

8.1 R&D Expenditure by Institutes of Higher Learning (IHL)

In 1998, three higher institutions were included in the survey compared to the one held in 1996. A total of RM133.6 million was spent on R&D activities by all twelve participating IHL in 1998, indicating a significant jump from just over RM40.4 million in 1996 [see Figure 8.1].

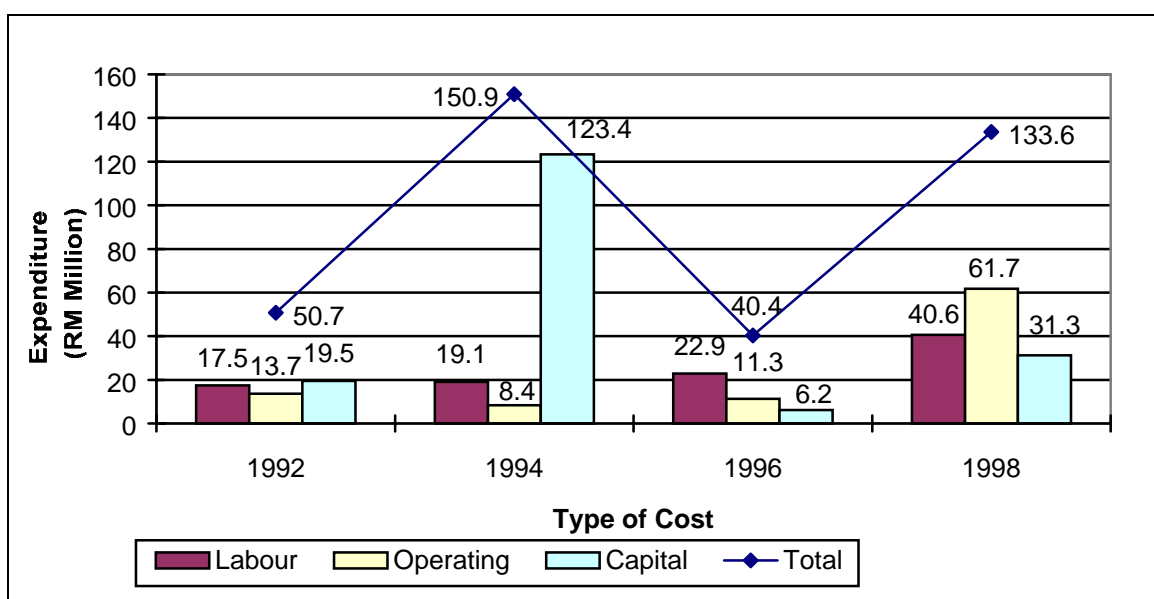


Figure 8.1 : The IHL Expenditures on R&D for the period 1992-1998

The current expenditure (labour and operating costs) on R&D in 1998 was RM102.3 million, representing 76.6% of the IHL total expenditure. The capital cost account for a smaller share, i.e., and 23.4% of the total expenditure [see Table 8.1]. Further investigation showed that the large portion of expenditure amounting to RM68.7 million was associated with research activities carried out in Chemical Sciences. Figure. 8.2 illustrates the amount of R&D spending by each institution in 1998.

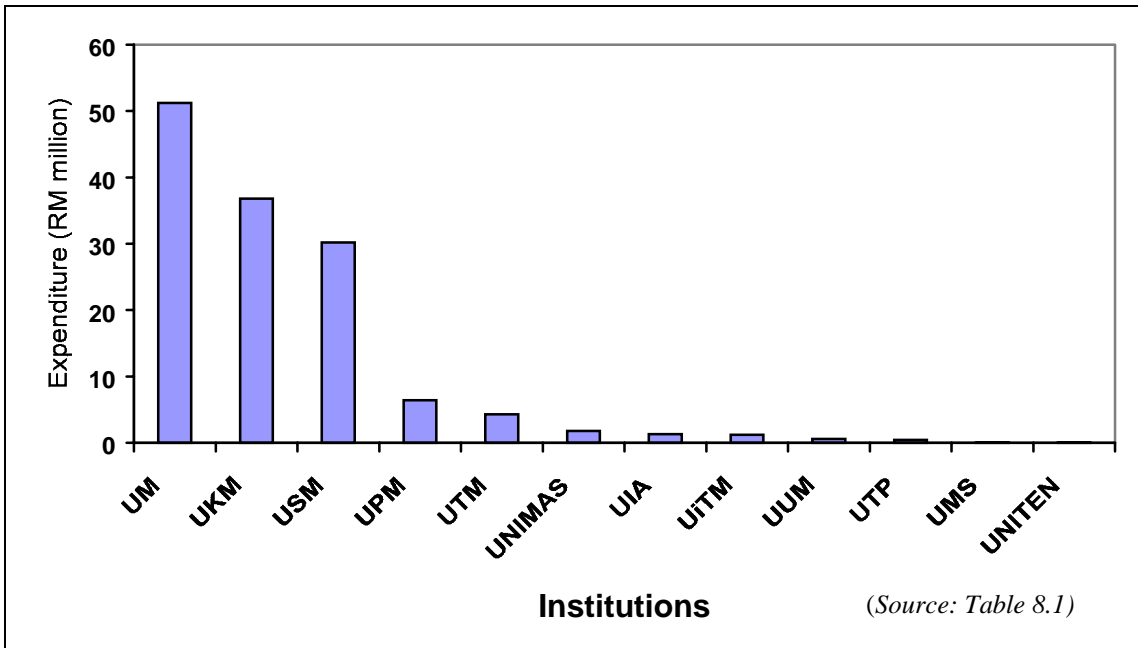


Figure 8.2 : Institutions of Higher Learning R&D Expenditures

It was found that 68.3% of the total expenditure spent by the higher institutions was on Basic research amounting to RM 91.3 million, while the amount spent on Applied Research was RM32.1 million (24%). Experimental Development accounted for only 7.6% (RM 10.2 million) of the total IHL expenditure on R&D [see Table 8.5(b)].

In 1998, UM was the leading institution with RM51.2 million spent on R&D, followed by three other major institutions, i.e., UKM with RM36.8 million, USM with RM30.3 million, and UPM with RM6.4 million. Further investigations revealed that operating cost accounted for 86% of UM total expenditure, USM spent almost 72% of its total expenditure on labour, while 57% of UKM's expenditure was due to purchase of land and building.

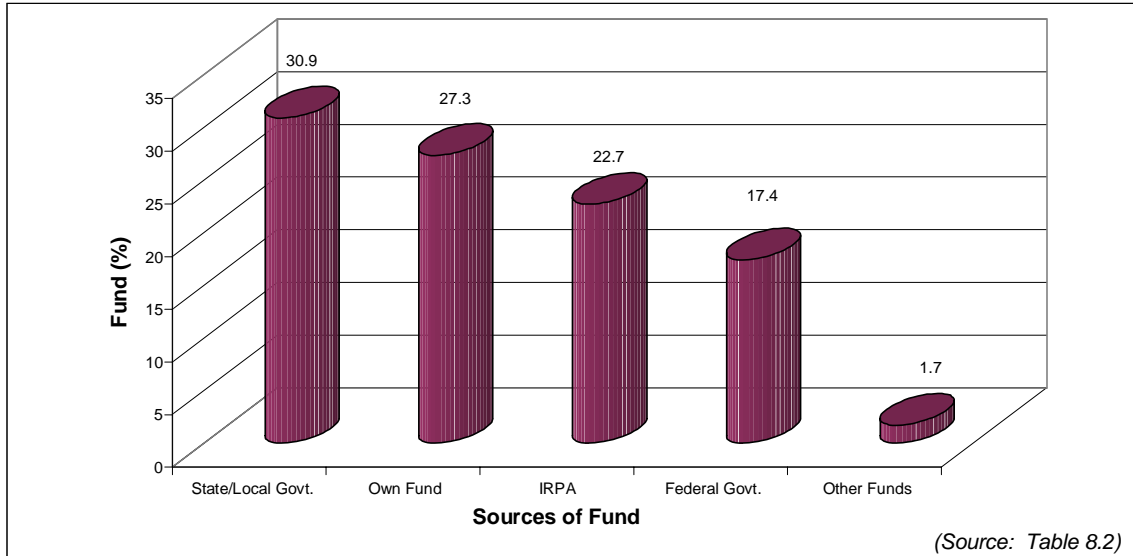


Figure 8.3 : Sources of Fund (%)

The R&D funding for IHL came from various sources as illustrated in Figure. 8.3. About 30.9% of the R&D funds was from State/Local Government, 27.3% was from the institution’s own fund, 22.7% came from IRPA and 17.4% fund was allocated by Federal Government [see Table 8.2].

8.2 Human Resources

There was a total of 2,735 research personnel from all twelve IHL in 1998. There was obviously an increase of 55.7% in the number of research personnel since 1996. The breakdown of 916.23 FTEs and 2,735 research personnel was made up of 1975 researchers, 237 technicians and 523 other support staffs [see Figure.8.4 and Figure.8.5].

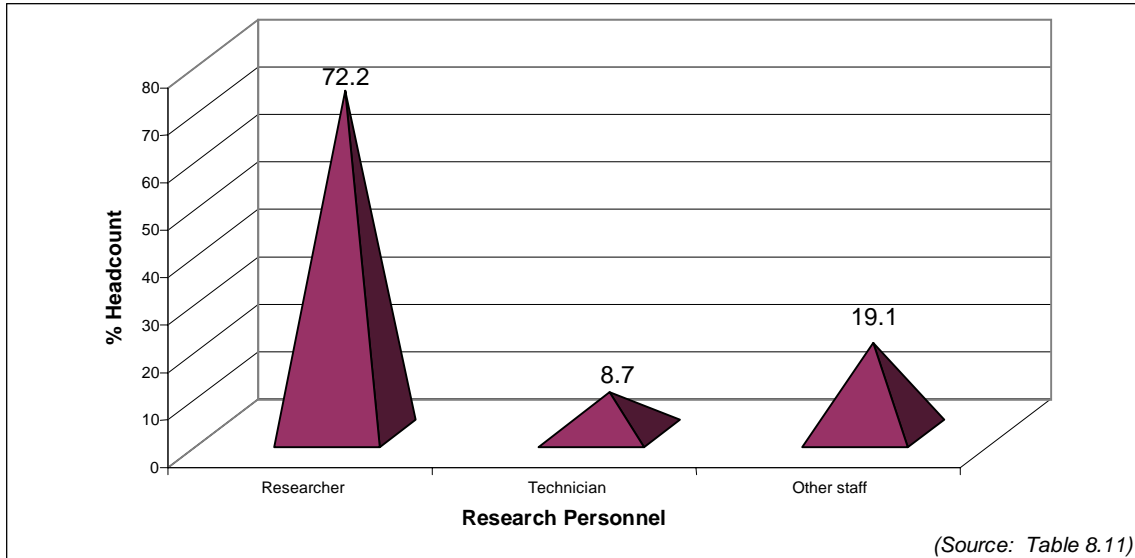


Figure 8.4 : Breakdown Percentage of R&D Personnel (Headcount) for IHL in 1998

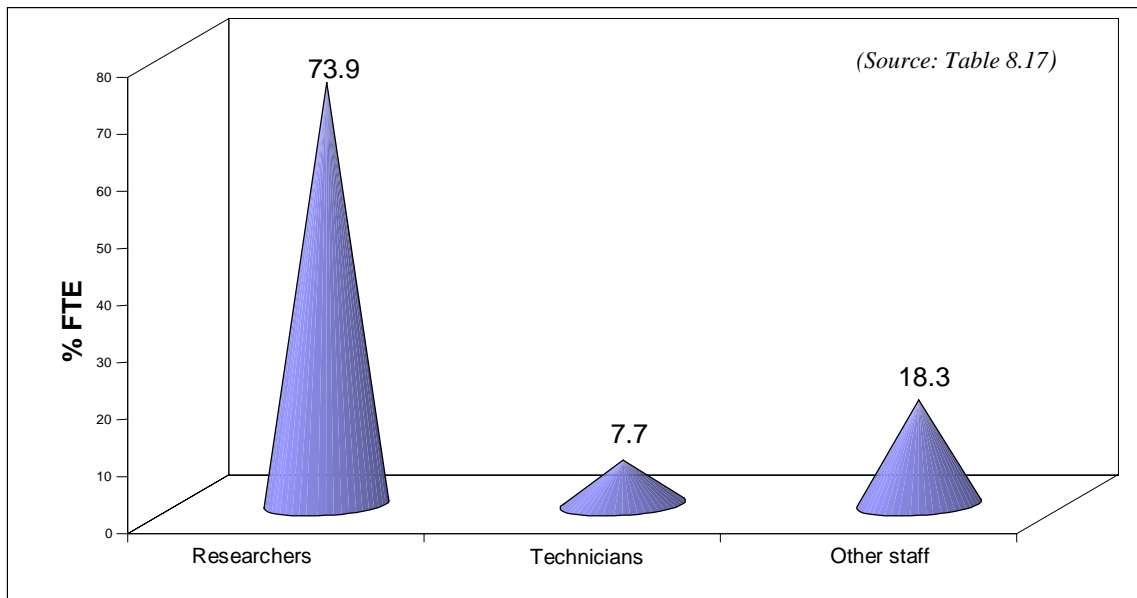


Figure 8.5 : Breakdown Percentage of FTE among R&D Personnel for IHL in 1998

In 1998, the number of researchers holding at least a basic degree qualification was 62%. The overall picture showed a decrease of 9.4% in the number of researchers having at least basic degree compared to 1996. The Ph.D. holders constituted 27.8% of the total research personnel. Foreign researchers constituted 6.9% of the total number of researchers from IHL. USM continued to be the leading IHL in having the largest

number of research personnel with 674 researchers and 242 support staffs [see Table 8.15]. USM also constituted the largest number of Ph.D. holders (318), followed by UKM with 154 Ph.D. holders, and UM with 122 Ph.D. holders carrying out R&D activities [see Table 8.16]. Foreign researchers constitute only a small portions (around 9%) of the total (headcount) researchers involved in R&D activities.

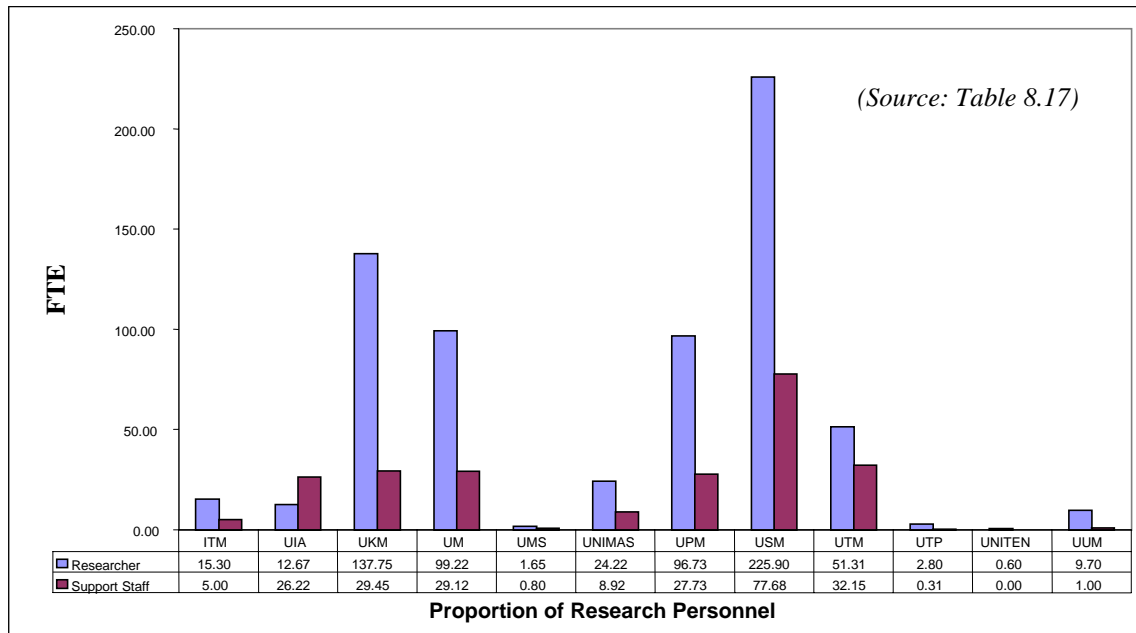


Figure 8.6 : The proportion of Researchers to Support Staff categories for IHL

Figure. 8.6 illustrates the breakdown of the researchers and support staffs in terms of FTE for the IHL. The higher institution that recorded the highest count of total research effort was USM (FTE 303.58), followed by UKM (FTE 167.2), UM (FTE 128.34), UPM (FTE 124.46) and UTM (FTE 83.86). However, even with low FTE, UTM registered the second largest total expenditure among the IHL. It is quite interesting to note that even though UM was the institution with the largest amount of R&D expenditure, their research effort in terms of FTE was quite moderate [see Table 8.17]. The most important field in the R&D activities carried out by the IHL was Medical & Health Sciences, which accounted for 21.3% of the total FTE. Based on the total research efforts (FTEs), the breakdown of fields of research (FOR) were Agricultural Sciences (12.2%), Engineering (12.0%), Social Sciences (9.6%), Biological Sciences (9.6%) as displayed in Figure. 8.7

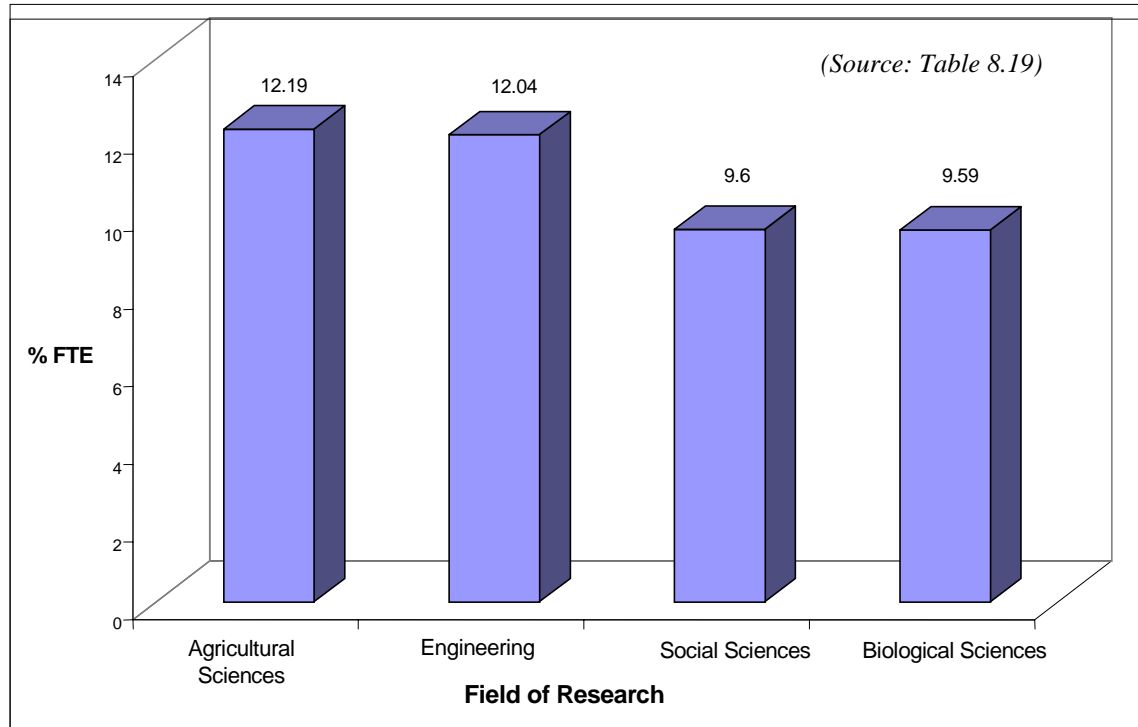


Figure 8.7 : Breakdown of IHL Total FTE by Field of Research (FOR)

The relative R&D strengths in terms of manpower for R&D of the major IHL in Malaysia are illustrated in Table 8.15. USM was the leading institution in this respect. This is reflected by the large pool of researchers in a number of fields, namely, Medical and Health Sciences; Information, Computer and Communication Technologies, Social Sciences, Chemical Sciences and Applied Sciences and Technologies. The research field that employed the second highest number of researchers was Agricultural Sciences and the leading institution was UPM, followed by UKM. UKM represented the second largest number of researchers in the field of Medical & Health Sciences, followed by Agricultural Sciences [see Table 8.13].

8.3 Intensity of R&D in Institutes of Higher Learning

The measure of R&D intensity is the amount of money spent in carrying out research activities. Based on this measure, three major institutions that registered the highest R&D intensities were UM, UKM and USM [see Table 8.1]. UM spent 79.3% of its total

expenditure on Chemical Sciences, 13.9% on Medical & Health Sciences while UTM spent 40% of its expenditure on Engineering Sciences and 36.6% on Applied Sciences & Technologies. UKM spent 68.8% of the expenditure on Chemical Sciences and 12.3% on Medical & Health Sciences, followed by 5.3% on Environmental Sciences and 5.19% on Biological Sciences. USM spent 25.4% of the expenditure on Medical & Health Sciences and 16.3% on Information, Computer & Communication Technologies. However, USM emerged as the most all-rounder institution that had involvement in all fields of research except for Marine Sciences [see Table 8.3].

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

The distribution of R&D expenditure by IHL can be identified according to the following ranked field of research: Chemical Sciences shared up about 51.4% of the total expenditures, followed by Medical & Health Sciences (15.6%), Agricultural Sciences (6.1%), Information, Computer & Communication Technologies (5%) and Biological Sciences which accounted for about 4.9% of the IHL total expenditure [see Figure. 8.8].

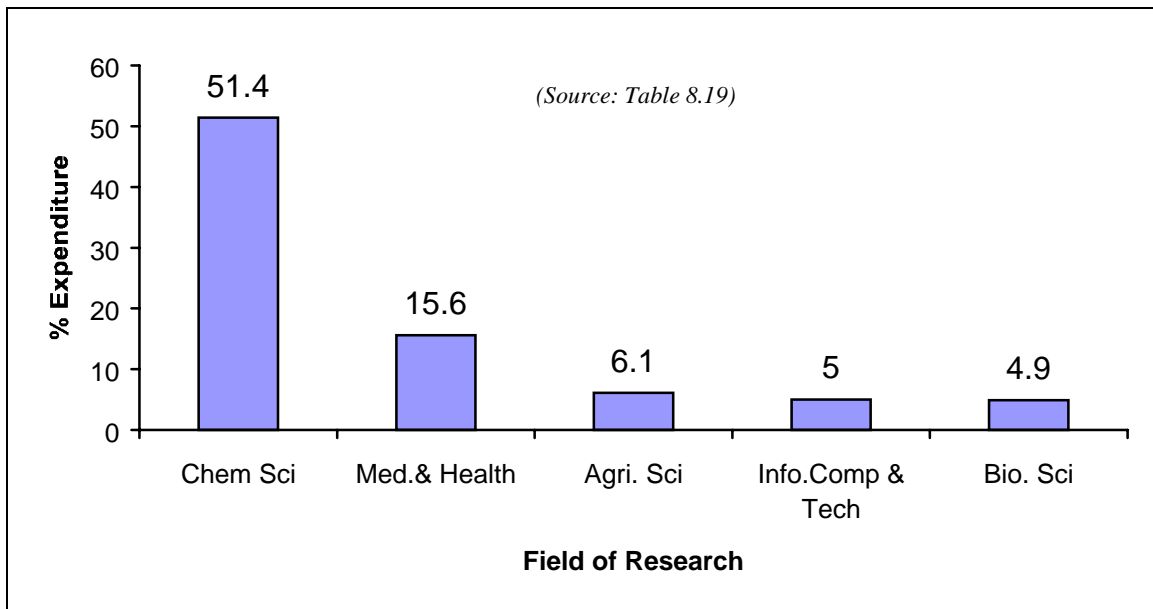


Figure. 8.8 : Breakdown of IHL Total Expenditure by Field of Research (FOR)

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

Manufacturing sector attracted the highest expenditure (36.5%) with regard to socio-economic objectives. The next important sector with respect to SEO was Plant Production & Plant Primary Product (22.4%), followed by Health (14.9%) [see Figure. 8.9]. These three areas contributed 73.9% of the total IHL R&D expenditure. As observed in the field of research (FOR), USM also emerged as the most all-rounder institution in terms of the coverage of SEO except for Defence and Social Sciences & Humanities sectors. Other institutions like UM, UPM, UiTM, UNIMAS, UTM, and UKM have moderate coverage of the SEO.

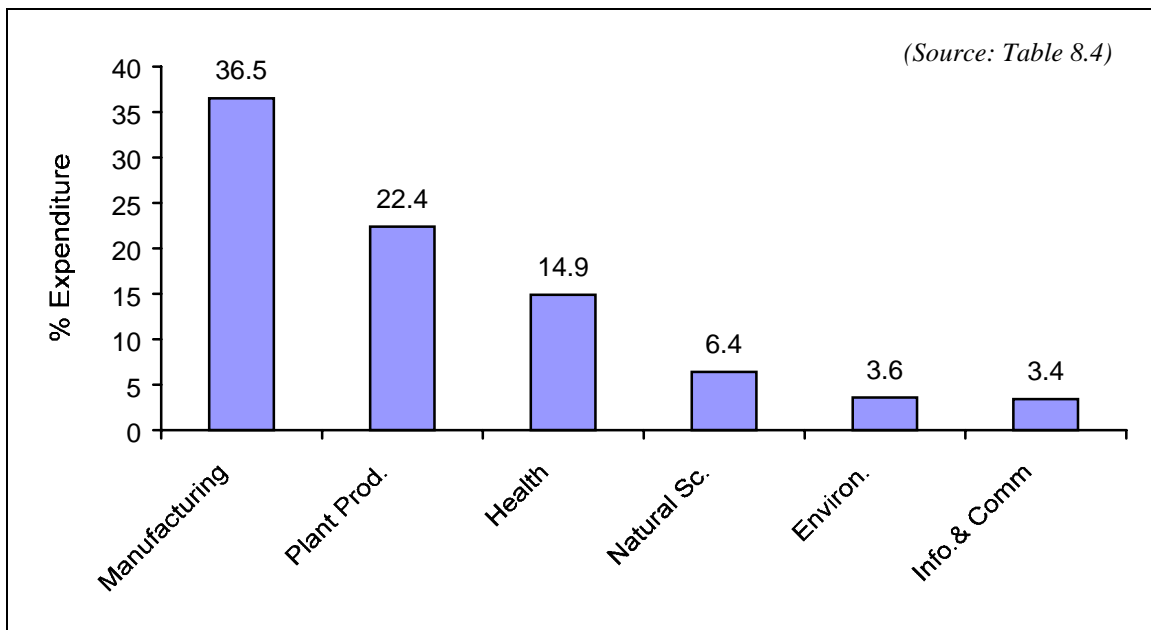


Figure. 8.9 : Percentage Expenditures on IHL Socio-Economic Objectives

8.6 R&D Labour Cost

In terms of the R&D expenditure, the IHL that spent most per research personnel was USM with RM 23,747.67 per personnel, followed by UM and UKM with RM16,375.25 and RM 11,518.99 per personnel, respectively [see Table 8.10].

8.7 R&D Outsourcing

Six research institutions had contract out their funds in 1998, compared to only one institution (UKM) in 1996. UKM was the leading institution in outsourcing its fund (amount to RM 462,000) to other institutions. Four other institutions that contracted out their funds were UTP (RM 194,300), UUM (RM 30,000), USM (RM18, 000) and UTM (RM 7000) and the least contracted out fund was from UM with only RM 200. [See Table 8.8]

8.8 Factors Limiting R&D activities in Institutes of Higher Learning

‘Limited financial resources’, ‘Lack of skilled R&D personnel’ and ‘Delays in making decisions by the management’ were considered by most institutions as major internal factors that limited their R&D activities [see Figure 8.9].

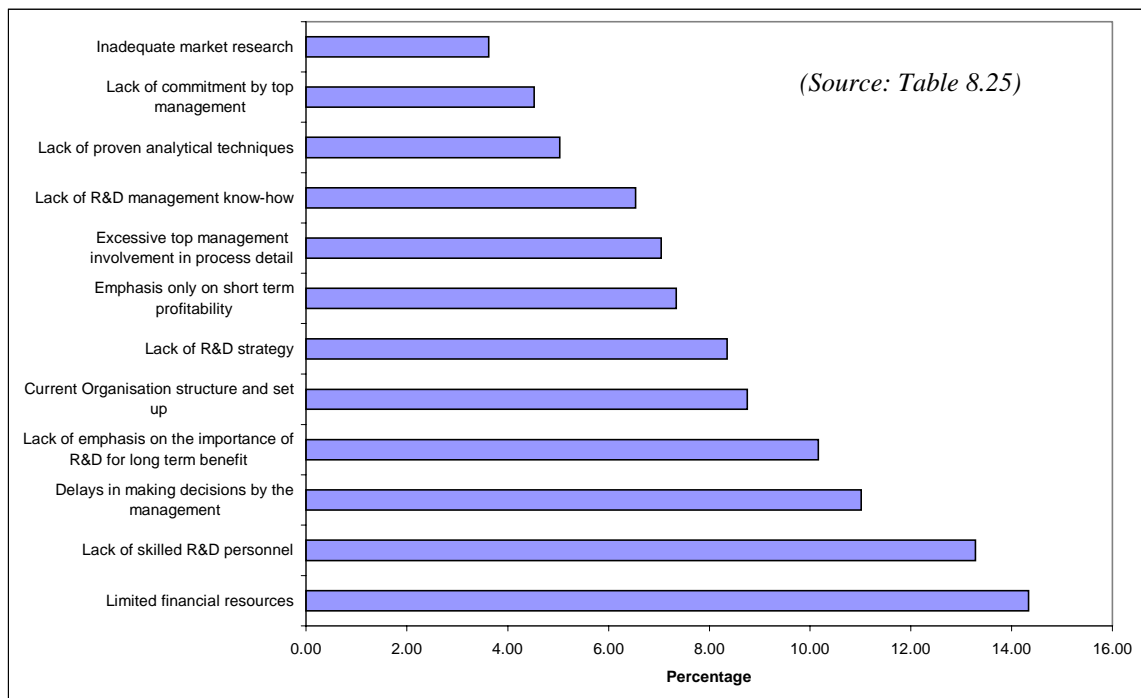


Figure 8.9 : Internal Factors Limiting R&D Activities of the IHL

Three major external factors that limited the R&D activities were as follows; ‘ Increasing capital costs’, ‘Shortage of R&D personnel with requisite expertise’ and ‘ Poor physical infra structural support’ [see Figure 8.10 below].

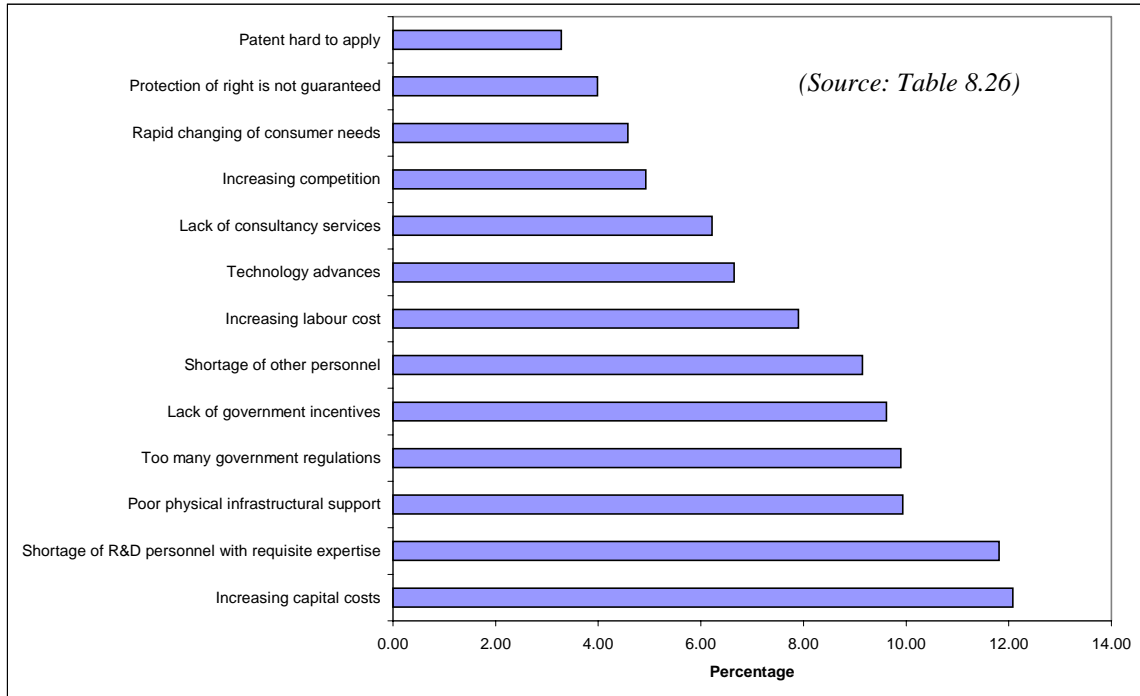


Figure 8.10 : External Factors Limiting R&D Activities of the IHL