

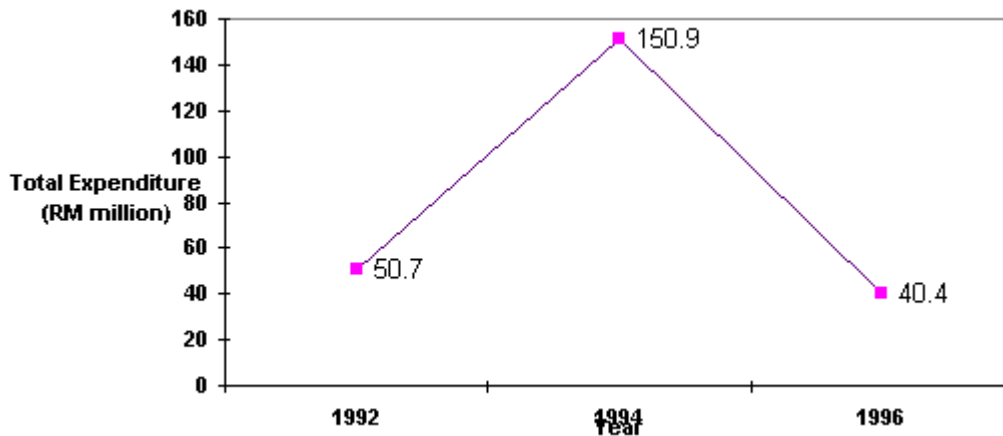
Chapter 7 - INSTITUTES OF HIGHER LEARNING (IHL) R&D ACTIVITIES

7.1 Structure of Sector

Malaysia's institutes of higher learning (IHL) also play a significant role in the area of R&D. Apart from helping the organisations to fulfil their role of the expansions of knowledge, R&D activities also serve to train future scientists, technicians and other research personnel.

7.2 R&D Expenditure by Institutes of Higher Learning

There were altogether nine research institutions that responded to the 1996 National R&D Survey. IHL spent a total of RM 40.4 million in 1996. This represents a significant reduction of 73% from RM 150.9 million in 1994 [see Fig 7.1]. On further investigation, it was found that a large proportion (amounting to RM 120 million) of the total expenditure in 1994 was spent on energy industry (due to the purchase of equipment), which came under applied science and technology. By excluding the cost for the purchase of equipment in 1994, the actual expenditure for R&D in 1996 would be relatively higher in 1996 than that of 1994.



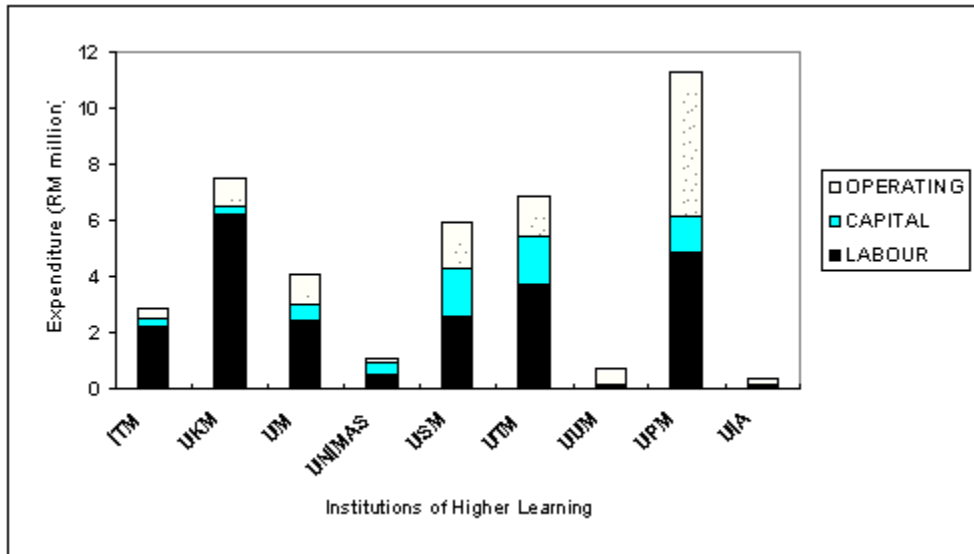
(Source : Table 4.1)

Fig. 7.1 Comparison of Total Expenditures in 1992-1996

Labour costs, being part of the capital item, contributed 56.6% of the total R&D expenditures of IHL [see Table 7.1]. Figure 7.2 shows a breakdown by type of costs and institution. UPM spent nearly 28% of the total expenditures of Malaysia's IHL. This is followed by UKM, which accounted for 19%. Together these two universities dominated approximately 47% of the total IHL expenditures. It is interesting to note that UKM spent nearly 82% of the total

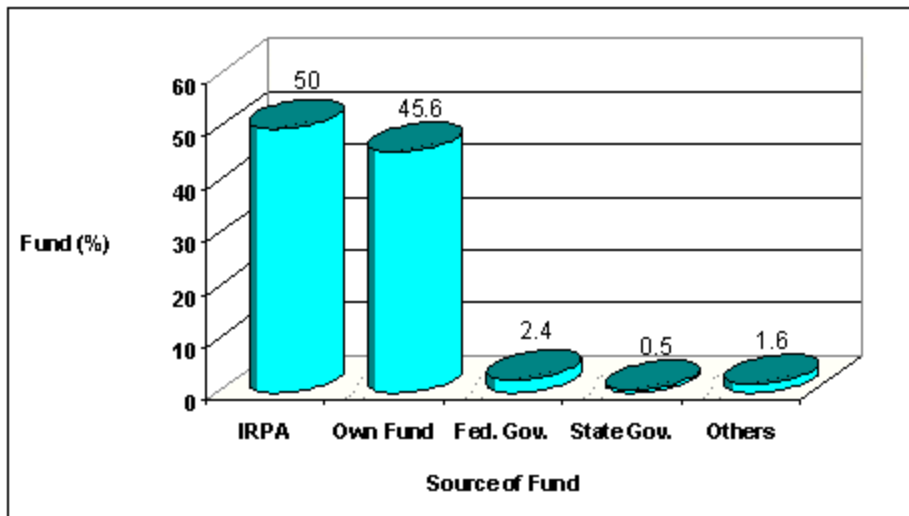
expenditure on labour while UPM's largest expenditure was on operating cost (RM 5.17 million).

The amount of expenditure spent on basic research as reported was RM 14.4 millions (36%) while applied research spent RM 18.5 millions (46%) of IHLs total expenditure and the remaining amount (18%) went to experimental development.



(Source : Table 7.1)
 Fig 7.2 : Institute of Higher Learning R&D Expenditures.

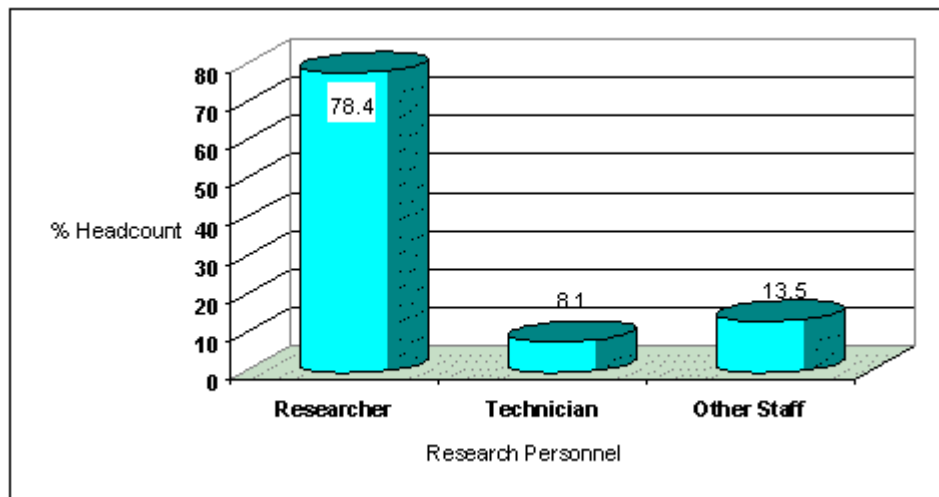
Around 50% of the R&D fund for IHL came from IRPA while 45% of the funds came from the institutions own fund as shown in Fig. 7.3.



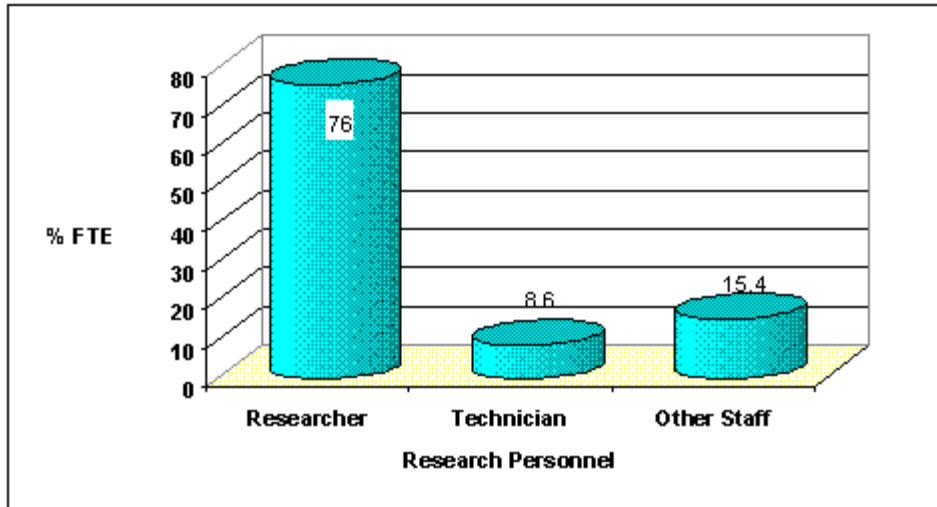
(Source : Table 7.2)
 Fig. 7.3 : Sources of Fund (%)

7.3 Human Resources

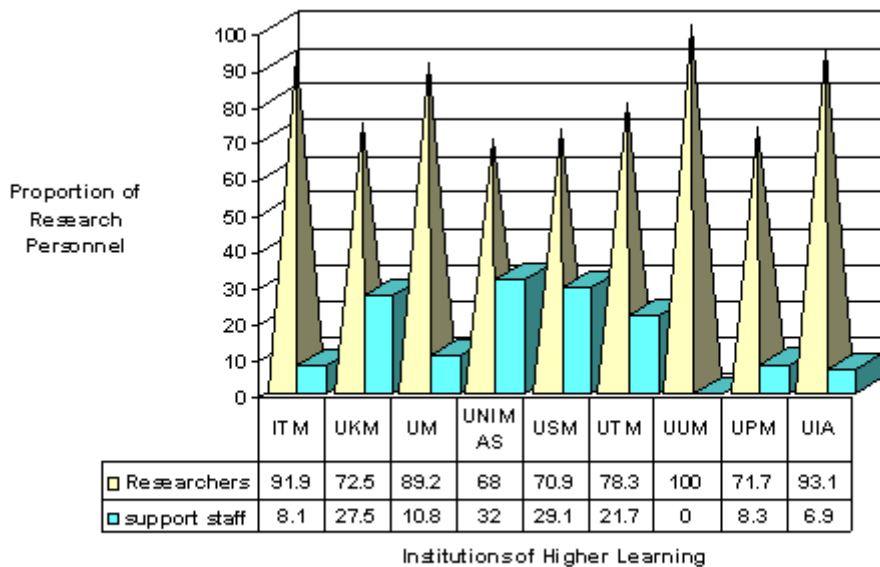
The total number of research personnel put in by all nine IHLs in 1996 was 1,757. There seemed to be some improvement in terms of the number of research personnel involved when compared to a total of 1,417 research personnel in 1994. Fig 7.4(a)-(b) illustrates the breakdown of 520.3 FTE and 1,757 headcount contributed by IHL personnel, which was made up of 1,377 researchers, 143 technicians and 237 other support staffs. The number of researchers holding at least a basic degree qualification is 71%. PhD holders constituted 32.1% of the total research personnel. Of these only 7.8% of the total researchers were foreign researchers.



(Source : Table 7.3)
Fig. 7.4(a) Breakdown percentage of R&D personnel (headcount)



(Source : Table 7.4)
 Fig. 7.4(b): Breakdown percentage of FTE among R&D personnel



(Source : Table 7.3)
 Fig 7.4(c) The proportion of researchers to support staff categories for IHL.

The largest number of PhD holders involved in R&D was from USM. In terms of research personnel, USM recorded the highest total with 291 researchers and 120 support staffs. This is followed by UTM, UKM, UPM, UM, ITM, UUM, UNIMAS and UIA [see fig. 7.4(c)].

Focusing on the research effort (FTE), on average about 29% of their efforts were actually focused into performing R&D activities. The other 71% of their

effort may have been spent on teaching, administration as well as consultancy work. IHL does not seem to be employing many foreign researchers in R&D (i.e. only 7.8% of their total researchers). USM also recorded the highest count of total research effort (125.12) followed by UTM (102.4), UM (83.89), UKM (79.75) and UPM (73.96) [see Table 7.4]. It is interesting to note that while UPM registered the lowest FTE its total expenditure was the highest among the IHLs. It can be observed that UPM's expenditure was approximately twice higher than that of USM. Most of UPM's expenditure went to operating cost [see table 7.1].

As a proportion of the country's total research effort, researchers effort (FTE) from the higher education represent 11.7%, down from 17% in 1994 [see Fig. 7.5].

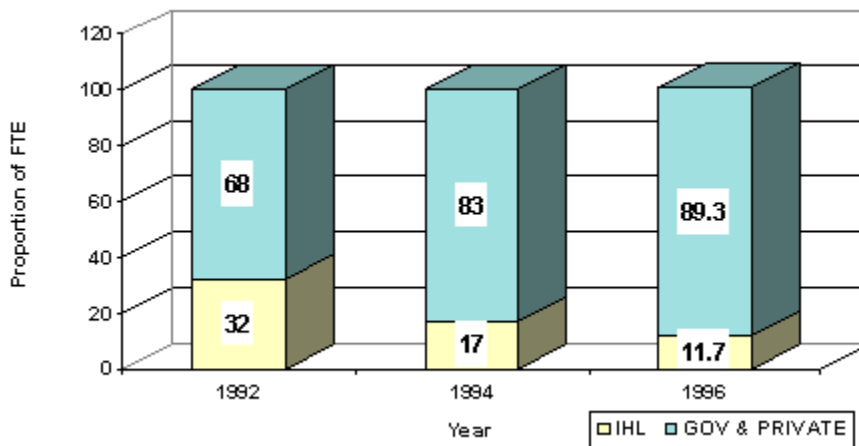
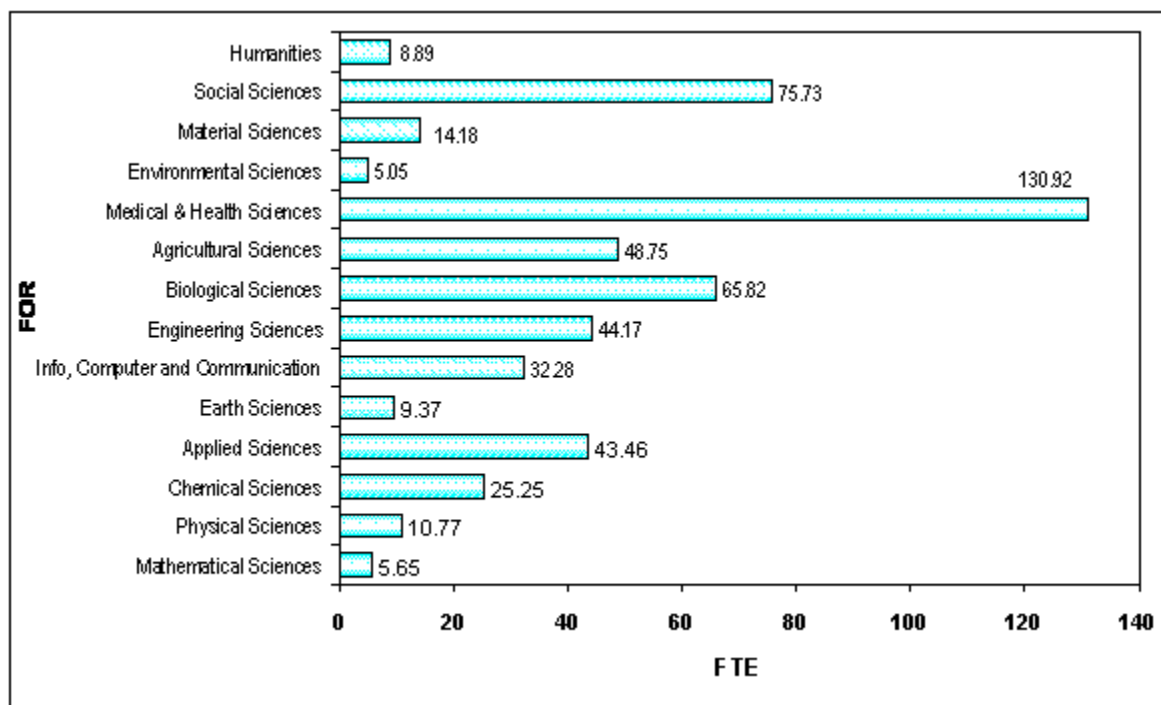


Fig 7.5: Proportion of IHL research effort (FTE) to Government & Private Sector

In terms of total research efforts (FTE) by the researchers, medical and health Sciences emerged as the most important field at institutes of higher learning (25%), followed by social Sciences (14.6%) and biological Sciences (12.6%). Figure 7.6 display the breakdown of the total research effort by field of research (FOR).



(Source : Table 7.7)
 Fig. 7.6 Breakdown of IHL's total FTE by Field of Research (FOR)

Table 7.9 gives some indication of the relative R&D strengths of the major universities in Malaysia. UTM reflected to have the largest number of researchers (headcount) in the fields of Applied Science and Technology, Material Science and Engineering Science. UPM led others in a number of fields including Agricultural Sciences, Biological Sciences and Earth Sciences. UM, on the other hand, had the largest number of researchers in the fields of Chemical Sciences. USM seems to have the largest group involve in Medical and Health Sciences as well as Information, Computer and Communication Technology.

7.4 Intensity of R&D in Institutes of Higher Learning.

One of the important measures of the intensity of R&D is the amount spent in doing research. Table 7.1 allows us to rank the institutes of higher learning in terms of the amount of research activities conducted. The three research institutions that spent most of IHL's R&D expenditure are UPM, UKM and UTM (ranked in order). UPM spent nearly 38% of its expenditures on Agriculture and 30% on Biological Sciences while UKM spent around 32% of its expenditure on Chemical Sciences. UTM, on the other hand, spent almost 36% in the area of Applied Science and Technology while 34% of USM's expenditure went to Medical and Health Sciences.

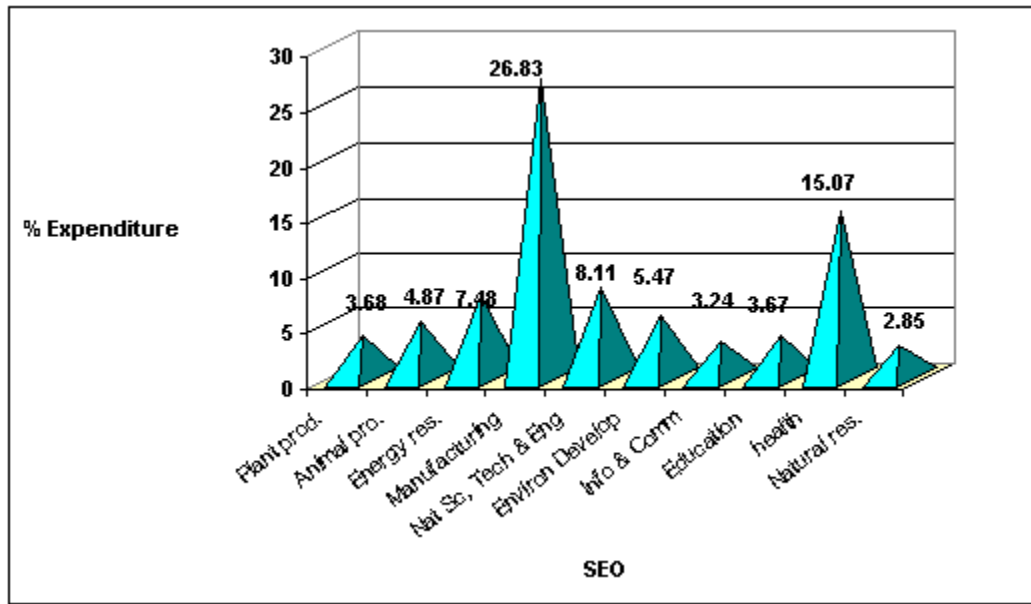
However the ranking in terms of research effort (FTE) as shown in Table 7.4 are USM, UTM and UM. The differences in the ranking may be due to the fact that the universities differ from each other in many respects including academic orientations and research priorities.

7.5 Priorities in R&D by Fields of Research (FOR)

In terms of IHL's expenditure for R&D, 15% was spent in the field of medical and health science. This is slightly less than the amount spent on biological Sciences, which takes up about 20% of the total IHL expenditure. Engineering and Applied Sciences accounted for about 11% and 10% , respectively, of the IHL's total expenditure.

7.6 Socio-Economic Objectives (SEO) of R&D

In terms of socio-economic objectives, 27% of the expenditure went to research on manufacturing with the bulk of it focusing on research on processed food products and beverages [see Fig. 7.7] . The next most important socio-economic objective was health, which constituted approximately 15% of the expenditure followed by Natural Sciences, Technology and Engineering (8%). These three areas jointly accounted for nearly 50% of the total IHL research expenditures.



(Source : Table 7.6)
 Fig. 7.7: Percentage Expenditures on IHLs Socio-Economic Objectives

7.7 R&D Labour Cost

In general, the IHL spent around RM 13,000 per research personnel on labour [see Table 7.1 and 7.3]. The highest labour cost per personnel was RM 25,000 per personnel at UKM, followed by UPM and ITM at RM 22,000 and RM 16,500 per personnel respectively.

7.8 R&D Outsourcing

UKM is the only institution, which contracted out its funds to other research institution. Further evidence revealed that the total amount contracted out by UKM was RM 69,700 in the field of Medical and Health Sciences [see table 7.1].

7.9 Factors Limiting R&D Activities in Institutes of Higher Learning.

Overall, researchers in this survey considered 'Delays in making decisions' was the major internal factor that has limited their R&D activities in the IHL. The three major factors that may have subsequent impact on R&D activities are listed as follows.

Ranking	Factor
1	Delays in making decisions
2	Current organisation structure
3	Ineffective communication between function and department

The major external factors that were recognised as the ones that limited the R&D activities are ranked as follows.

Ranking	Factor
1	Shortage of R&D personnel with requisite expertise
2	Shortage of other personnel
3	Poor physical infrastructure support

