of employees; 2) *MNC group factors*, including the nationality of the subsidiary, its expatriates index, and the number of expatriates; and 3) *Environmental factors*, which include the location of the firm and its government linkages. These three factors are discussed further in the analysis and discussion chapters.

Based on the categorization of the MNC subsidiaries, tables 5.7 and 5.9 show the backward linkages index of each category of MNC subsidiary. Table 5.7 presents the BL Index of MNC subsidiaries with basic product suppliers, while Table 5.9 presents the BL Index of MNC subsidiaries with advanced product suppliers.

5.4.1 BL Index of Each Category of MNC Subsidiaries with Basic Product Suppliers

Again taking a BL Index of more than 0.6 as showing a strong diversified backward linkage, Table 5.7 shows that there are more linkages between the wholly local-owned firms LOP and LOM and basic product suppliers, but they are different in kind. In the case of LOM, the BL Index values are: Product (0.83), Innovation (0.40), Process (0.20), Training (0.20), Others (0.60) and Management (0.43). For LOP, the values are: Product (0.83), Innovation (0.80), Process (0.50), Training (0.60), Others (0.80) and Management (0.86). With LOM, the BL Index values that show strong diversification are in Product (0.83) and Others (0.60). In contrast, with LOP the BL Index values are higher for Product (0.83), Innovation (0.80), Training (0.60), Others (0.80) and Management (0.86). However, the BL Index value for Process is low (0.5). This shows that LOP, which is a subsidiary of Petronas, provides basic product

suppliers with more linkages in Product, Innovation, Training, Others and Management than does LOM.

Compared to the BL Index values of the wholly local-owned firms, the strength of the backward linkages of the wholly foreign-owned firms FOJ, FOB and FOT is very weak in every category. For FOJ, the BL Index values are: Product (0.00), Innovation (0.00), Process (0.10), Training (0.20), Others (0.20) and Management (0.00). None of the BL Index values for FOJ show any signs of strength or diversification. In the case of FOT, the only signs of some backward linkages are in Product (0.17) and Innovation (0.20). For the other categories, the values are nil.

For FOB, on the other hand, the BL Index values are: Product (0.83), Innovation (0.00), Process (0.40), Training (1.0), Others (0.6), and Management (0.57). The strength of FOB's BL Index values shows that, in contrast to FOJ and FOT, the firm provides local suppliers with linkages in Product, Training, Others and Management. (Since no linkage was formed in some categories, the value of 0.57 is considered a diversified backward linkage).

In terms of the embeddedness and global outlook of the wholly foreign-owned firms, FOB has been operating in Malaysia since 1994 and its main customers are domestic, with more than 60% of its output being destined for the local market. FOJ, on the other hand, was established in 1997 and exports more than 83% of its output. FOT was established in 1998 and also exports most of its output.

As for the joint-venture firms JVGP, JVJG, JVJP and JVAM, Table 5.7 shows some trends among them in regard to the BL Index. JVGP and JVAM show a higher strength in the BL Index compared to the other two companies; and, in sharp contrast to all three of the other joint ventures, JVAM shows more strength in at least three categories of its

backward linkages: Product (0.67), Others (0.60) and Management (0.57). JVGP is strong in two BL Index categories, Others (0.6) and Management (0.57).

JVJG and JVJP show no diversified strength in backward linkages. For JVJG, the BL Index values are: Product (0.50), Innovation (0.20), Process (0.10), Training (0.20), Others (0.40) and Management (0.00). For JVJP, the BL Index values are: Product (0.50), Innovation (0.00), Process (0.00), Training (0.20), Others (0.20) and Management (0.00). That is, these two firms – both of them Japanese joint ventures, respectively with a German firm and Petronas – have forged few linkages with local suppliers.

Table 5.8 shows a breakdown of the categories that have significant backward linkages between MNC subsidiaries and basic product suppliers. The table clearly shows there are more linkages in each category of BL in the LOP category of MNC subsidiaries, followed by FOB.

Table 5.7: Distribution of Backward Linkages Index of Each Category of MNC Subsidiary with Basic Product Supplier

MNC Sign	Firm Type	Firm Nationality	Product	Innovation	Process	Training	Others	Management
LOP	1	Malaysia Petronas	0.83	0.80	0.50	0.60	0.80	0.86
LOM	1	Malaysian	0.83	0.40	0.20	0.20	0.60	0.43
Average BL Index			0.83	0.60	0.35	0.4	0.7	0.65
FOJ	2	Japanese	0.00	0.00	0.10	0.20	0.20	0.00
FOB	2	British	0.83	0.00	0.40	1.00	0.60	0.57
FOT	2	Taiwanese	0.17	0.20	0.00	0.00	0.00	0.00
Average BL Index			0.33	0.07	0.17	0.4	0.27	0.20
JVGP	3	German- Malaysia Petronas	0.33	0.00	0.20	0.40	0.60	0.57
JVJG	3	Japanese- German	0.50	0.20	0.10	0.20	0.40	0.00
JVJP	3	Japanese- Malaysia Petronas	0.50	0.00	0.00	0.20	0.20	0.00
JVAM	3	US- Malaysia	0.67	0.40	0.50	0.20	0.60	0.57
Average BL Index			0.5	0.15	0.20	0.25	0.45	0.30

1: 100% Local-owned MNC

2: 100% Foreign-owned MNC

3: Joint-venture MNC

Table 5.8: Breakdown of BL Categories with Significant BL between MNC Subsidiaries and Basic Product Suppliers

MNC Sign	Firm Nationality	Product	Innovation	Process	Training	Others	Management
LOP	Malaysia Petronas	X	X		X	X	X
LOM	Malaysian	X				X	
FOJ	Japanese						
FOB	British	X			X	X	X
FOT	Taiwanese						
JVGP	German-Malaysia Petronas					X	X
JVJG	Japanese-German						
JVJP	Japanese-Malaysia Petronas						
JVAM	US-Malaysia	X				X	X

5.4.2 Distribution of BL Index of Each Category of MNC Subsidiaries with Advanced Product Suppliers

The findings for each category of MNC concerning backward linkages with advanced suppliers are similar to the findings for their backward linkages with basic suppliers, but with some notable differences. Once again taking a BL Index of more than 0.6 as showing a strong diversified backward linkage, Table 5.9 shows that more backward linkages were established between the wholly local-owned firms, LOP and LOM, and advanced product suppliers. But these two firms differ in terms of the extent or strength of linkages they formed. In the case of LOM, the BL Index values are: Product (0.83), Innovation (0.40), Process (0.20), Training (0.20), Others (0.60) and Management (0.43). The BL Index values for LOM that show strong diversification are in Product (0.83) and Others (0.60). In contrast, the BL Index values for LOP are higher in Product (0.83), Innovation (0.80), Process (0.70), Training (0.60), Others (0.80) and Management (0.86). However, LOP's BL Index value for Process (0.70) is

higher than its BL Index value with basic product suppliers (0.50). This shows that LOP, a subsidiary of Petronas, provides advanced product local suppliers with more linkages in Product, Innovation, Process, Training, Others and Management than does LOM. The finding confirms that MNC subsidiaries are more willing to transfer knowledge to suppliers in advanced knowledge categories, in this case engineering (Ivarsson and Alvstam, 2009).

Compared to the BL Index values of the wholly local-owned firms, the strength of the backward linkages of the wholly foreign-owned firms FOJ, FOB and FOT is very weak in every category. However, there are some differences when these values are compared to the basic product suppliers. For FOJ, the BL Index value with the advanced product suppliers are: Product (0.17), Innovation (0.00), Process (0.10), Training (0.20), Others (0.20) and Management (0.00). None of the BL Index values for FOJ show any sign of strong diversification, but the product category value is higher compared to the BL Index value with the basic product suppliers. In the case of FOT, the only sign of some backward linkages is in Product (0.33) and Innovation (0.20), where Product registers a higher value of 0.33. For the other categories, the BL Index values are nil.

For FOB, the BL Index values are: Product (0.83), Innovation (0.20), Process (0.40), Training (1.0), Others (0.6), and Management (0.71). The BL Index values show an increase when compared with the basic product suppliers: Innovations registers an increase of 0.2, and Management, an increase from 0.57 to 0.71. The strength of FOB's BL Index values shows that, in contrast to FOJ and FOT, the firm provides Product, Training, Others and Management linkages to local suppliers. (Since no linkage was formed in some categories, the value of 0.57 is considered a diversified backward linkage).

In terms of the embeddedness and global outlook of the wholly foreign-owned firms, FOB has been operating in Malaysia since 1994 and its main customers are domestic, with more than 60% of its output being destined for the local market. FOJ, on the other hand, was established in 1997 and exports more than 83% of its output. FOT was established in 1998 and also exports most of its output.

As for the joint-venture firms JVGP, JVJG, JVJP and JVAM, Table 5.9 shows some trends among them in regard to the BL Index. JVGP and JVAM show a higher strength in the BL Index compared to the other two companies; and, in sharp contrast to all three of the other joint ventures, JVAM shows more strength in at least three categories of its backward linkages: Product (0.67), Others (0.60) and Management (0.57). JVGP is strong in two BL Index categories, Others (0.6) and Management (0.57).

JVJG and JVJP show no diversified strength in backward linkages. For JVJG, the BL Index values are: Product (0.50), Innovation (0.20), Process (0.10), Training (0.20), Others (0.40) and Management (0.00). For JVJP, the BL Index values are: Product (0.50), Innovation (0.00), Process (0.00), Training (0.20), Others (0.20) and Management (0.00). That is, these two firms – both of them Japanese joint ventures, respectively with a German firm and Petronas – have forged few linkages with local suppliers.

Table 5.9: Distribution of Backward Linkages Index of Each Category of MNC Subsidiary with Advanced Product Supplier

MNC Sign	Firm Type	Firm Nationality	Product	Innovation	Process	Training	Others	Management
LOP	1	Malaysia Petronas	0.83	0.80	0.70	0.60	0.80	0.86
LOM	1	Malaysian	0.83	0.40	0.20	0.20	0.60	0.43
Average BL Index			0.83	0.60	0.45	0.40	0.70	0.65
FOJ	2	Japanese	0.17	0.00	0.10	0.20	0.20	0.00
FOB	2	British	0.83	0.20	0.40	1.00	0.60	0.71
FOT	2	Taiwanese	0.33	0.20	0.00	0.00	0.00	0.00
Average BL Index			0.44	0.13	0.17	0.40	0.27	0.23
JVGP	3	German-Malaysia Petronas	0.33	0.00	0.00	0.40	0.60	0.57
JVJG	3	Japanese-German	0.50	0.20	0.30	0.20	0.40	0.00
JVJP	3	Japanese-Malaysia Petronas	0.50	0.00	0.00	0.20	0.20	0.00
JVAM	3	US-Malaysian	0.67	0.20	0.50	0.20	0.60	0.57
Average BL Index			0.50	0.10	0.20	0.25	0.45	0.28

1: 100% Local-owned MNC

2: 100% Foreign-owned MNC

3 – Joint-venture MNC

Table 5.10 shows a breakdown of the categories that have significant backward linkages between MNC subsidiaries and advanced product suppliers. The table clearly shows again that LOP has more linkages in every category of BL, followed by FOB. In the case of LOP there are linkages in every category of backward linkages, including Process. Thus for the advanced product suppliers, LOP even gives Process linkages, though it does not with the basic product suppliers. This shows that Petronas is willing to give process linkages to advanced product suppliers, so that the suppliers can increase their building of technological capabilities.

Table 5.10: Breakdown of BL Categories with Significant BL between MNC Subsidiaries and Advanced Product Suppliers

MNC Sign	Firm Nationality	Product	Innovation	Process	Training	Others	Management
LOP	Malaysia Petronas	X	X	X	X	X	X
LOM	Malaysia	X				X	
FOJ	Japan						
FOB	United Kingdom	X			X	X	X
FOT	Taiwan						
JVGP	German-Malaysia Petronas					X	X
JVJG	Japanese-German						
JVJP	Japan-Malaysia Petronas						
JVAM	US-Malaysian	X				X	X

5.4.3 Summary of Significant BL between MNC Subsidiaries with Basic and Advanced Product Suppliers

Tables 5.8 and 5.10 show that LOP provides diversified linkages in every category of backward linkages except for one with basic product suppliers, namely Process (assuming a BL Index of more than 0.6 shows a diversified backward linkage). LOP is followed by FOB in both basic and advanced product suppliers, with diversified linkages in at least four categories: Product, Training, Others and Management. FOB is followed by JVAM in both basic and advanced product suppliers, with diversified linkages in three categories: Product, Others and Management. LOM shows diversified linkages in Product and Others in both basic and advanced product suppliers, while JVGP shows diversified linkages in Others and Management.

In the category of type of linkages provided by MNC subsidiaries, Table 5.8 and Table 5.10 show that the Others category is given more often. Five categories of MNC gave this type of linkage to both basic suppliers and advanced suppliers. This was followed by Product and Management (four subsidiaries gave each of these linkages), Training (two subsidiaries gave this linkage) and one each of Innovation and Process. The Innovation and Process linkages were from LOP. However, LOP only gives diversified linkages in the Process category for advanced product suppliers, not for basic product suppliers.

5.5 Factors Affecting Backward Linkages: Provided by Different Subsidiary

Typology

As described in Chapter 2, different MNCs have different motivations for investing in foreign countries, and they develop their strategies based on these motivations. To analyze the extent of backward linkages developed as a result of linkage collaboration between MNC subsidiaries and local suppliers, this section uses the strength of the backward linkages formed (the BL Index) as a proxy for their interaction. It describes how different modes of entry on the part of the subsidiaries correspond to their engagement to varying extents in backward linkages with different types of local suppliers. The first step in the analysis is to examine the strategies of the various MNCs. Two aspects of each company's strategy are used to discuss the extent of the interaction: 1) FDI motives and 2) the autonomy of MNC subsidiaries.

In this study, the extent of an MNC subsidiary's exports is used to measure its FDI motives, while its autonomy level is measured from the answers given to a question asked during the interview survey: "Does the parent company allow your subsidiary to decide the following? a) launching new products; b) adopting new processes; c) deciding which parts are to be outsourced; d) changing relationships with local

companies; e) choosing suppliers; f) spending for local suppliers' staff training?" The variable has a value of 1 = not at all; 2 = allowed; and 3 = positively. Table 5.11 was constructed from these two dependent variables.

Even though the number of respondents was small, the trend shows that the average autonomy level is i) low for a foreign-owned firm (1.67), ii) high for a local-owned firm (3.0), and iii) in-between for a joint venture (2.67). The same applies with the FDI motive, where the volume of exports is assumed to be high for the foreign-owned (61%), low for local-owned (30%), and in-between for joint ventures (57.5%).

Table 5.11: Level of Autonomy

MNC Sign	Firm Nationality	% of Exports	Average % of Exports	Level of Autonomy	Average level of Autonomy
LOP	Malaysia- Petronas	MITCO	30	3.00	3.00
LOM	Malaysian	30		3.00	
FOJ	Japanese	83	61	1.50	1.67
FOB	British	40		2.50	
FOT	Taiwanese	60		1.00	
JVGP	German-Malaysia (Petronas)	80	57.5	3.00	2.67
JVJG	Japanese-German	100		2.17	
JVJP	Japan-M'sia Petronas	20		2.50	
JVAM	US-Malaysian	30		3.00	

Tables 5.12 and 5.13 show the average value of the BL Index for different types of MNC subsidiaries engaging in different forms of backward linkages with basic and advanced product suppliers respectively. (Advanced product suppliers show marked interactions or greater linkages as compared to basic product suppliers). The two tables show that local-owned firms engage in the greatest depth of backward linkages, followed by joint-venture and then foreign-owned firms. Assuming that a BL Index of more than 0.6 should be considered as a strong showing of diversified backward

linkages, for local-owned producer firms with basic and advanced product suppliers the strong linkage categories are Product, Innovation, Others and Management. The joint-venture and foreign-owned firms show no significant diversified backward linkages. However, the results show that joint-venture firms have relatively broader linkages than wholly foreign-owned subsidiaries in their interactions with both basic product suppliers and advanced product suppliers.

This result shows that, as Lundvall (1988) argued they would, both MNC subsidiaries and local suppliers are benefiting from learning by interacting. From these data we can generalize that wholly local-owned firms provide stronger backward linkages than joint ventures, which in turn provide stronger backward linkages than wholly foreign-owned MNC subsidiaries.

Table 5.12: Average Value of BL Index Provided by Subsidiary Typology with Basic Product Suppliers

Typology	Product	Innovation	Process	Training	Others	Management
Local-owned	0.83	0.60	0.35	0.4	0.7	0.65
Joint Venture	0.5	0.15	0.20	0.25	0.45	0.30
Foreign-owned	0.33	0.07	0.17	0.4	0.27	0.20

Table 5.13: Average Value of BL Index Provided by Subsidiary Typology with Advanced Product Suppliers

Typology	Product	Innovation	Process	Training	Others	Management
Local-owned	0.83	0.60	0.45	0.40	0.70	0.65
Joint-Venture	0.50	0.10	0.20	0.25	0.45	0.28
Foreign-owned	0.44	0.13	0.17	0.40	0.27	0.23

5.6 Distribution of Backward Linkages Index of Each Category of Local Suppliers

Eighteen responses altogether were obtained from the sample of local suppliers. They were carefully examined in order to verify that the suppliers did indeed have buyer-supplier relationships with MNC subsidiaries in Malaysia. After using the Mann-Whitney test, the local suppliers were categorized according to the supplier typology as discussed in Chapter 2. The sample was divided into two categories: 1) basic suppliers and 2) advanced suppliers. There were seven suppliers in the basic category, and eleven in the advanced. Of the eighteen, eleven firms were located in the Klang Valley (in the State of Selangor and in Kuala Lumpur), six were located on the East Coast of Peninsular Malaysia and one was in Johor. Of the basic product suppliers, two firms were located on the East Coast and five were in the Klang Valley, while four of the advanced product suppliers were located on the East Coast, six were in the Klang Valley and one was in Johor.

The two categorizations of local suppliers used in this study are based on the typology of Kaufmann (2000). Being at the receiving end of technology transfer, the suppliers have to depend on the strategy of the MNC subsidiaries. Thus the different roles

played by subsidiaries in accordance with their typology will have different effects in terms of their linkages with the suppliers. Among the determinants that affect the technological capabilities of local suppliers are: 1) backward linkage factors; 2) internal suppliers' factors; and 3) environmental factors. The third of these factors is not discussed here as it is beyond the scope of the study.

Table 5.14 shows the backward linkages index of each category of local supplier. Once again taking a BL Index of more than 0.6 as showing a strong diversified backward linkage, the table shows a stark difference in the strength of backward linkages formed between MNC subsidiaries and basic product suppliers and those formed with advanced product suppliers. If we look at the average BL Index value in each category of backward linkages for both basic product suppliers and advanced product suppliers, none of the basic product suppliers shows any diversified backward linkages, compared to two categories for advanced product suppliers, namely Product (0.77) and Training (0.60), with Process registering 0.55.

Table 5.14: Distribution of BL Index of Each Category of Local Supplier

For Technological Level/main area of business

LS Sign	Tech Level	Product	Innovation	Process	Training	Others	Management
SA1	1	0.83	0.20	0.60	0.80	0.60	0.57
SA2	1	0.00	0.00	0.00	0.00	0.20	0.00
SA3	1	0.50	0.00	0.50	0.00	0.40	0.00
SA4	1	0.83	0.40	0.00	0.20	0.00	0.00
SA5	1	0.50	0.00	0.00	0.00	0.20	0.00
SA6	1	0.83	0.20	0.50	0.80	0.60	0.14
SA7	1	0.00	0.00	0.00	0.20	0.40	0.14
Average BL Index for basic suppliers		0.50	0.11	0.23	0.30	0.34	0.12
SB1	2	0.83	0.40	0.90	0.40	0.60	0.43
SB2	2	0.83	0.20	0.50	0.60	0.40	0.57
SB3	2	0.83	0.20	0.50	0.80	0.40	0.86
SB4	2	0.50	0.00	0.20	0.40	0.20	0.71
SB5	2	0.83	0.20	0.80	0.80	0.40	0.29
SB6	2	0.83	0.40	0.50	0.60	0.40	0.57
SB7	2	0.67	1.00	0.60	1.00	0.80	0.57
SB8	2	0.67	0.20	0.60	0.60	0.40	0.14
SB9	2	0.83	0.80	0.30	0.40	0.40	0.14
SB10	2	0.67	0.00	0.80	0.60	0.40	0.43
SB11	2	1.00	0.00	0.40	0.40	0.80	0.29
Average BL Index for advanced suppliers		0.77	0.31	0.55	0.6	0.47	0.45

Technological Level

1 - Basic Items Suppliers/Contractors: the company supplies basic items/parts such as nuts and bolts that use standardized technologies and meet customer specifications, and delivery services. It may supply many industries.

2 – Advanced Engineering Suppliers/Contractors: the company supplies highly specialized products and services and continuously acquires and evolves new ways to solve process and product problems.

5.6.1 Distribution of BL Index of Each Category of Local Supplier: Basic Product Suppliers

As shown in Table 5.15, of the seven respondents among the basic product suppliers, only three show high-strength diversified backward linkages. They are SA1, SA4 and SA6. In the case of SA1, the BL Index values are: Product (0.83), Innovation (0.20), Process (0.60), Training (0.80), Others (0.60) and Management (0.53). This shows that SA1 receives Product, Process, Training, Others and Management linkages from subsidiaries. SA6 shows the second highest degree of strength in linkages. Its BL Index values are: Product (0.83), Innovation (0.20), Process (0.50), Training (0.80), Others (0.60) and Management (0.14). This shows that SA6 receives high-strength diversified backward linkages in the categories of Product, Training and Others. The third basic product supplier to show a significant amount of linkages is SA4, but it has only one significant diversified backward linkage, with a 0.83 BL Index in the category of Product.

The other four basic product suppliers do not show significant diversified backward linkages. For example, the state-owned SA2 does not register any strength of backward linkages in any of the categories. SA3 only shows some linkages in Product (0.50), Process (0.50) and Others (0.40). In the case of SA5, the only strength of backward linkages is in Product (0.50) and Others (0.20), while with SA7 the strength lies in Training (0.20), Others (0.40) and Management (0.14).

Table 5.15: Distribution of BL Index – Basic Product Suppliers

LS Sign	Tech Level	Product	Innovation	Process	Training	Others	Management
SA1	1	X		X	X	X	X
SA2	1						
SA3	1						
SA4	1	X					
SA5	1						
SA6	1	X			X	X	
SA7	1						

5.6.2 Distribution of BL Index of Each Category of Local Supplier:

Advanced Product Suppliers

If we look at the average BL Index value in each category of backward linkage from Table 5.14, advanced product suppliers receive some significant strength of diversified backward linkages in the categories of Product (0.77), Process (0.55) and Training (0.60). Of the eleven advanced product suppliers' respondents shown in Table 5.16, all except one show high strength of diversified backward linkages in the Product category. In the Training category, all respondents except for four show a high strength of diversified backward linkages, while in the Process category five firms show a high strength of diversified backward linkages. A total of eight firms register strong backward linkages in at least three categories. Of the eleven advanced product suppliers, one supplier, SB7, shows high strength in every category of backward linkages. SB7's BL Index values are: Product (0.67), Innovation (1.00), Process (0.60), Training (1.00), Others (0.80) and Management (0.57). However, one supplier firm, SB4, shows strength in only one category of backward linkages, Management (0.71).

Breaking down the BL Index for firms that register a high strength of BL Index in Product, Process and Training, the firms are SB5, SB7, SB8 and SB10. For SB5, the BL Index values are Product (0.83), Process (0.80), and Training (0.80). SB8 registers Product (0.67), Process (0.60), and Training (0.60), while SB10 has Product (0.67), Process (0.80) and Training (0.60). At the same time, SB1, SB2, SB3 and SB6 show strong linkages in at least three categories. SB1 has high strength in Product (0.83), Process (0.90) and Others (0.60). Three companies register high strength in three categories: SB2 with Product (0.83), Training (0.60) and Management (0.57); SB3 with Product (0.83), Training (0.80) and Management (0.86); and SB6 with Product (0.83), Training (0.60) and Management (0.57). Finally, two firms show strength in at least two categories. SB9 shows strength in Product (0.83) and Innovation (0.80), and SB11 in Product (1.00) and Others (0.80).

Table 5.16: BL Index – Advanced Product Suppliers

LS Sign	Tech Level	Product	Innovation	Process	Training	Others	Management
SB1	2	X		X		X	
SB2	2	X			X		X
SB3	2	X			X		X
SB4	2						X
SB5	2	X		X	X		
SB6	2	X			X		X
SB7	2	X	X	X	X	X	X
SB8	2	X		X	X		
SB9	2	X	X				
SB10	2	X		X	X		
SB11	2	X				X	

5.7 Factors Affecting Backward Linkages: Provided by Suppliers' Typology

From the above BL Index analysis, there is a marked difference in terms of the suppliers' typology: suppliers with different technological levels engage in different strengths and in different categories of backward linkage. Table 5.17 shows the different technological levels of local suppliers that register different strengths of backward linkage.

Table 5.17: Average BL Index According to Suppliers' Technological Level

Supplier Typology	Tech Level	Product	Innovation	Process	Training	Others	Management
Average BL Index for basic suppliers	1	0.50	0.11	0.23	0.30	0.34	0.12
Average BL Index for advanced suppliers	2	0.77	0.31	0.55	0.60	0.47	0.45

Looking at the average BL Index for basic product suppliers, none of the categories shows any diversified backward linkages (taking the value of more than 0.6 as a diversified BL). This shows that the technology requirements are simple and suffice for the firms to concentrate on having their own internal technological capability. Comparing Level 1 suppliers, there is a difference with the advanced product suppliers, which are Level 2 suppliers. From the table, we can see that there is a high intensity of Product linkages (0.77), Process linkages (0.55), and Training linkages (0.60). These linkages show that local suppliers are looking up to MNC subsidiaries for knowledge in Product, Process and in Training. Besides these three linkages, Level 2 suppliers also show stronger linkages in Innovation (0.31), Others (0.47) and Management (0.45) compared to Level 1 basic product suppliers.

5.8 Conclusion

The chapter shows that the interaction between MNC subsidiaries and local suppliers can be measured by using the backward linkages index. Though there are limitations as to the accuracy of the index, it does provide a pattern of linkages observed across different types of MNC subsidiaries and across different technological levels of local suppliers. It is found that local-owned MNCs engage in the greatest depth of backward linkages, followed by joint ventures and foreign-owned firms. The extent of backward linkages is stronger between MNC subsidiaries and advanced product suppliers than it is between MNC subsidiaries and basic product suppliers. This finding is in agreement with the results taken from the data obtained from the suppliers' side. The results from the suppliers' side demonstrate that the strength of backward linkages between basic product suppliers and MNC subsidiaries, compared with that between advanced product suppliers and MNC subsidiaries, is different in each of the backward linkages categories. Advanced product suppliers show a higher strength of backward linkages with MNC subsidiaries than do basic product suppliers.

The reasons for these differences are analyzed further in Chapter 6, where the factors affecting backward linkages provided by different supplier typology and MNC subsidiary typology is analyzed using the theory of MNC strategy as a basis for discussion.

The findings and analysis from this chapter show how "ownership" of MNCs (locals or foreigners) as technology supporters matters for development. This corresponds to the argument by Amsden (1989) that industry which experienced progress and hence spillover knowledge to the local economy was domestic-owned productive organizations, where the government had systematically intervened in the industries' production and market.