

## Chapter 6 - PRIVATE SECTOR R&D ACTIVITIES

### 6.1 Companies with R&D activities

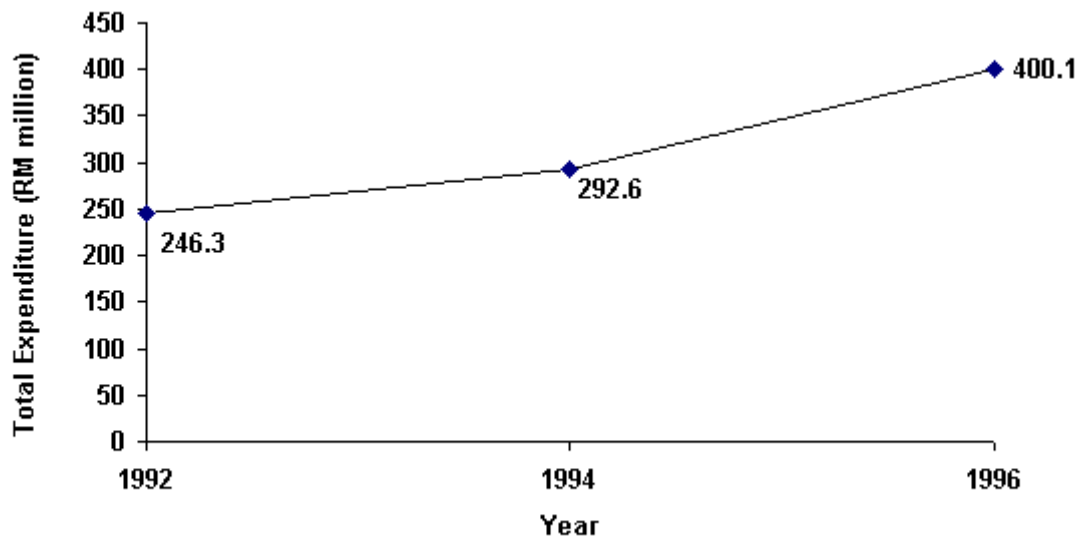
A total of 158 companies reported carrying out R&D activities in 1996. This represents an increase of about 13% from 140 companies since 1994. About 31% of the company belongs to the category with sales revenue of more than RM100 million. It is interesting to note that 24.7% of the companies belong to the company with sales revenue of less than RM10 million. [see Table 6.1].

Most of the companies engaged in high technology companies, namely the electronic equipment companies (12%), rubber and plastics (11%), followed by chemical products (11%). In terms of employment size, the companies were quite evenly spread out. The biggest category, contributing 24.1% of the total, was those employing 75 to 200 workers. Small and medium sized companies (employing 75 workers and less) contribute 20.9% of the total [see Table 6.2].

However, there is no significant relationship between employment sizes and sales revenues (the strength of the relationship, i.e., correlation coefficient, is less than 0.4). This means that having information on employment sizes alone is not enough to predict sales revenues and vice versa.

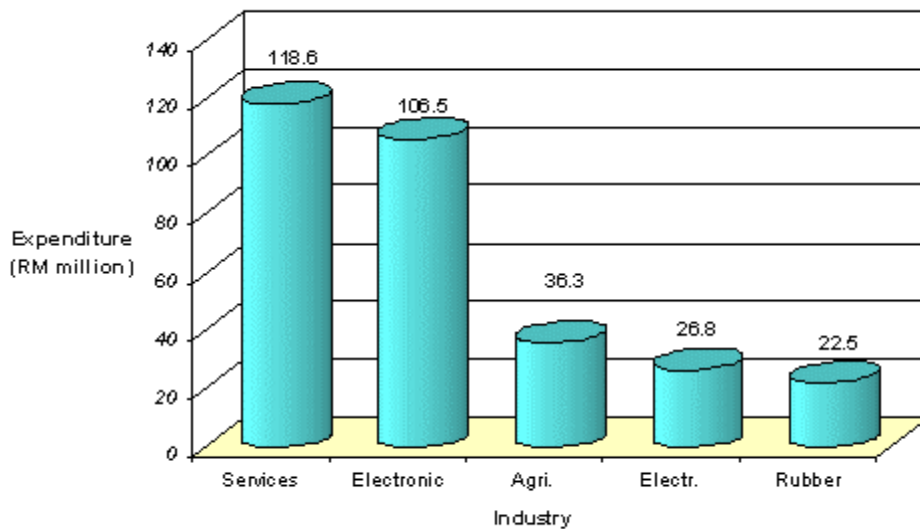
### 6.2 Expenditures on R&D

The private sectors in Malaysia spent a total of RM400.1 million on R&D in 1996 [see Fig. 6.1]. This represents a fairly significant increase of 36.7% from RM292.6 million spent in 1994.



(Source : Table 4.1)  
 Fig. 6.1: Comparison of Total Expenditures in 1992-1996

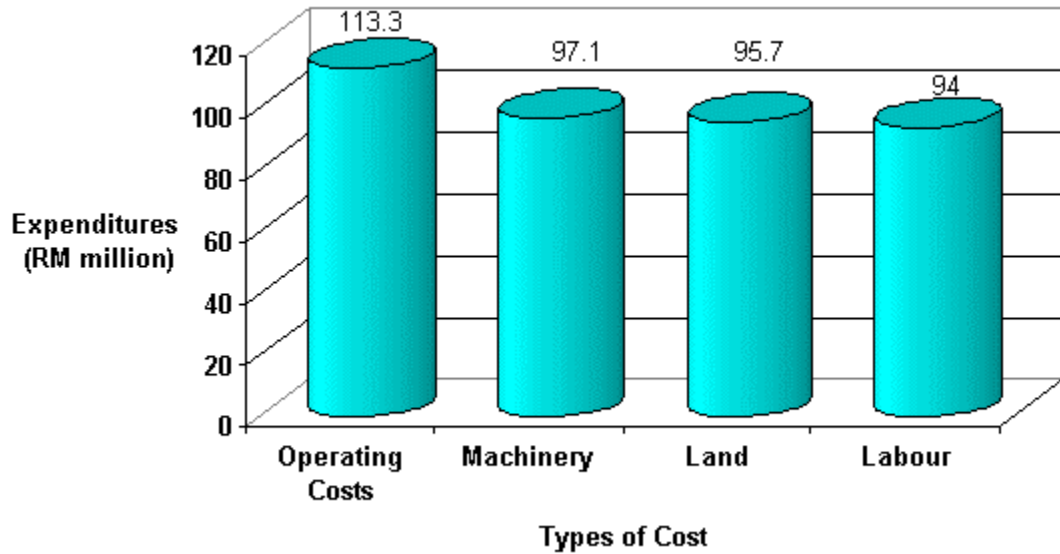
The sectors that spent the most on R&D were service industries. The major share was for research, technical and consultancy services for PETRONAS which contributed almost 96% (RM 113.8 million) of the total expenditure (RM 118.6 million) in these industries [see Fig. 6.2]. They contributed almost 30% of the total private sector R&D expenditure. The second and third biggest industry group spenders were the electronic equipment and agriculture sectors, respectively.



(Source : Table 6.3)  
 Fig.6.2: Total Expenditures for selected industry

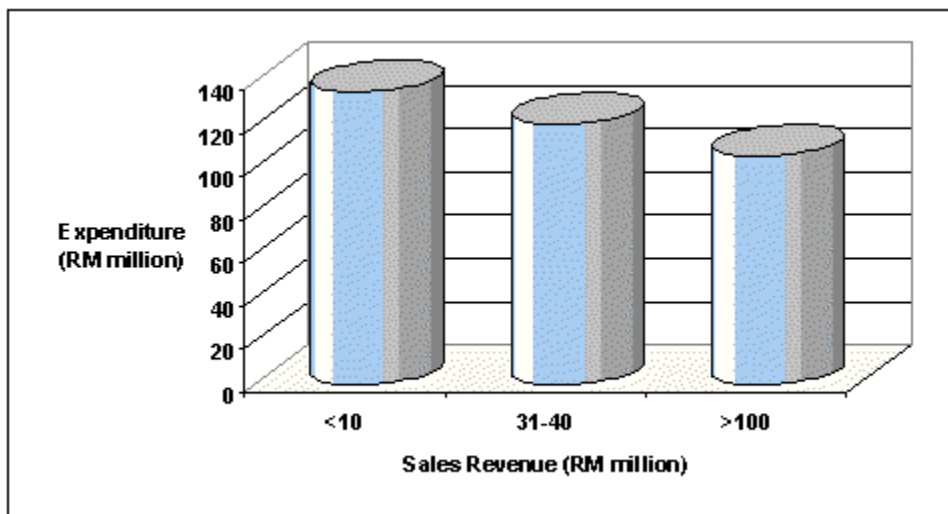
This scenario has changed from that of 1994 where the biggest spenders were from electronic equipment, agricultural products and electrical machinery. By contrast, the largely locally-owned Food and Rubber & Plastic industries (combined) contributed 4% of total R&D spending [see Table 6.4].

Fig. 6.3 shows the distribution of R&D expenditures in 1996. The majority (about 28% of the total expenditure excluding outsourced expenditure which is equivalent to RM113.3 million) of the costs went to operating costs. About RM97.1 million or 25% was spent on machinery and equipment, another RM95.7 million on land and buildings, and the balance (i.e., RM94 million) on labour costs [see Fig. 6.3].



(Source: Table 6.3)  
 Fig. 6.3 : R&D Expenditures by Type of Costs

It is interesting to note that companies with sales revenue below RM10 million spent the most on R&D amounting about RM135.6 million (30% of the total expenditure) followed by companies with sales revenues between RM (31 - 40) million which contributed about RM120.6 million while companies with sale revenues of more than RM100 million spent RM 105.9 million (23%) [see Fig. 6.4].



(Source: Table 6.5)  
 Fig. 6.4 : R&D Expenditure by Sales Revenue

Table 6.6 indicates R&D intensity (R&D Expenditure/Sales) for the industry categories. Thirteen industries recorded R&D expenditure of more than 1% of revenue. The largest was Electronic Equipment and Component Industry. This is followed by Service Industries like Transport, Wholesale Retail and Business Services (33.2%), Telecommunication service industry (19.7%) and Electrical Machinery and Appliances (5.4%).

### **6.3 R&D Expenditure by Size of Company**

In terms of employment size, most of the companies that spent on R&D activities were medium sized company employing between 75-200 workers [see Table 6.2]. They accounted for 24% of the total number of companies, and their expenditures constituted nearly 14% of the total expenditures (including outsourced funds). Companies which employed between (201-500) workers and more than 2000 workers contributed 30% and 20% of the total expenditures, respectively.

### **6.4 R&D Expenditure by Type of Ownership/Control**

There are four categories of company ownership/control based on their capital structure; that is,

- a) Foreign owned-Foreigners own 100% of the equity;
- b) Foreign controlled- Foreigners own more than 50% of the equity;
- c) Locally owned- Locals owned 100% of the equity; and
- d) Locally controlled-Local own more than 50% of the equity.

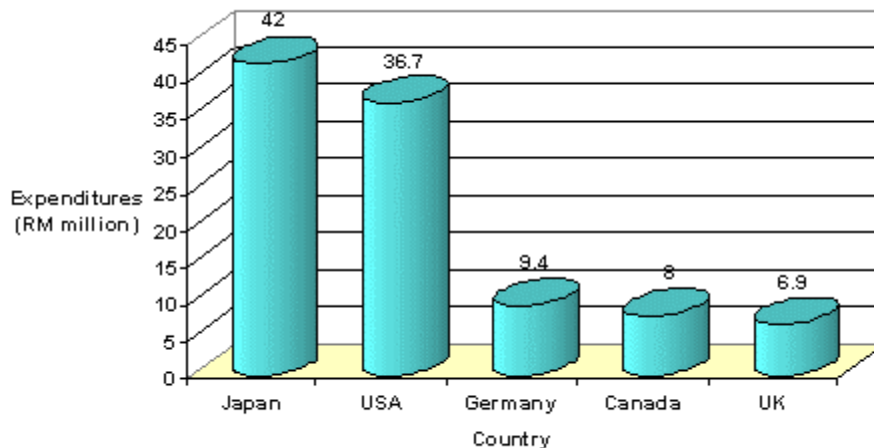
Table 6.7 shows the Capital Structure of companies with R&D. Sixty-six companies or about 42% of the total number of companies that carried out R&D activities in 1996 were locally owned. Together with those companies that were locally controlled they made up nearly 67% of the total number of companies.

Of those which were foreign-owned or controlled, some (about 94%) could be identified by country (i.e., where more than 50% of equity were held by owners of one foreign country only). The United States, Japan and United Kingdom of foreign owned/ controlled companies which carried out R&D activities in Malaysia in 1996 contributed the same percentages of 14% of the total number of foreign-owned/controlled companies (7 companies each) [see Table 6.8].

Most of the foreign-owned/controlled companies were in electronic industry (10 companies) whilst the majority of the locally-owned/controlled companies were in Chemical Products (12 companies) and Food industries (10 companies) [see Table 6.7].

The locally owned and controlled companies spent RM 342 million (75% of total expenditure including outsourced expenditure) on R&D compared to foreign-owned/controlled companies which spent RM 115.2 million on R&D (25%) [see Table 6.4].

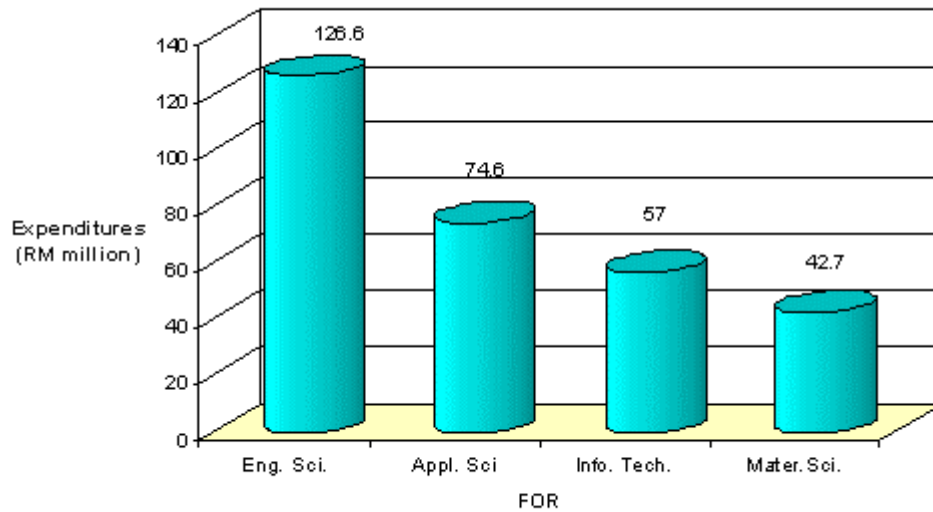
It is interesting to note that companies, which were 100% owned by Malaysians [see Table 6.4], spent 48% of R&D total expenditures (including outsourced expenditure). Locally owned companies spent comparatively more on capital (about 30% of total capital expenditure excluding outsource expenditures) than foreign-owned companies (only 8%). Among foreign controlled joint ventures which carried out R&D activities, Japanese companies spent the most (RM42 million contributing to 9% of the total expenditures), and this is followed by United States (RM 36.7 million or 8%) and German companies (RM 9.4 million or 2%) [see Fig 6.5].



(Source : Table 6.8)  
 Fig. 6.5: R&D Expenditures (RM million) for selected foreign owned/controlled companies

### 6.5 R&D Expenditure by Field of Research (FOR)

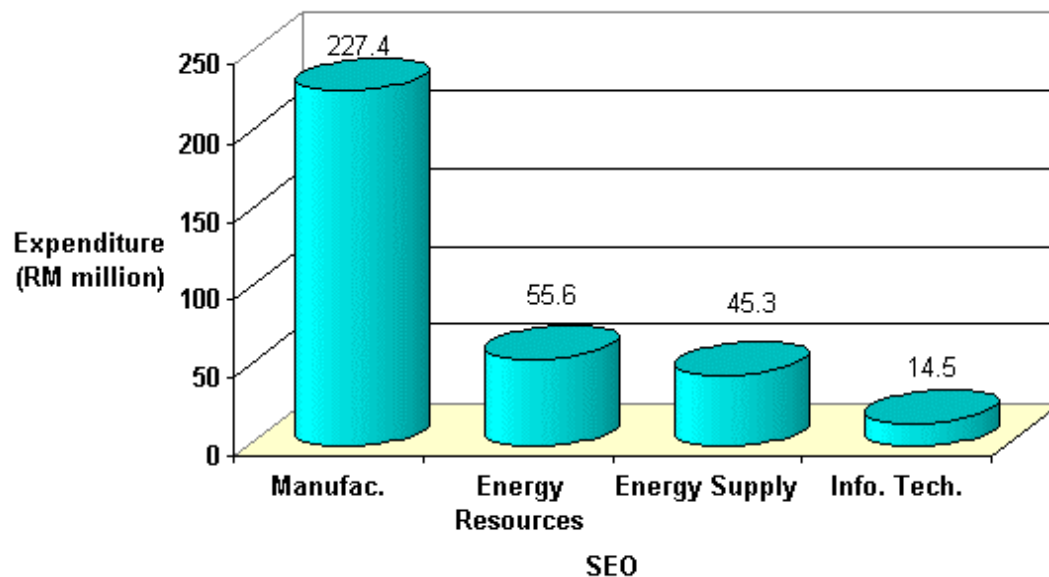
Table 6.9 shows the Private Sector R&D personnel (FTE) and expenditure by Field of Research. The R&D expenditure in the private sector was concentrated in the areas of Engineering Sciences (RM126.6 million), Applied Sciences and Technologies (RM74.6 million), Information, Computers and Communication Technologies (RM57 million) and Material Sciences (RM42.7 million) [see Fig. 6.6].



(Source : Table 6.9)  
 Fig. 6.6: Total Expenditure for selected FOR

### 6.6 R&D Expenditure by Socio-Economic Objective (SEO)

Fig. 6.7 and Table 6.10 illustrate the Private Sector R&D personnel and expenditure by Socio-economic Objective (SEO). Manufacturing sector dominated Malaysian R&D expenditure (RM227.4 million), accounting for approximating 57% of the total expenditure. This is followed by Energy Resources which spent RM55.6 million (14%). It is surprising that Information and Communication only contributed about 4% of the total expenditure.



(Source: *Table 6.10*)  
 Fig. 6.7: Total Expenditures for selected SEO

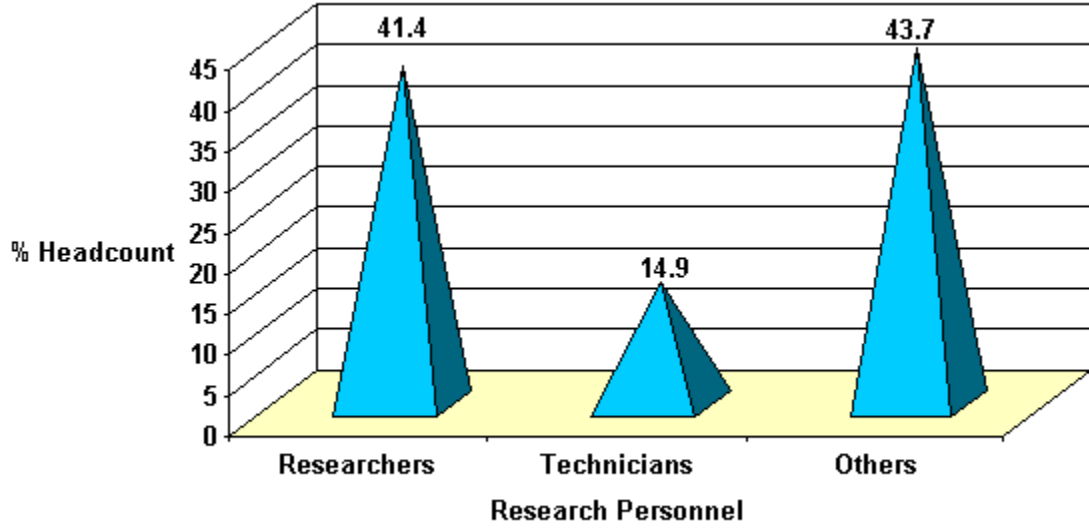
Within Manufacturing sector, Industrial Chemical and Related Products as well as Communication Equipment were the two most important objectives. This is somewhat different from the SEOs in 1994 where Communication Equipment as well as machinery and Equipment contributed the most.

### 6.7 R&D Expenditure per Research Personnel

The private sector spent around RM28,961.6 per research personnel in 1996 [See Table 6.11]. The most expensive research personnel were in services industries like transport, wholesale and business services industry, amounting to RM 56,335.9 per research personnel. This is followed by Construction industry, which costs RM 50,501.1 per research personnel and Textile Industry (RM 49,836.6 million per research personnel).

### 6.8 Human Resource by Industry

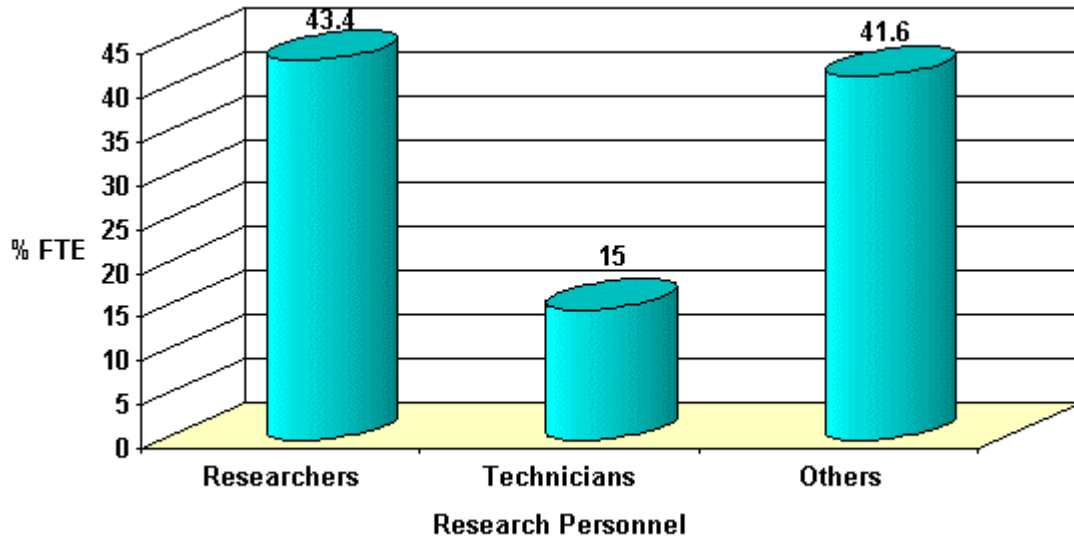
The number of researchers, technicians and support staff involved in R&D programs in 1996 was 3,245. The distribution of R&D headcount across all three categories of research personnel is illustrated in Fig. 6.8 (a) [see Table 6.12]. The ratio of researchers (1,342 headcount) to technicians (484 headcount) was approximately 3:1 and the ratio of researchers to other support staff (1,419 headcount) was about 1:1.



(Source : Table 6.12)  
 Fig. 6.8 (a): Percentage of breakdown of headcount among R&D personnel

The highest number of researchers was in electronic industry (361), followed by the service industries like transport, financial and business services (155) and Telecommunication service industry (153) as shown in *Table 6.13*.

The total research effort of 2,349.94 was reported in 1996. The researchers contributed about 1,026.4 research effort. Technicians and other support staff amounting to 341.04 and 982.14, respectively contributed the remaining FTEs. An almost similar pattern of the distribution of the FTE among R&D personnel can be seen in Fig. 6.8 (b).



(Source : Table 6.12)  
 Fig. 6.8 (b): Percentage of breakdown of FTE among R&D personnel

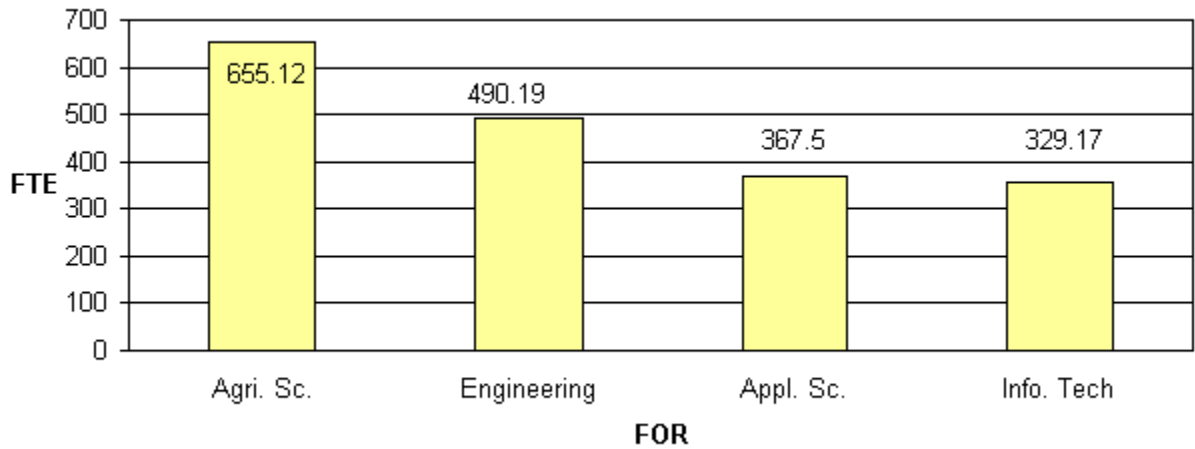
Foreigners made up only 2.4% of the total researcher effort (FTE) in the country and they were mostly in electronic industries.

The ratio of technicians per researcher for all industries was less than 1. However, the Agricultural sector had the highest support staff per researcher (i.e., 7:1) [see Table 6.13].

### 6.9 Human Resource by Field of Research (FOR)

The private sector's effort on R&D were mainly concentrated in the field of Agricultural Sciences (28%) as illustrated in Fig. 6.9 and Table 6.9. This is followed by, Engineering Sciences (21%) and Applied Sciences and Technologies (16%). It is interesting to note that about 14.6% of the private sectors focused were in the field of information, computer and communication technology.

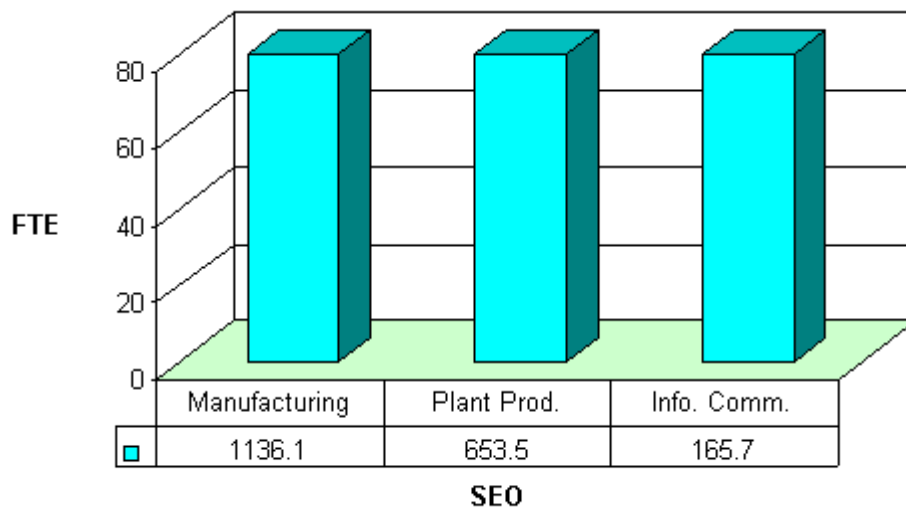
Foreign researcher contributions were mainly in Engineering Science, Applied Sciences and Technology; and Information, Computer and Communication Technology. Most of technology or knowledge transfer may have occurred more in these areas.



(Source : Table 6.9)  
 Fig. 6.9: The percentages of selected R&D (FOR) priorities.

### 6.10 Human Resource by Socio-Economic Objectives (SEO)

The private sector's effort on R&D were mainly focused in the field of Manufacturing (48% of the total industries), followed by Plant Production and Plant Primary (28%) and Information, Computer and Communication Technology (7%) as shown in Fig. 6.10.



(Source : Table 6.10)  
Fig. 6.10: The percentages of the selected R&D (SEO) priorities.

A total of 3,245 personnel (headcount) were engaged in R&D in the private sector in 1996. They spent almost 72% of their time (2,349.94 efforts against 3,245 headcount) doing research in 1996. The balance was non-R&D activities.

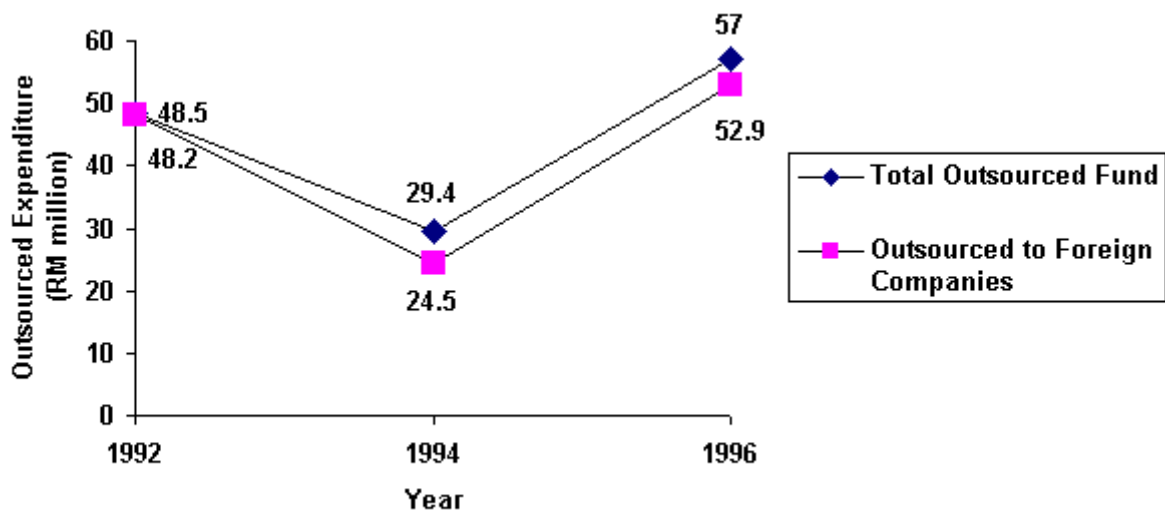
### **6.11 Qualifications and Gender of Researchers**

The majority of Malaysian researchers hold first degree (67.7%), 17.5% possess Masters, and 6% have doctorate qualification [see Table 6.14]. The private companies employed about 9% Malaysian researchers with non-degree qualification to conduct R&D projects. About 20% of the researchers in Malaysia were females and they were concentrated in service industries such as transport, retail and financial, followed by Electronic Equipment and Component and telecommunication services [see Table 6.15].

### **6.12 Sources of Funding and R&D Linkages**

The bulk of private sector sources of funding were their own companies' fund (80%). Even if external funds were obtained by R&D companies, it seemed that these funds came mainly from their company's head office in Malaysia, for example, in the case of Rubber and Plastic, Agriculture and Electricity industries. Less than 1% of their funds were obtained from the state or local government. None of their funds came from Industrial Technical Assistance Fund (ITAF) [see Table 6.16].

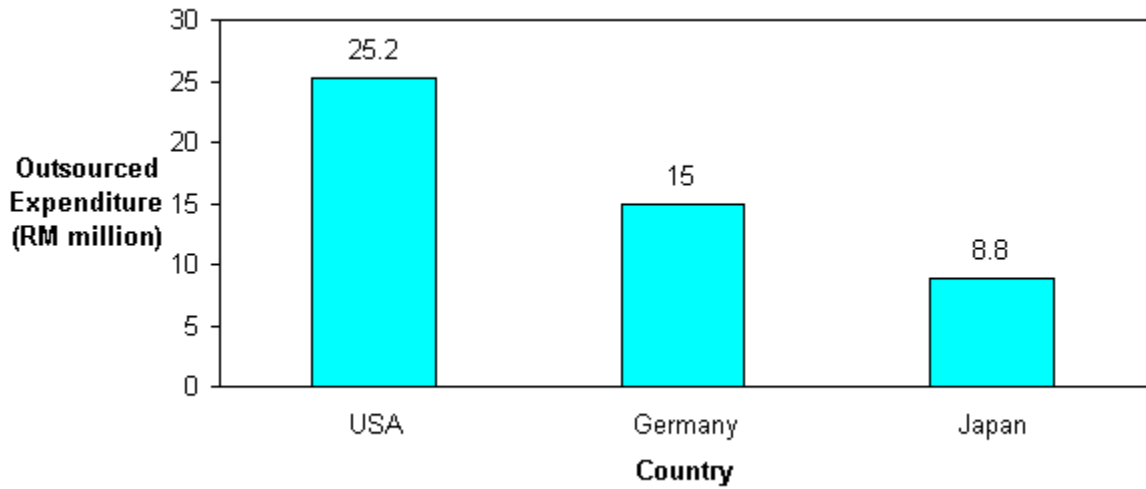
A total amount of RM 57 million was contracted out by the private sectors either locally or overseas. This contributed to an increase of 93.9% compared to RM29.4 millions spent in 1994 [see Fig. 6.11].



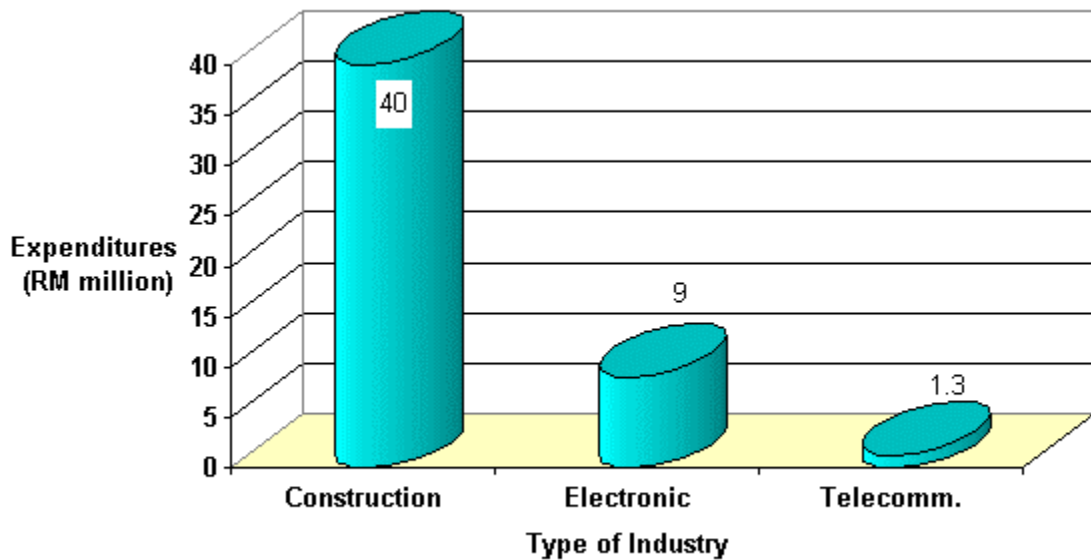
(Source : Table 4.1)  
 Fig. 6.11: Comparisons of Outsourced Expenditures (RM million) to foreign Companies in 1992- 1996.

Payments to local and foreign entities for R&D conducted were in the form of contracts and grants. In 1996, less than RM5 million or approximately 7% of total R&D contracted out was paid in the form of contracts or grants by the private sectors to local institutions for conducting R&D [see Table 6.17].

There were sizeable foreign linkages as measured by the amount paid for R&D to foreign countries as compared to linkages with local institutions. Table 6.18 shows the total expenditure contracted out overseas by the industries. Nearly RM 53 million was paid to foreign companies for conducting R&D activities in 1996, an increase of about 55% compared to that of 1994. This was equivalent to about 93% of total extramural expenditure on R&D. The country that received the largest amount was USA, followed by Germany and Japan as illustrated in Fig. 6.12 and Table 6.19.



(Source : Table 6.19)  
 Fig. 6.12: The R&D outsourced expenditures to foreign companies



(Source : Table 6.18)  
 Fig. 6.13: Outsourced expenditure to foreign companies for selected Industries in Malaysia

It is interesting to note that among industries which carried out R&D activities, construction industries spent the most expenditures to private sectors overseas

amounting to RM40 million [see Fig. 6.13]. The second largest spender was the electronic industries (RM 9 million) and followed by telecommunication services industries (RM1.3 million).

### 6.13 Factors Limiting R&D Activities

The most common reason cited as being an internal factor in limiting R&D activities was 'Lack of new product/R&D strategy'. This is followed by two other factors, which are ranked accordingly as follows;

Ranking	Internal Factor
1	Lack of new products/R&D strategy
2	Inadequate market research
3	Lack of proven analytical techniques

The survey also tried looking at reasons for private sectors not wanting to apply for R&D incentives. Almost 54% of those who encountered problems had difficulties in understanding the procedures for application for R&D. 50% mentioned that they had problems understanding the definition of R&D and 46% had difficulties with the scope of eligibility, which was too narrow. It is interesting to note that about 23% (combined) of the total respondents were not aware of the R&D incentives plus not knowing how to apply for them.

The most common reason cited as being an external factor in limiting R&D activities was 'Shortage of R&D personnel with requisite expertise' followed by 'Increasing competition', 'Increasing labour cost' and 'Technology advances'. The three factors were summarised as shown below;

Ranking	External Factor
1	Shortage of R&D Personnel with Expertise
2	Increasing Competition

3	Increasing Costs	Labour
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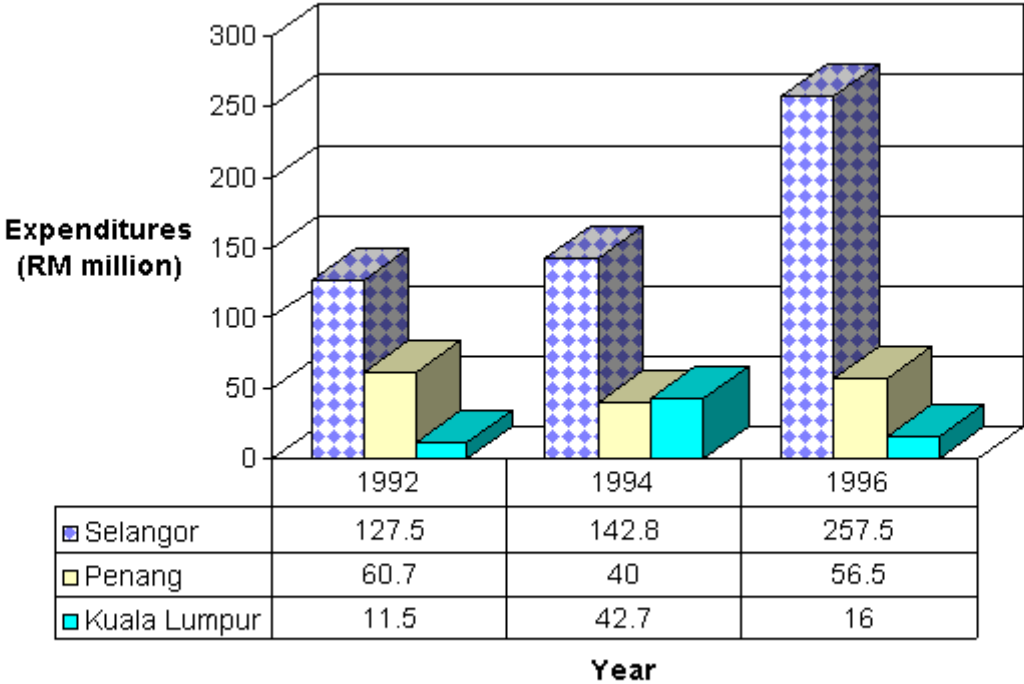
The first common factor is quite understandable but the second factor is indeed surprising because one would have thought that an increase in the level of competition would spur companies to spend more on R&D in order to maintain competitiveness.

The commonly enjoyed R&D incentives by private sectors were the 'Double Deduction on revenues expenditure for approved research project'. This was enjoyed by 66% of the total companies.

**6.14 R&D Activities by Geographical Location**

Fig. 6.14 shows the R&D expenditures for selected states. Selangor spent the most expenditures amounting to RM257.5 million (about 56%) for its R&D activities in 1996. This is followed by Pulau Pinang and Kuala Lumpur. The amount was up 80% from 1994 (i.e., RM 142.8 million) [see Table 6.20].

Penang indicated an increase from RM 40.0 million in 1994 to RM 56.5 million in 1996 (up 41%). Meanwhile, Kuala Lumpur's contribution decreased from RM42.7 million in 1994 to RM 16 million in 1996.



(Source : Table 6.20)  
Fig. 6.14: Comparison of total expenditures for selected states in 1992-1996.