Section C

ABOUT GOVERNMENT-FUNDED PROJECTS

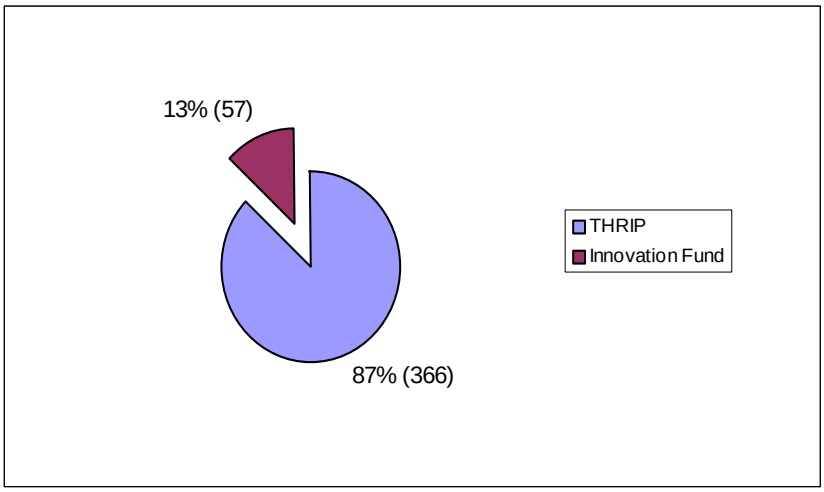
5

PARTNERSHIP PROJECTS

A total of 423 partnership projects were incentivised through THRIP and the Innovation Fund (Fig 12) in the period under review.[7] This total includes all industry and HEI/SETI partnerships.[8] In many cases, the partnership projects are complex networks that include more than one HEI/SETI and more than one industry partner.

Of the 423 projects, 13% (57 projects) are projects incentivised through the Innovation Fund and 87% (366 projects) through THRIP (Fig 12). Chapter 3 indicated that the Innovation Fund targets large interventions, with budgets at a minimum of R1 million per year. This may account for the smaller number of projects.

Figure 12: Total projects by the Innovation Fund and THRIP

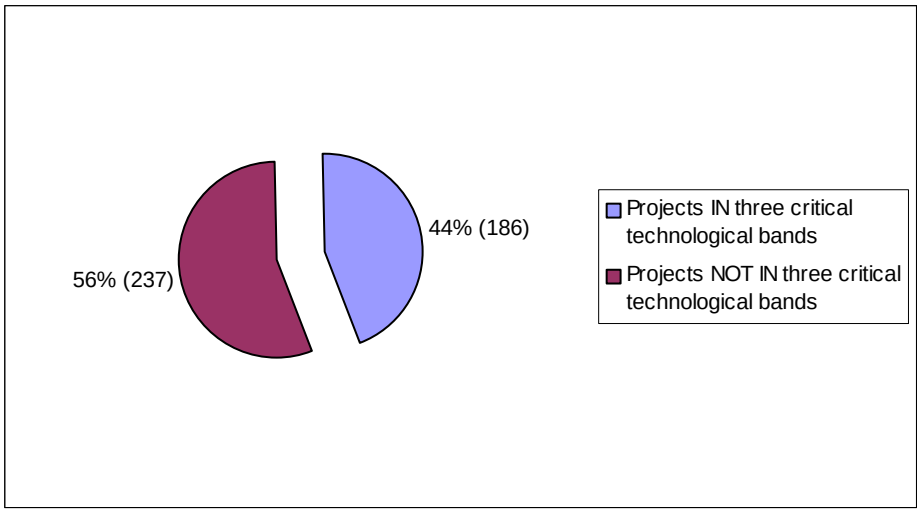


These partnerships include projects in the three priority technological fields of biotechnology, ICT and new materials development as well as projects in forestry, agriculture, minerals, power, manufacturing, animal husbandry and crime prevention. Of the 423 projects, 44% (186) are in the three technological areas identified as the focus of this study, namely biotechnology, ICT and new materials development (Fig 13).

[7] The methodology section provides an overview of the scope of the study. It indicates that THRIP projects for 2001 and 2002 were selected as the sample of this study, while all projects initiated since the inception of the Innovation Fund, were included.

[8] Details of the HEI and/or SETI partners are discussed in Chapter 8 and that of the industry partners in Chapter 7.

Figure 13: Total projects by the three critical technological bands



Of these 186 projects, 35% (66) are in biotechnology, 28% (53) in ICT and 37% (67) in new materials development (Fig 14). Figure 15 illustrates that 12% of projects funded by the Innovation Fund are not in the three critical technological bands, while Figure 16 shows that 63% of THRIP projects are not in the three bands.

Figure 14: Total projects for the Innovation Fund and THRIP by the three critical technological bands

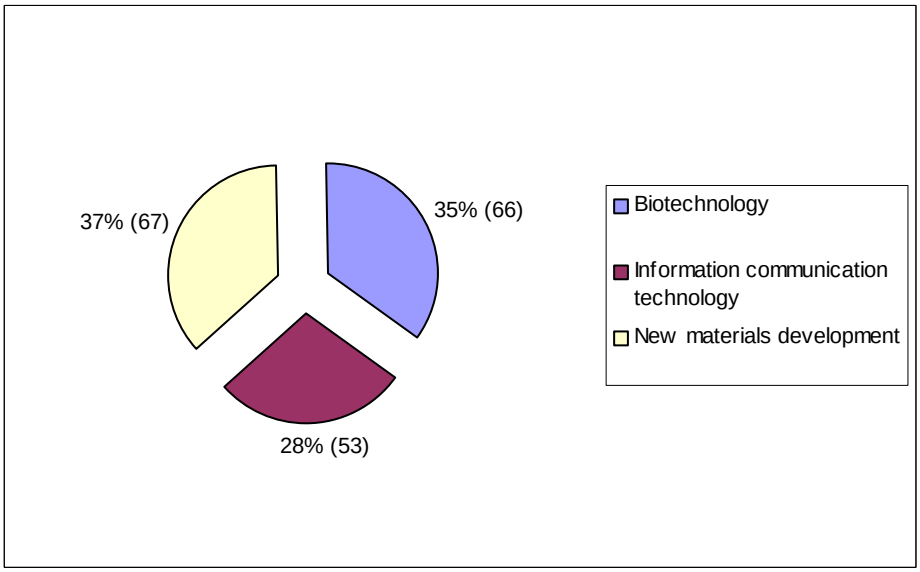


Figure 15: Total projects for the Innovation Fund compared by the three critical technological bands

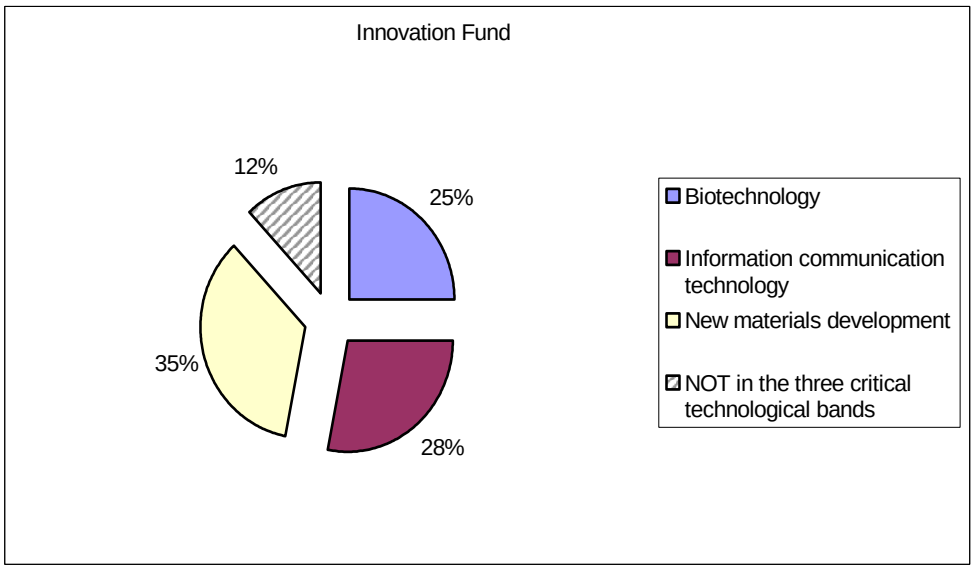
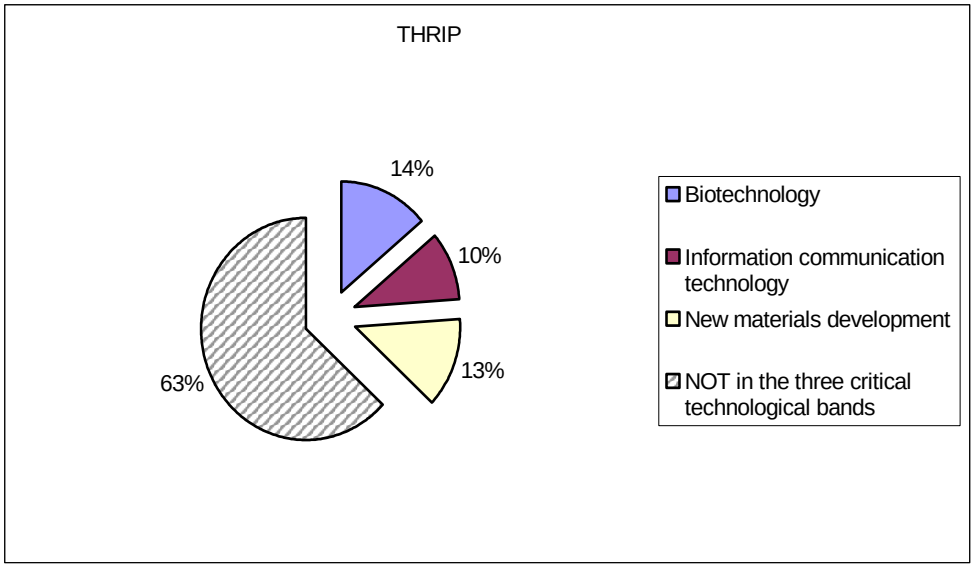


Figure 16: Total projects for THRIP compared by the three critical technological bands



It must be noted that this data does not provide an evaluative assessment of the extent to which THRIP and the Innovation Fund contribute to the three critical technological bands identified for this study. Chapters 3 and 4 indicated that while THRIP funds projects across thirteen technological focus bands, the Innovation Fund focuses predominantly on the three technological fields of ICT, new materials development and biotechnology. This is supported by a comparison between the figures which show that 25% of Innovation Fund projects are in the field of biotechnology, compared with 14% of THRIP projects; 28% of Innovation Fund projects fall into the ICT band, compared with a smaller 10% of THRIP projects and 35% of the Innovation Fund projects are related to new materials development, compared with a smaller 13% in

THRIP (Fig 15 and Fig 16). A comparison of the total numbers of projects show that THRIP funds, overall, more projects in biotechnology, ICT and new materials development than the Innovation Fund.

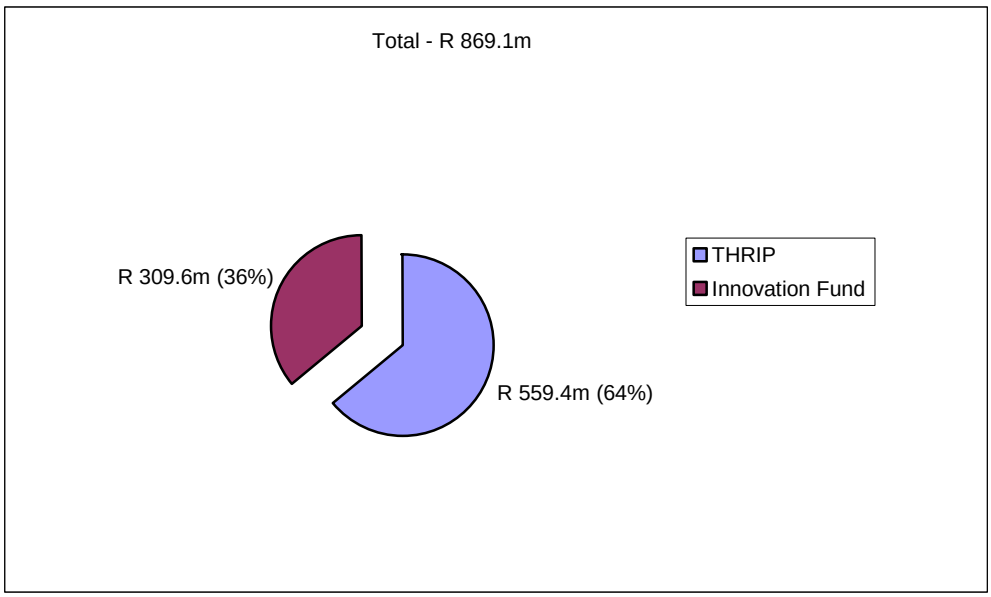
This chapter has shown that THRIP and the Innovation Fund make a marked contribution to incentivising higher education-industry linkages in the three technological bands as well as in other technological areas. The degree and extent of this contribution can only be measured against the total population of HE-industry partnerships in South Africa and is outside the scope of this study.

6

PARTNERSHIP EXPENDITURE

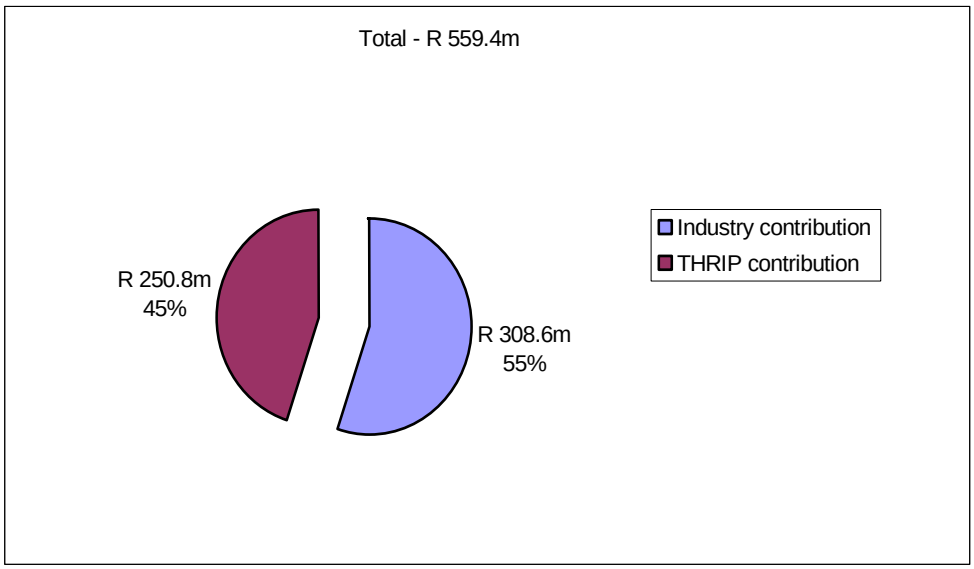
A total of R869.1 million was spent by THRIP and the Innovation Fund on HEI/SETI-industry linkages in the period under review. THRIP expenditure amounts to R559.4 million (64%) and Innovation Fund expenditure to R309.6 million (36%) (Fig 17). THRIP expenditure is divided between state expenditure and industry contributions. Industry contributions account for 55% (R308.6 million) of total THRIP expenditure (Fig 18).

Figure 17: Total expenditure by THRIP and the Innovation Fund[9]



[9] Expenditure for THRIP refers to projects funded in 2000/01. The budget allocations for five projects for the Innovation Fund (Project ID: 11101, 11103, 11115, 12101, 12113) was not reflected on the Internet site used as the primary source for this information. As such the Innovation Fund budget excludes these project budgets. (See methodology for further information on the Innovation Fund projects and the methods used to extract information.)

Figure 18: Total THRIP expenditure by industry and THRIP contribution



6.1 EXPENDITURE BY THE THREE CRITICAL TECHNOLOGICAL BANDS

Expenditure across the three technological bands comprises 54% (R466.8 million) of total THRIP and Innovation Fund expenditure. The remaining 46% (R402.3 million) is designated to projects that do not fall within the three bands (Fig 19). Since 54% of all THRIP and Innovation Fund projects are in the three bands, this implies that projects in these areas collectively account for a higher ratio of expenditure than projects not in these bands.

In the Innovation Fund, the vast majority of funding (98%) is allocated to projects within the three bands. New materials development receives a slightly higher proportion of the overall allocations (Fig 20). THRIP, in comparison, allocates 30% of its budget to projects within the three bands, with 12% of expenditure on projects in biotechnology, 10% in ICT and 8% in new materials development (Fig 21).

The average cost of projects falling within the three bands is evident in Figure 24, where all projects in the three bands fall above the average project costs, as compared to projects not in these bands. Figure 25 illustrates that the costs of Innovation Fund projects in the three bands are all slightly higher than the average, with biotechnology projects costing R1.2 million more than the average, ICT costing just R300 000 above the average and new materials development R600 000 above the average. Projects not in the three bands have considerably lower costs than the overall average. Figure 26 reviews the average costs per project area for THRIP. In this case, both biotechnology and new materials development costs are below the average, and ICT costs on the average. Projects that are not in the three bands, however, are fixed at slightly above the average, in contrast with the Innovation Fund.

Figure 19: Expenditure for the three technological bands

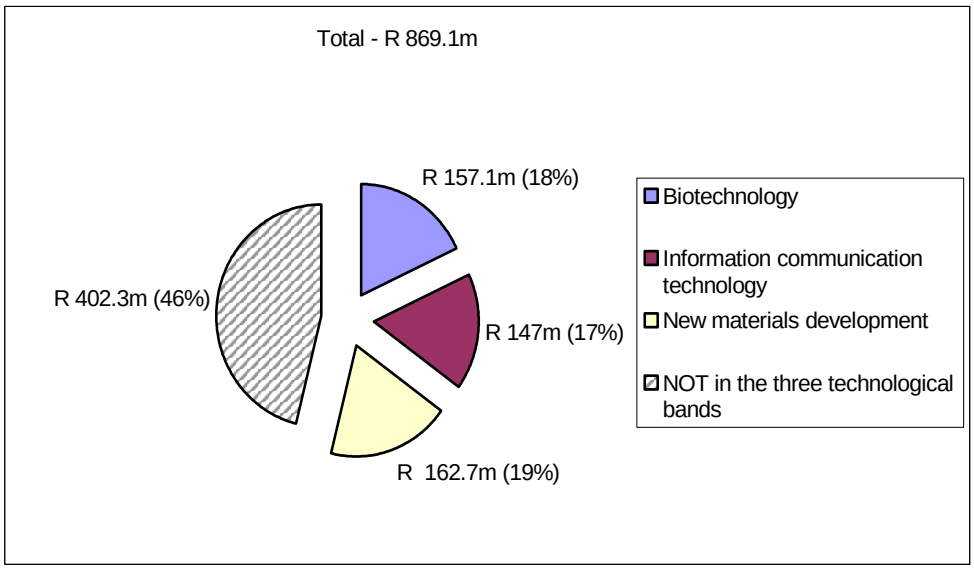


Figure 20: Expenditure for the three technological bands for Innovation Fund projects

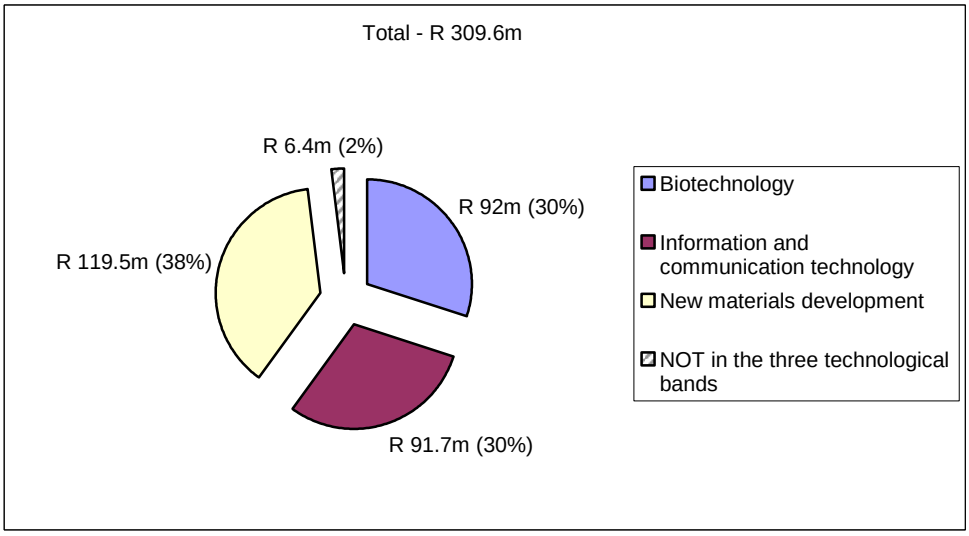
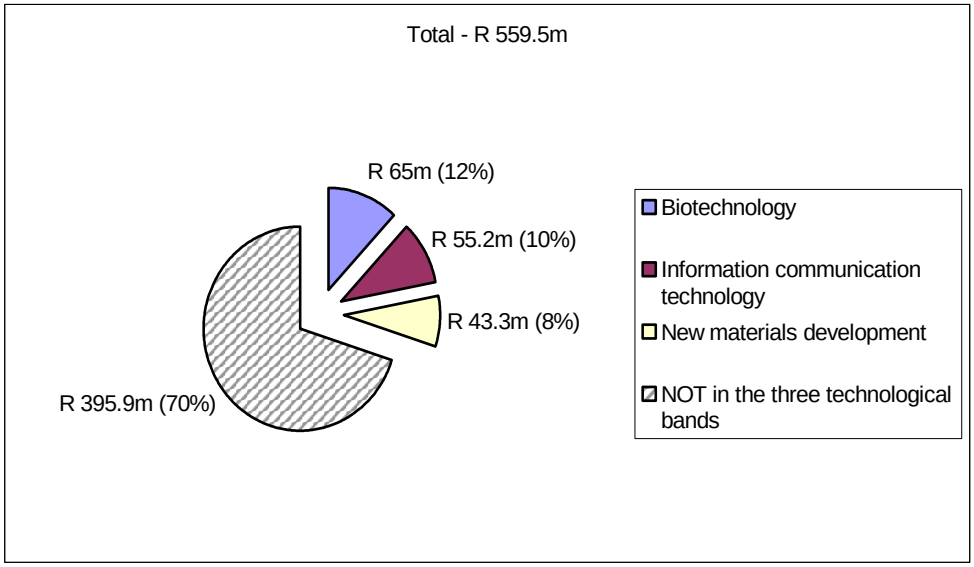


Figure 21: Expenditure for the three technological bands for THRIP-funded projects



6.2 AVERAGE EXPENDITURE BY PROJECT

The average expenditure per project for THRIP projects is R1.5 million, while the average expenditure for Innovation Fund projects is R5.4 million per year (Fig 22). As noted previously, the Innovation Fund targets larger projects with a minimum value of R1 million per year. In terms of lowest and highest expenditure per project, the lowest funded project by the Innovation Fund totals R1.6 million, whereas the lowest funded THRIP project is significantly lower, at R200 000 (Fig 23). Interestingly, THRIP's highest funded project totals R20.7 million, as compared to R14.5 million funded by the Innovation Fund.

Figure 27 provides the highest and lowest expenditure per project for THRIP and Innovation Fund projects by technological band. The figure illustrates that the most costly project falls within the ICT band (R14.5 million), followed by a biotechnology project (R13.9 million) and a new materials development project (R12 million). The variations between the bands by highest and lowest project expenditure do not vary significantly overall.

Figure 28 provides the highest and lowest expenditure per project for the Innovation Fund, where an ICT project cost is the highest, followed by a materials development project and a biotechnology project. The lowest expenditure per project are all above R1 million, in line with the Innovation Fund's policy to target larger projects for funding. Figure 29 provides the same information for THRIP projects. The highest ICT project expenditure is significantly lower than that of the Innovation Fund and is also lower than THRIP's highest project expenditure in the other technological bands. Also in contrast to the Innovation Fund, THRIP's highest project expenditure falls outside of the three bands and is R20.7 million, which is considerably higher than any of the HSRC band projects.

Figure 22: Average cost per project for the Innovation Fund and THRIP

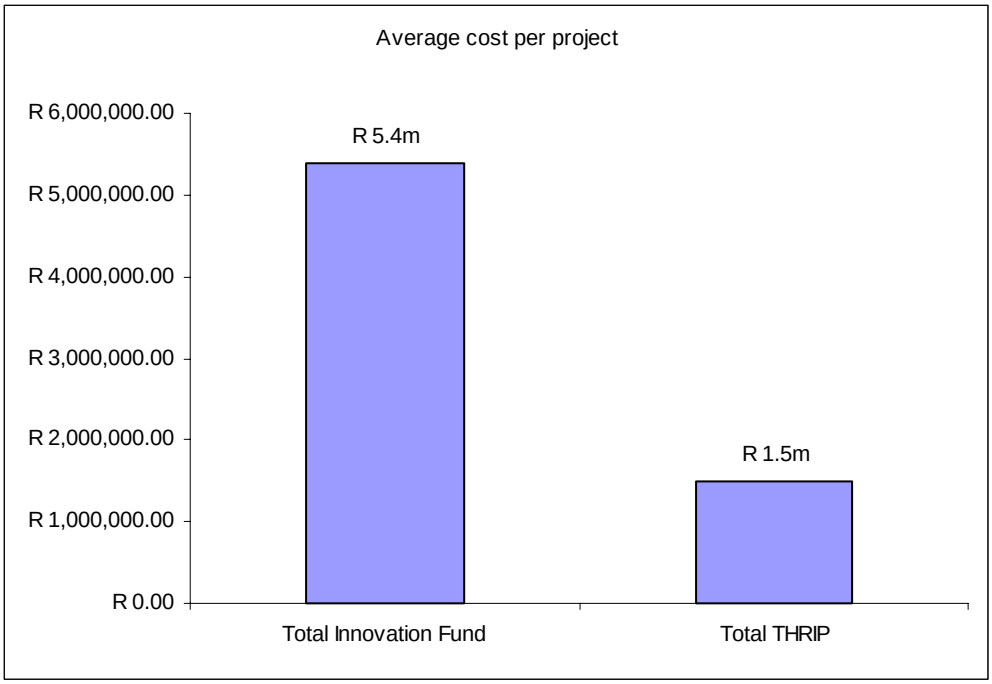


Figure 23: Funding by project by lowest and highest funded project

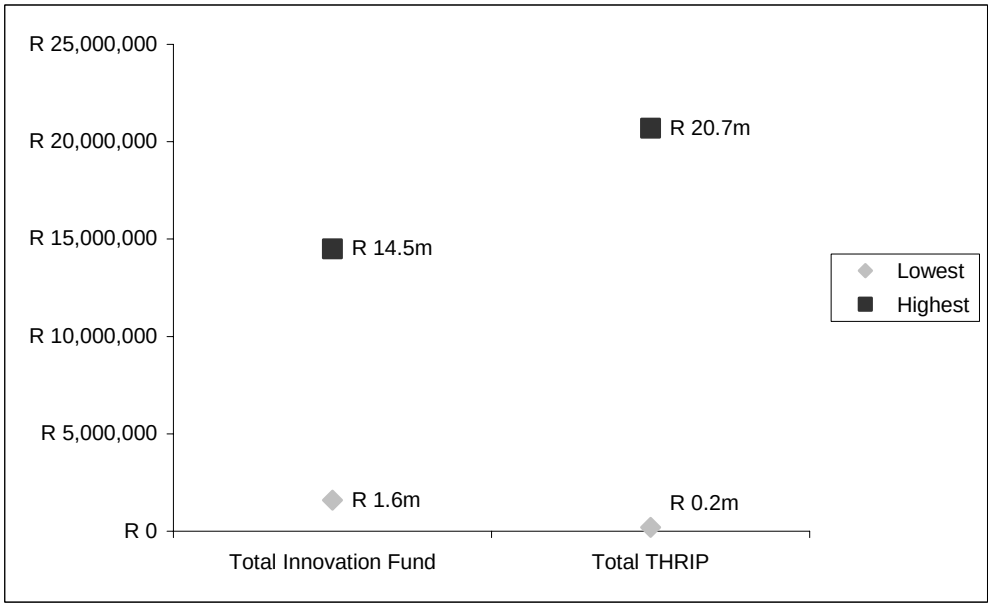


Figure 24: Average cost per project for the three technological bands

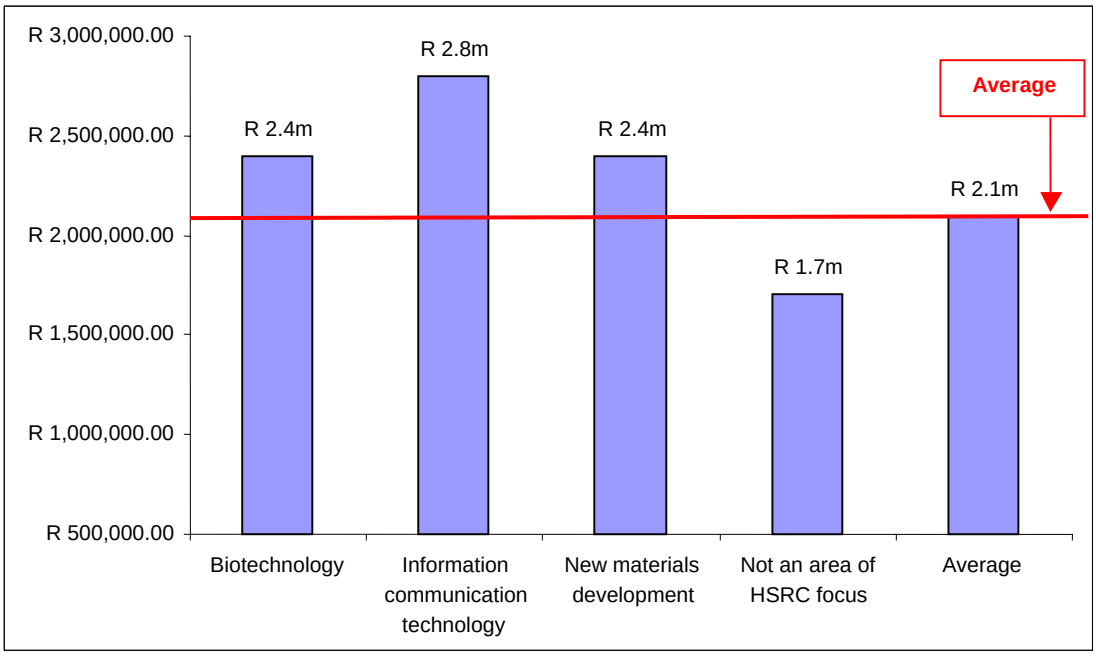


Figure 25: Average cost per project for the three technological bands for Innovation Fund-funded projects

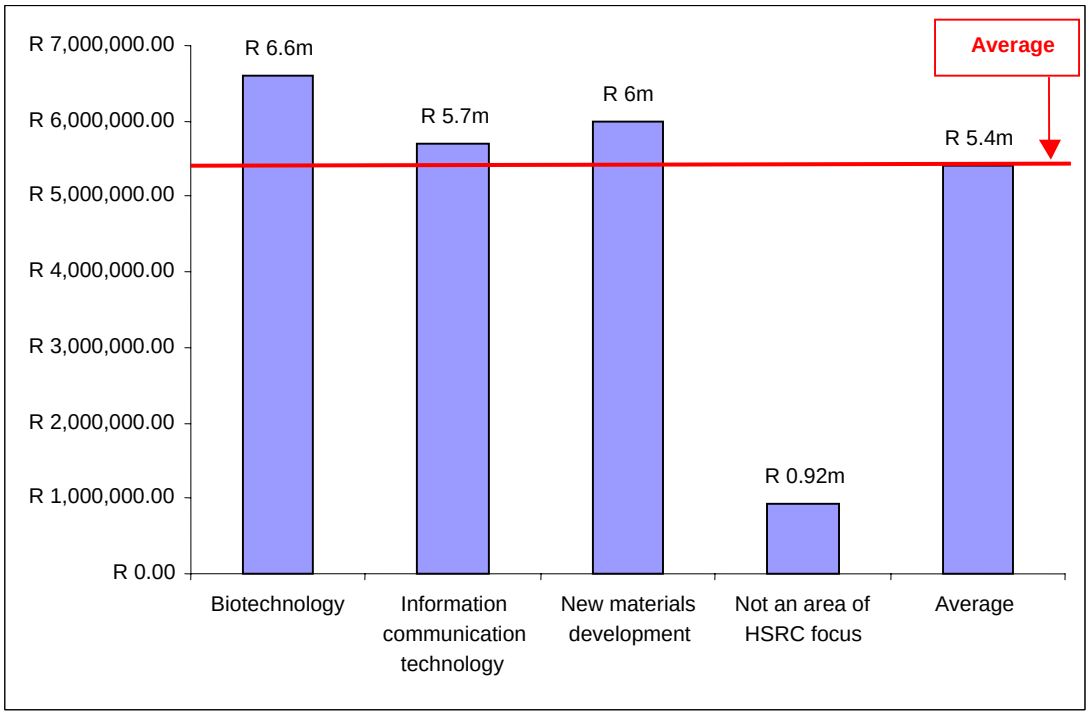


Figure 26: Average cost per project for the three technological bands for THRIP-funded projects

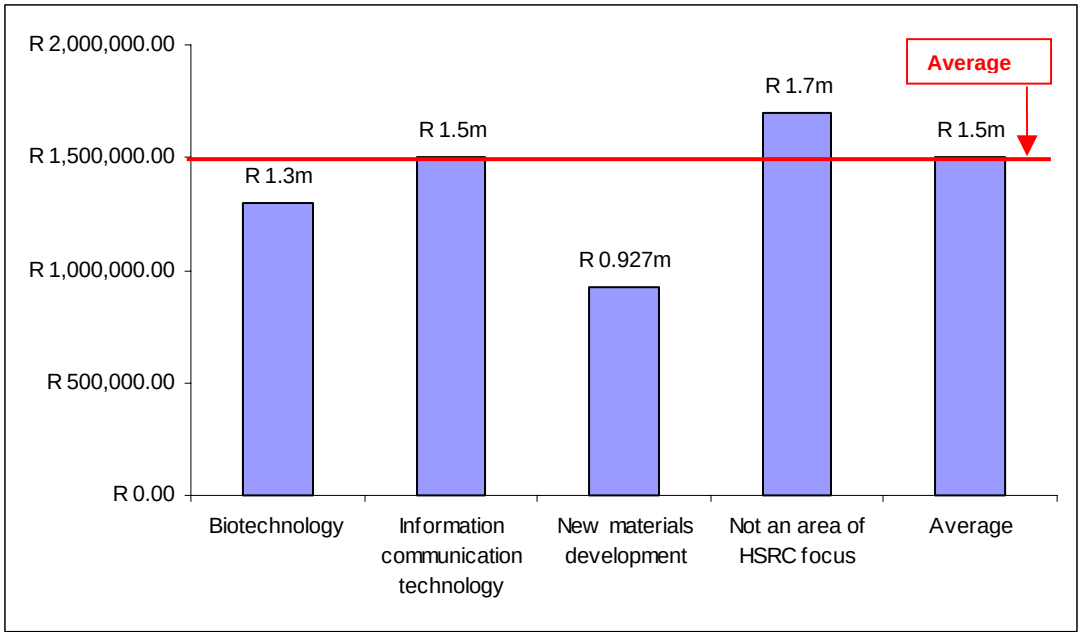


Figure 27: Highest and lowest cost by project for THRIP and the Innovation Fund together

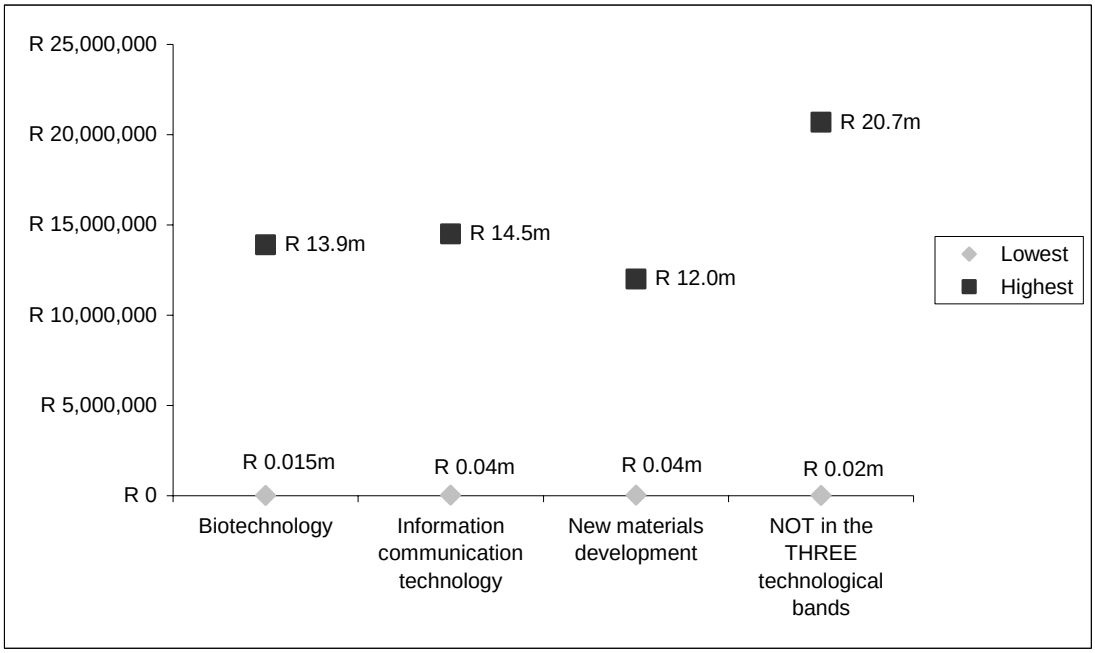


Figure 28: Highest and lowest cost by project for the Innovation Fund

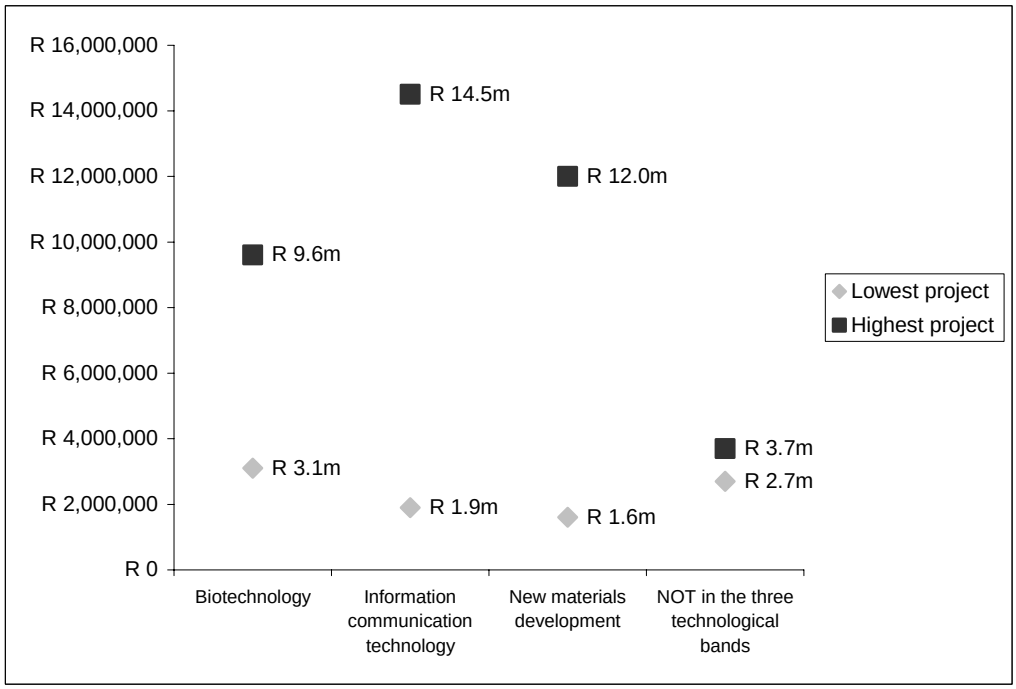
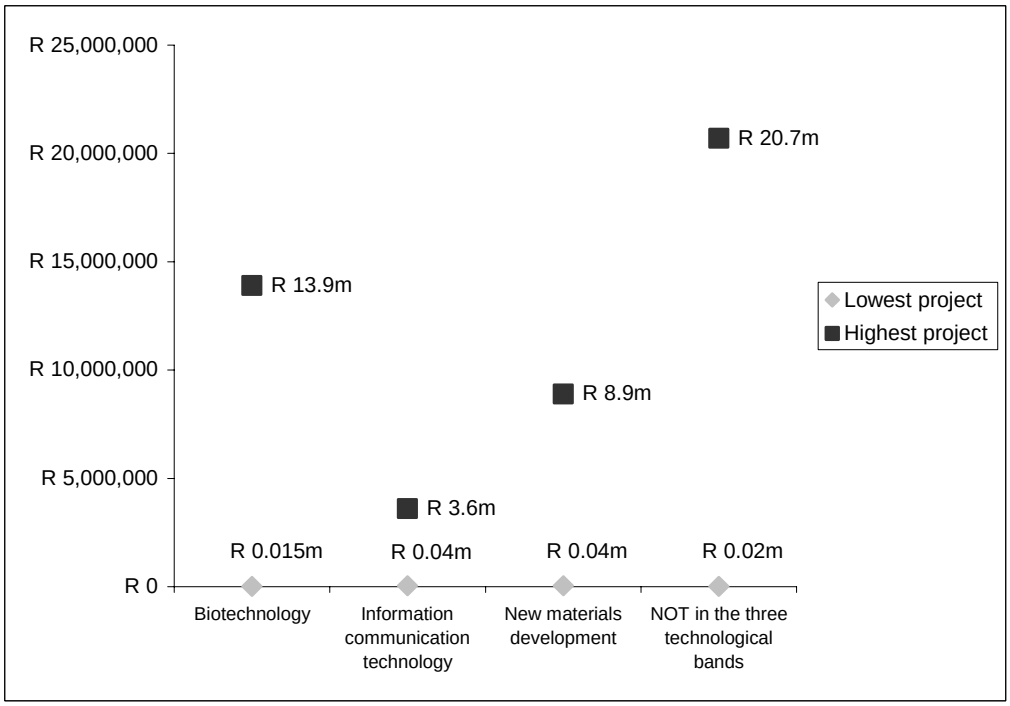


Figure 29: Highest and lowest cost by project for THRIP



6.3 AVERAGE EXPENDITURE BY HEI/SETI[10]

The expenditure by institutional type was calculated by allocating the full grant to what THRIP terms the grant holder (or the grant-holding institution) and to what the Innovation Fund terms the project co-ordinator (project co-ordinating institution). In this sense, the expenditure does not necessarily reflect the real income to these institutions as many of these institutions work collaboratively and in partnership with other institutions. In the absence of a detailed audit of each project in which the actual income to each institution can be calculated, the figures presented in this section were analysed to indicate the income to grant-holding institutions for THRIP and co-ordinating institutions for the Innovation Fund.

Figure 30 illustrates that total expenditure by institutional type is biased towards universities (59%), followed by SETIs (37%) and by technikons to a significantly lesser degree (4%). Figure 31 illustrates that THRIP funding is heavily biased towards universities (75%), with a smaller proportion being allocated to SETIs (19%) and technikons (6%). As shown in Figure 32, Innovation Fund expenditure, by contrast, is largely directed to SETIs (72%), followed by universities (28%). None of the funding to date for the Innovation Fund has been linked to technikons.

Figure 30: Expenditure by institutional type

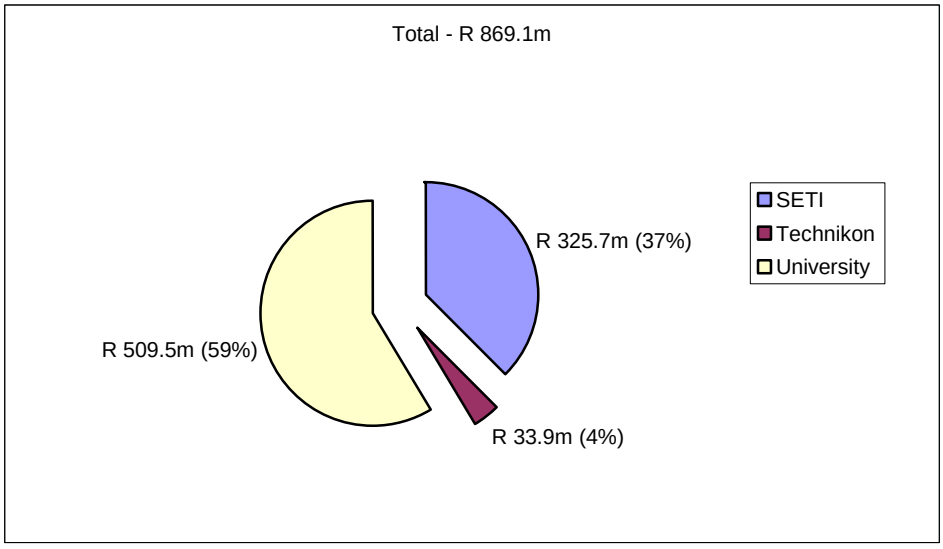


Figure 33 illustrates the expenditure for each HE institution involved in a partnership funded by THRIP or the Innovation Fund. Figure 33a reviews the distribution of funding across the 23 institutions indicated in Figure 33. As illustrated, there are only a small number of institutions (4) that are awarded up to 75% of the total funding. Figure 33 shows that the Universities of Stellenbosch, Cape Town, Pretoria and Potchefstroom

[10] Please note that the category SETI is used to refer predominantly to SETIs, but in the case of Innovation Fund projects also includes research units and other research organisations.

are awarded this 75%. The remaining funding is distributed across the remaining 19 institutions. Technikons (both historically advantaged and historically disadvantaged combined) are responsible for only 6% of the total expenditure. Historically black universities (HBUs) are responsible for a total of only 4% of the expenditure.

Figure 31: Expenditure by institutional type for THRIP-funded projects

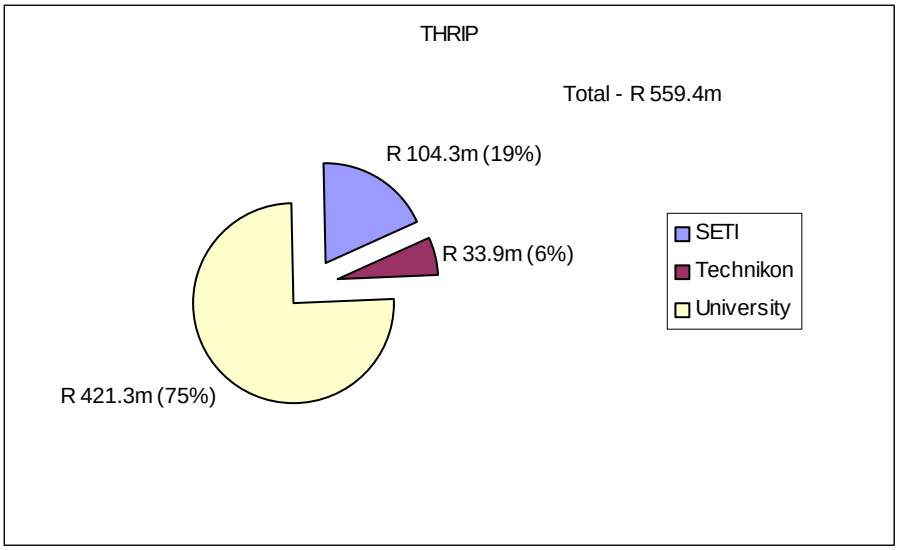


Figure 32: Expenditure by institutional type for Innovation Fund projects

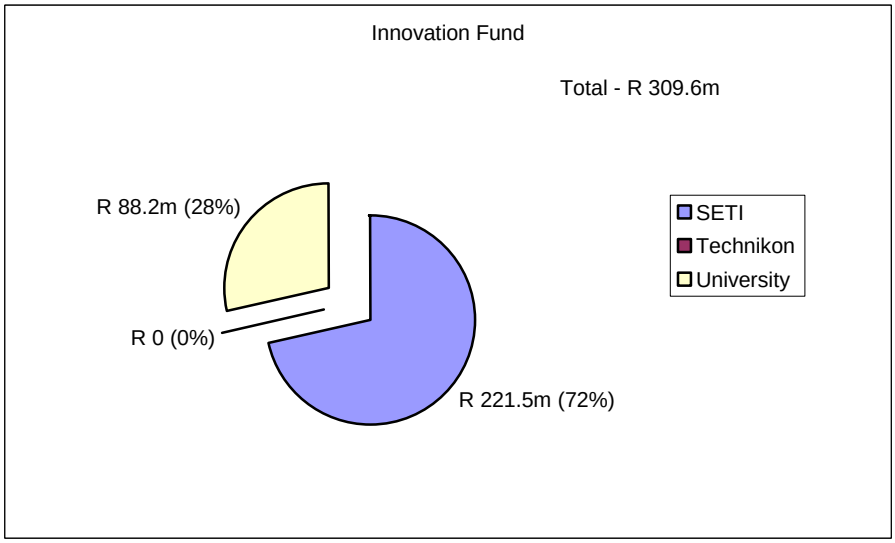


Figure 33: Expenditure by HEI – for THRIP and Innovation Fund projects together

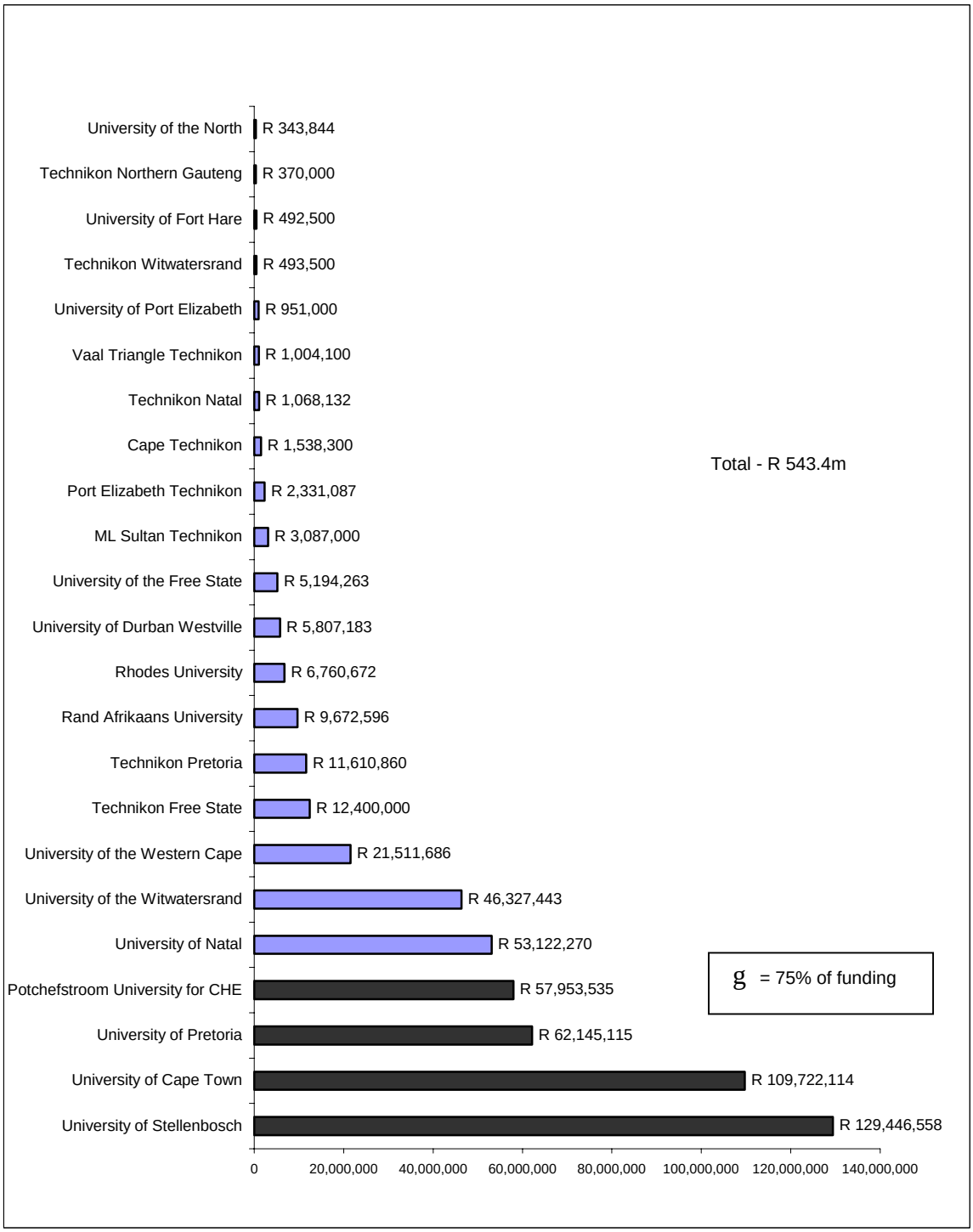


Figure 33a: Distribution of funding across institutions for THRIP and the Innovation Fund

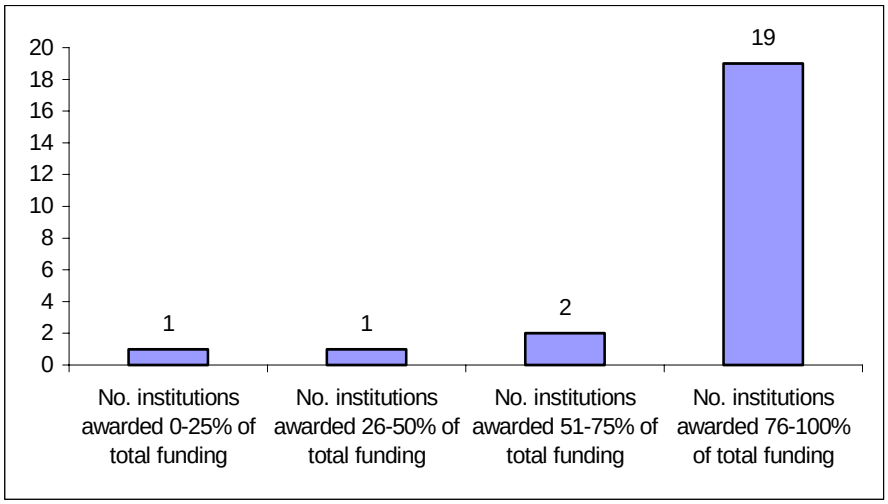


Figure 34 provides expenditure per institution for THRIP. As illustrated, five historically white universities account for a total of 75% of THRIP expenditure. In a THRIP *Evaluation Report* (DTI, 1997), THRIP acknowledges that the vast majority of its funding is located within a small number of historically white universities (HWUs) and comments that 'differing participation rates no doubt reflect a range of factors, such as the mix of disciplines within HE institutions, research traditions and attitudes towards working with industry'. At the time of the evaluation report in 1997 there were no THRIP allocations to historically black universities (HBUs), a factor which has changed over the period since 1997. A calculation based on Figure 34 on page 54 reveals that for projects funded in 2001/2002, 6% of total THRIP expenditure was allocated to historically black universities.

Figure 34a: Distribution of funding across institutions for THRIP

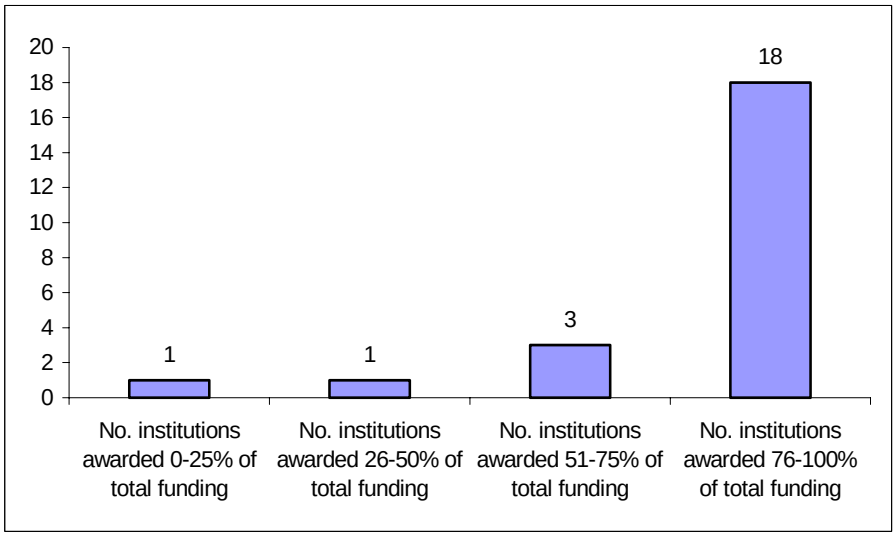


Figure 34: Expenditure by HEI – for THRIP projects

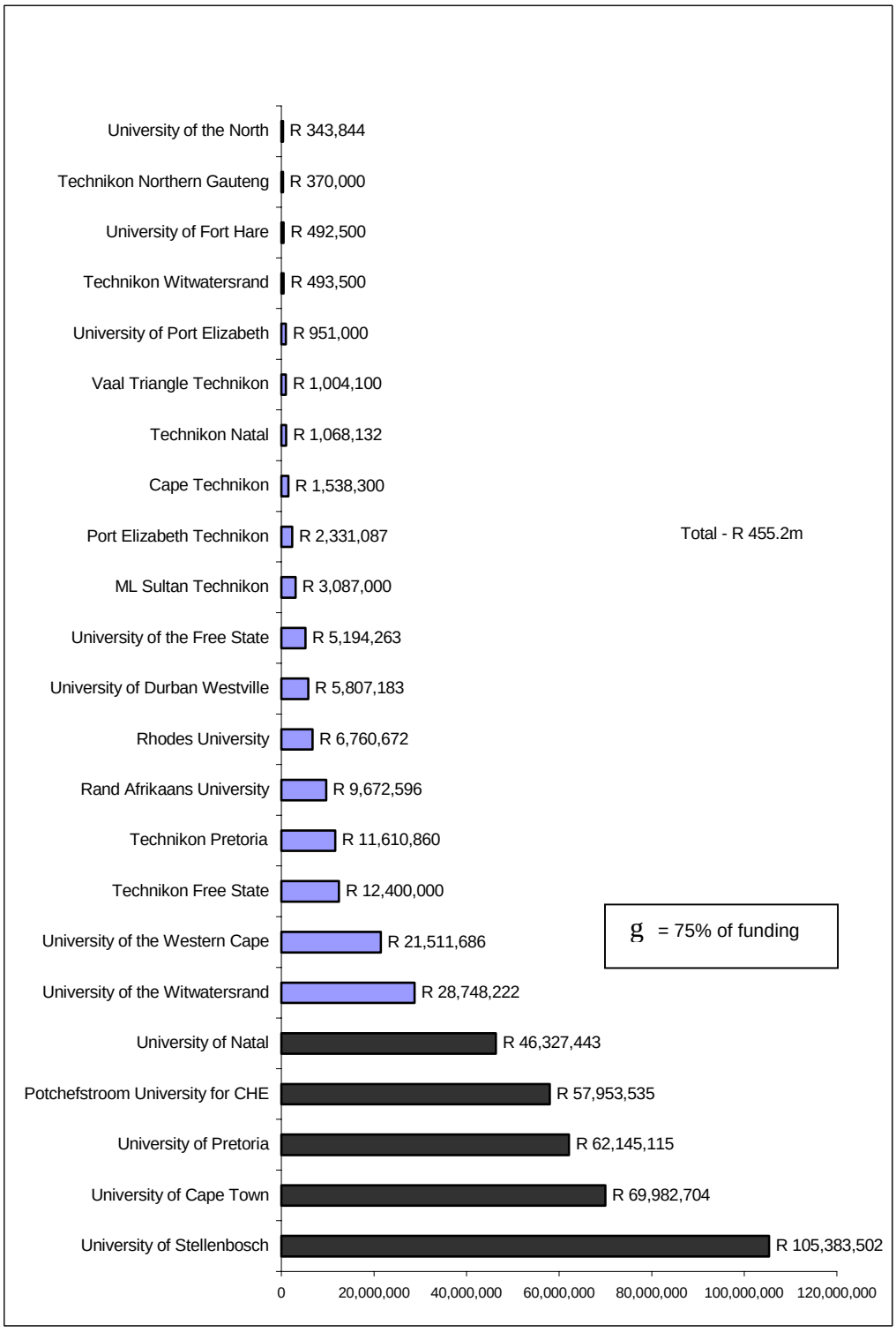
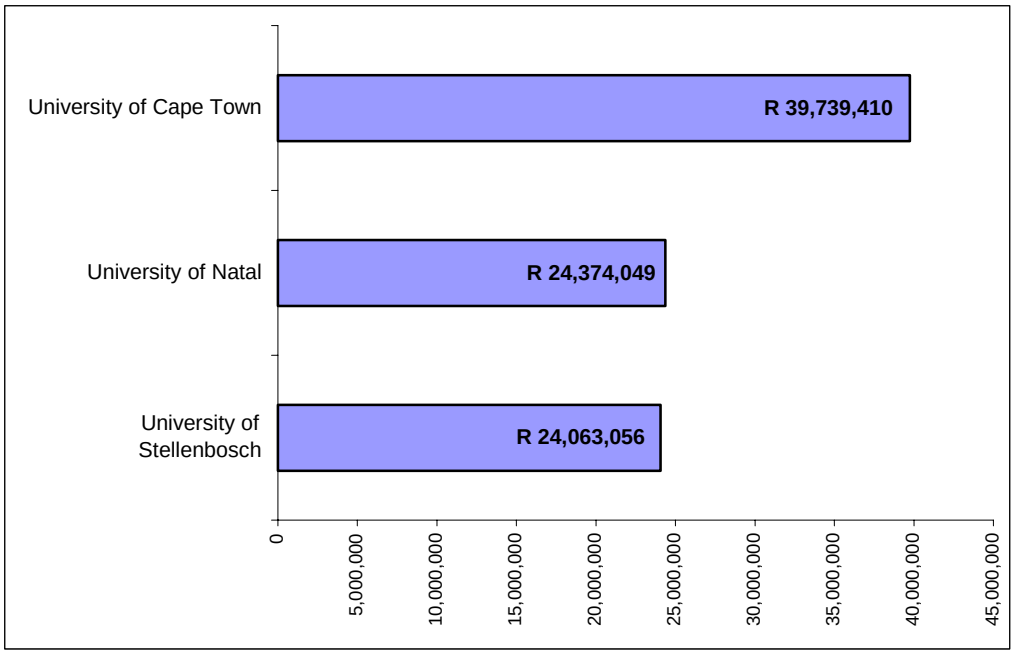


Figure 35 illustrates the Innovation Fund expenditure by institution. As the figure illustrates, all Innovation Fund expenditure is located in three HWUs at present, i.e., the University of Cape Town (45%), University of Natal (27.5%) and University of Stellenbosch (27.5%).

Figure 35: Expenditure by HEI – for Innovation Fund projects



6.4 AVERAGE EXPENDITURE BY HEI/SETI AND TECHNOLOGICAL BAND

Figure 36 reviews expenditure by institutional type in the three technological bands. The figure illustrates that more than 55% of biotechnology and ICT expenditure is located in universities and most of the remaining expenditure in SETIs. Technikons do not receive much funding in either of these areas. While this is to be expected for a field such as biotechnology, which is not traditionally located at technikons, it is interesting that there is very little ICT expenditure at technikons. The majority of new materials expenditure is located in SETIs (68%), with 30% located in universities. Once again, technikons receive a very small proportion of this funding (about 2%). It is interesting to note that in the case of projects or partnerships not in any of the three bands, universities are the predominant recipients (73%), followed by SETIs (20%) and a much higher proportion of technikons (7%).

Figure 36: Expenditure by institutional type by three technological bands

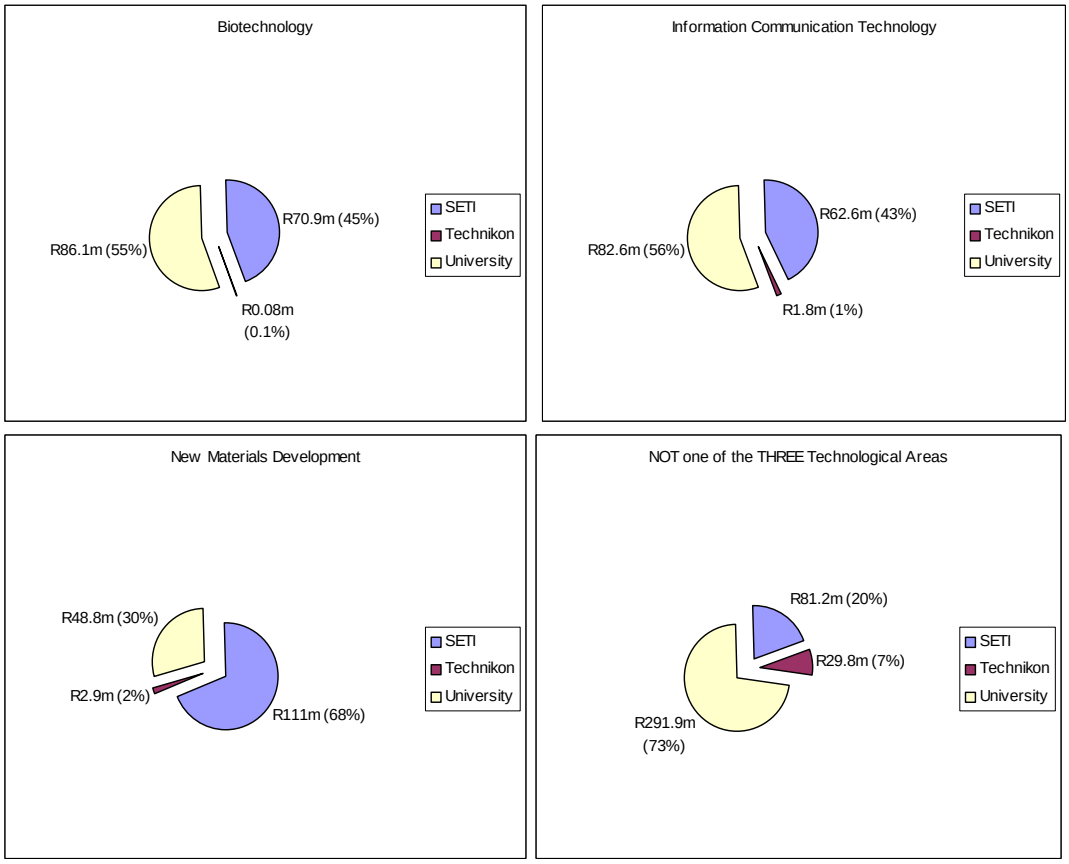


Figure 37 illustrates total expenditure for THRIP and the Innovation Fund on projects in biotechnology. Here it is interesting to note that the University of Natal, which does not form one of the top three institutions in terms of expenditure for the total figures, is the third highest recipient of funding. The University of the Western Cape, which is an historically disadvantaged institution (HDI), is responsible for approximately 9% of the expenditure in biotechnology. Figure 37a illustrates the distribution of funding by the field of biotechnology and illustrates that a total of seven institutions account for 76-100% of expenditure. No single project accounts for more than 25% of the total expenditure.

Figure 38 illustrates the expenditure for projects funded in the field of ICT. Here the Universities of Cape Town and Stellenbosch are the predominant recipients, and, along with the Universities of Potchefstroom and Natal, account for 75% of total Innovation Fund and THRIP expenditure. The three technikons, Pretoria, Witwatersrand and ML Sultan, account for 17% of the total expenditure in ICT (compared to 0.1% to technikons in the field of biotechnology). In addition, up to 5% of the total expenditure is attributed to the three HDIs, the University of the Western Cape, the University of Durban-Westville and Fort Hare University.

Figure 37: Expenditure by HEI – for projects funded in the area of biotechnology

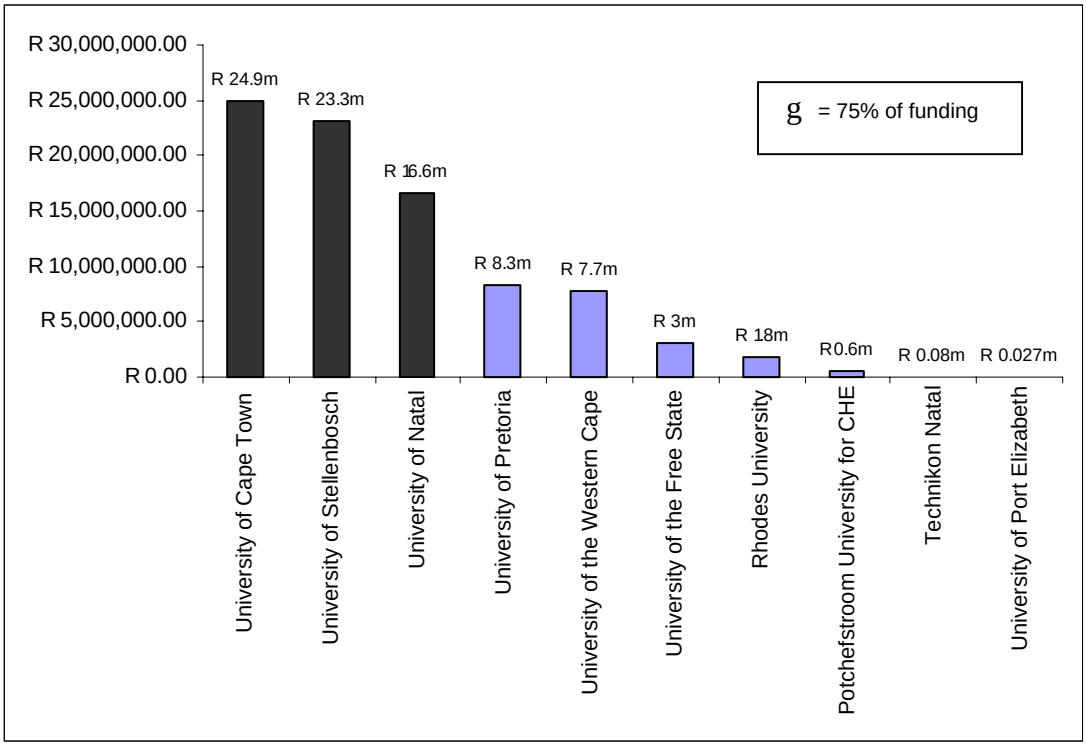


Figure 37a: Distribution of funds by technological areas across institutions

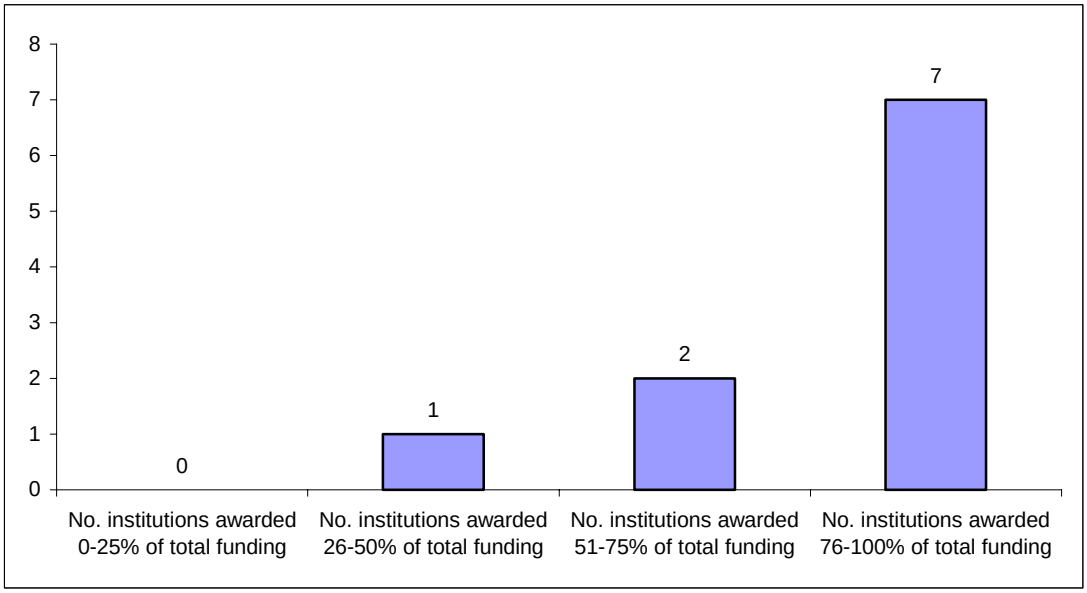


Figure 38a illustrates that seven institutions account for 76-100% of the expenditure in ICT and as in the case with biotechnology, no single ICT project or partnerships accounts for 25% or more of the total funding.

Figure 38: Expenditure by HEI – for projects funded in the area of ICT

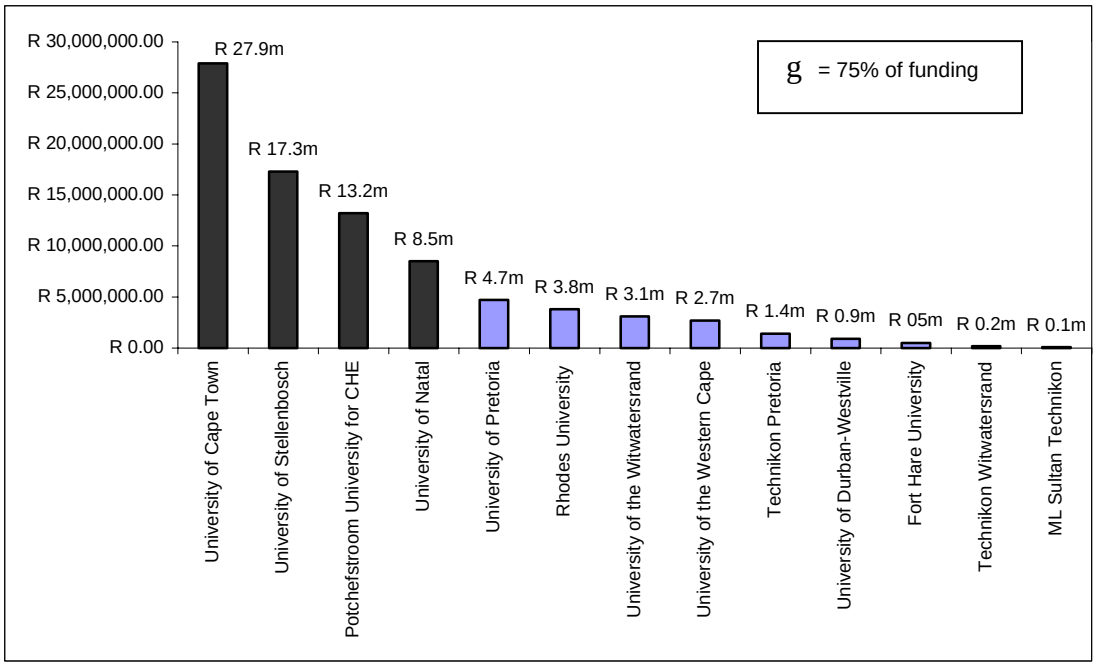


Figure 38a: Distribution of funds by technological areas across institutions

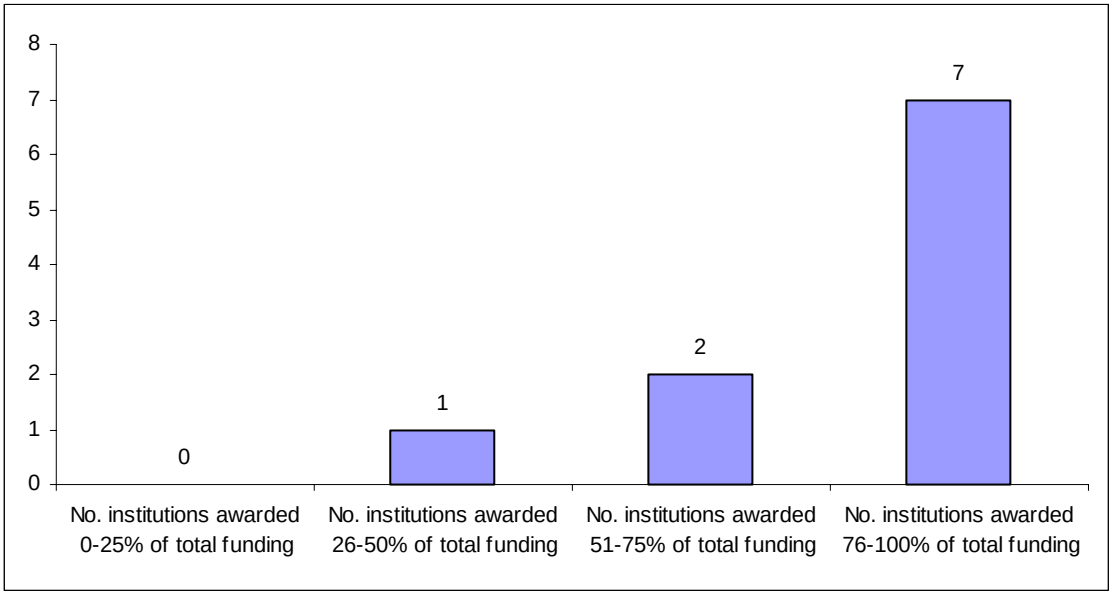


Figure 39 reviews expenditure by HE institutions in the field of new materials development. Here the University of the Witwatersrand is the major recipient, followed by the University of Stellenbosch. The University of the Witwatersrand is not accountable for any expenditure in the field of biotechnology and only a small proportion in the field of ICT. Technikons are responsible for 4% of total expenditure in new materials development and HDIs for less than 1% in the field. Figure 39a illustrates that 13 of the total 15 institutions are responsible for 76-100% of the total expenditure in new materials development and, once again, no institution is responsible for 25% or more of the total expenditure.

Figure 39: Expenditure by HEI – for projects funded in the area of new materials development

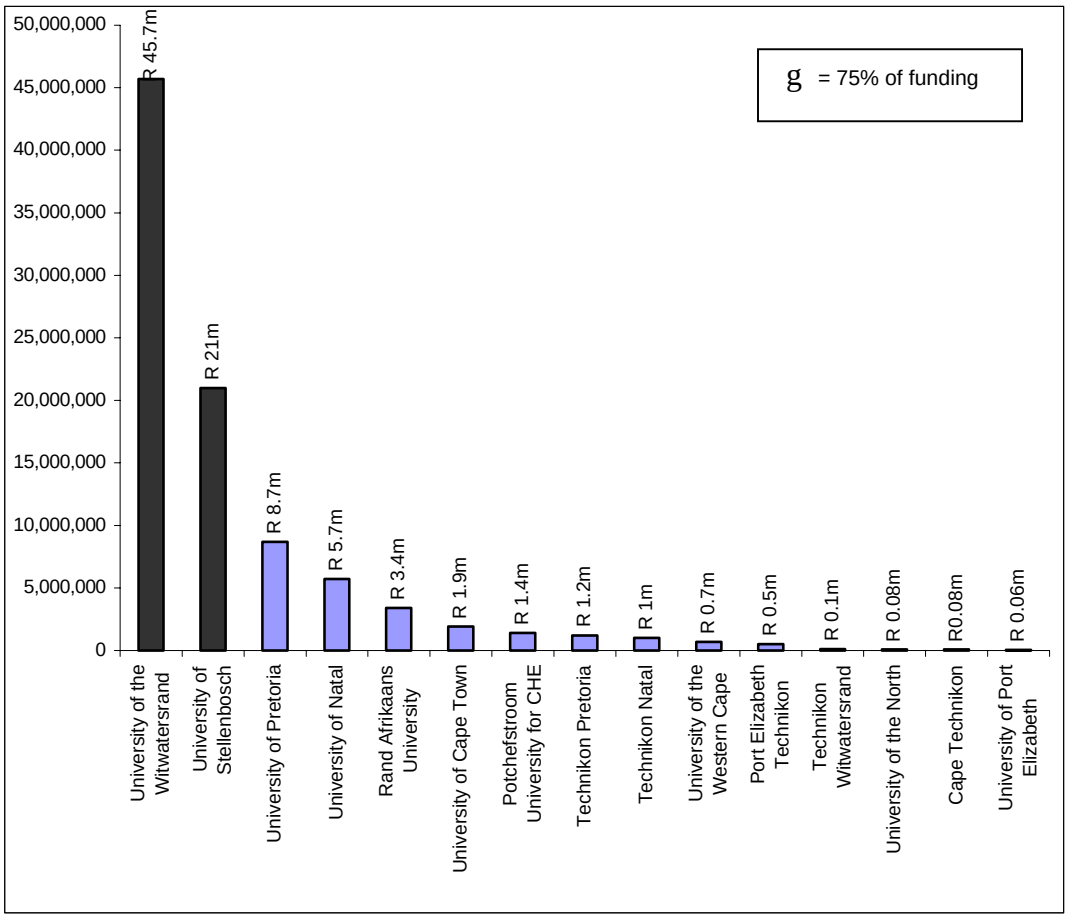
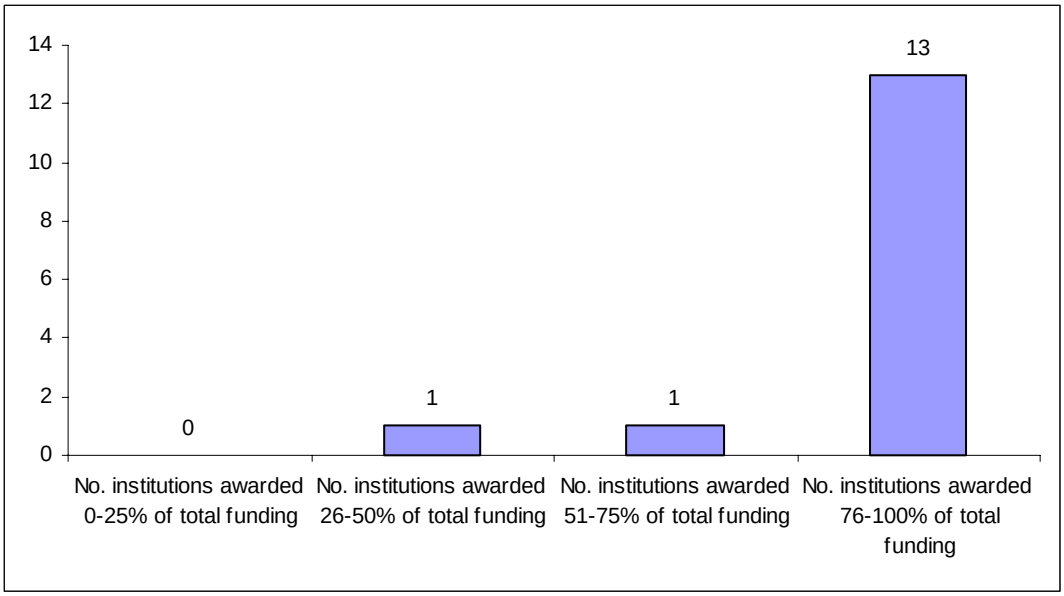


Figure 39a: Distribution of funds by technological areas across institutions



6.5 CONCLUSION

This chapter has shown that THRIP and the Innovation Fund make a marked financial contribution to incentivising higher education-industry linkages in the three technological bands, as well as in other technological areas. The degree and extent of this contribution should be measured against the total expenditure on HE institution-industry partnerships in South Africa.

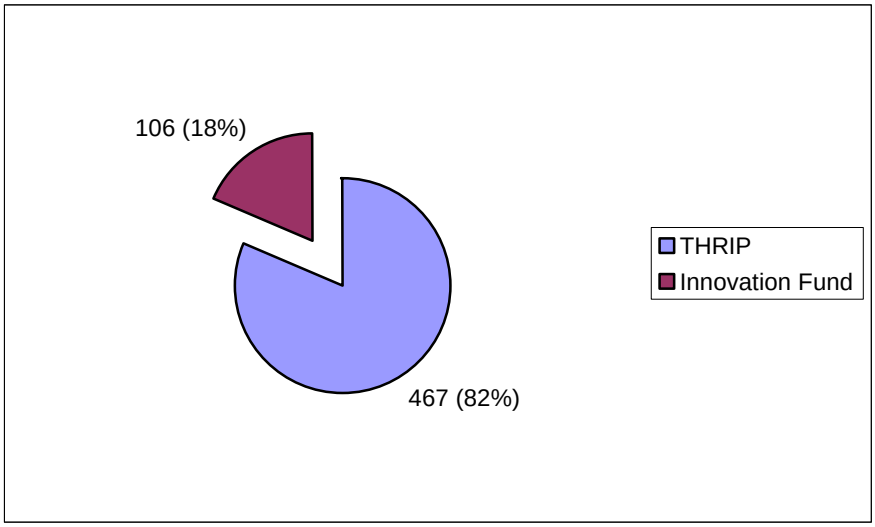
Furthermore, the chapter indicates that the financial contribution to research and development in the three critical technological bands is considerable. The degree and extent of this contribution should ideally be measured against the total research and development (R&D) expenditure in these three bands. While such analysis is not part of the scope of the study, it could serve as an important area of further investigation. The total industry contribution of R308.6 million to THRIP partnerships illustrates the large investment being made by industry into these projects. It also provides an indicator of the contribution of industry to R&D in the three technological bands.

7

THE INDUSTRY PARTNERS

The 423 THRIP and Innovation Fund projects involve 573 industry partners. Of this total, 82% (467) are linked to THRIP projects and 18% (106) to Innovation Fund projects (Fig 40). It must be noted that THRIP requires industry partner participation on each project as part of its project criteria, possibly accounting for the high number of industry partners for THRIP projects.

Figure 40: Total industry partners[11]



7.1 INDUSTRY PARTNERS IN THE THREE TECHNOLOGICAL BANDS

For THRIP and the Innovation Fund combined, 49% of the partners are located in the three bands and 51% in areas not the subject of investigation in this study. Approximately 18% of the industry partners participate in the biotechnology band; 18% in new materials development band and 13% in ICT (Fig 41).

[11] Note that THRIP defines 'industry partner' as a company that is registered. Holding companies and subsidiary companies were counted (applying this principle) as individual companies in their own right. For example, Mondi Forests and Mondi Ltd were considered as two separate companies. Three companies were involved in both THRIP and Innovation Fund projects. For the purposes of this analysis the three companies were double counted. It is important to note that in some instances there are more than one partner per partnership/project.

Of the total number of partners (including those not in the three bands) involved in THRIP projects, 18% are located in the field of new materials development, 14% in biotechnology and 10% in ICT (Fig 42). For the Innovation Fund, 41% of the industry partners are involved in biotechnology projects, 28% in ICT projects and 19% in the field of new materials development (Fig 43).

Figure 41: Total industry partners by industry technological bands[12]

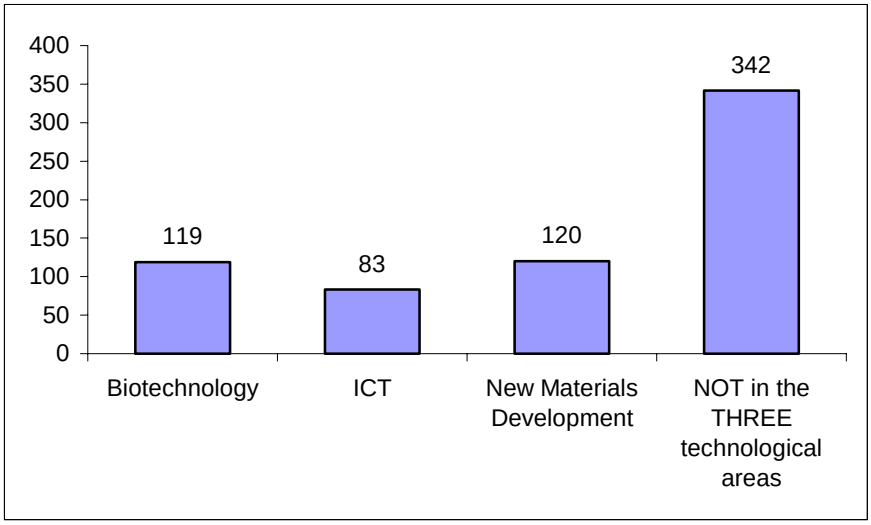
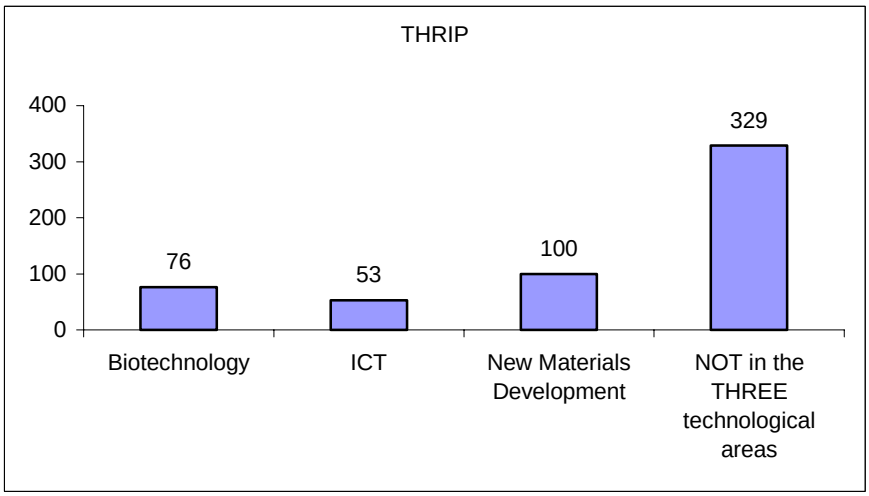
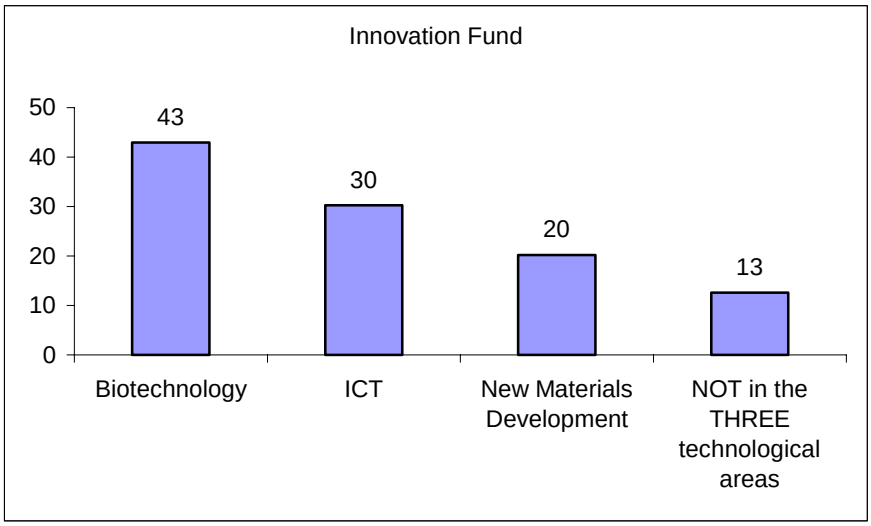


Figure 42: Total industry partners by industry technological bands for THRIP



[12] Note that some companies were involved in more than one technological area. Therefore, the total for this graph does not add up to 573 partners. This is especially the case for companies participating in THRIP projects.

Figure 43: Total industry partners by industry technological bands for the Innovation Fund

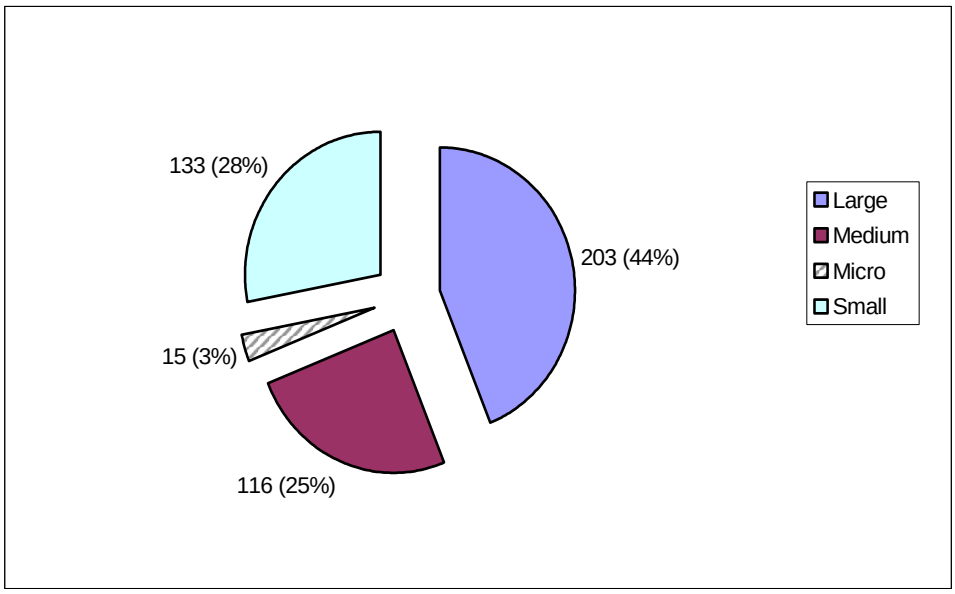


7.2 INDUSTRY PARTNERS BY SIZE[13]

The highest proportion of industry partners for THRIP are large enterprises (44%), followed by small enterprises (28%) and medium enterprises (25%). Only 3% are micro enterprises (Fig 44). These figures must be seen against the backdrop of THRIP placing significant emphasis on promoting SMME participation in partnerships and contributing R1:R1 (instead of R1:R2) in projects where only SMMEs invest financially. These figures suggest high SMME participation in research and development programmes with South African HE institutions. While the highest proportion of enterprises are large, the high number of small and medium enterprises needs to be acknowledged. Closer analysis indicates that most of the small and micro enterprises (with the exception of two cases) are involved in collaborative relationships with large enterprises in establishing and managing these higher education-industry partnerships.

[13] Industry size was provided by the THRIP database and by Innovation Fund Higher Education beneficiaries surveyed.

Figure 44: Industry partners by size[14]



The majority of industry partners in the biotechnology band are medium enterprises (49%), followed by large enterprises (34%) and a significantly smaller proportion of small (12%) and micro (5%) enterprises (Fig 44a). ICT industry partners are predominantly either large (42%) or small (40%) enterprises, followed by a smaller proportion of medium enterprises (18%) and no micro enterprises (Fig 44b). This mirrors enterprise size across the ICT sector, characterised by large national and multi-national enterprises and large numbers of smaller local enterprises. Almost half of the partner enterprises involved in new materials development projects are large enterprises. Medium and small enterprises are also represented (21% and 23% respectively) and a relatively high percentage (7%) of micro enterprises are involved (Figure 44c).

[14] These graphs exclude enterprises participating in Innovation Fund programmes as the numbers were too small to disaggregate with any degree of validity to this level.

Figure 44a: Industry partners by size – biotechnology

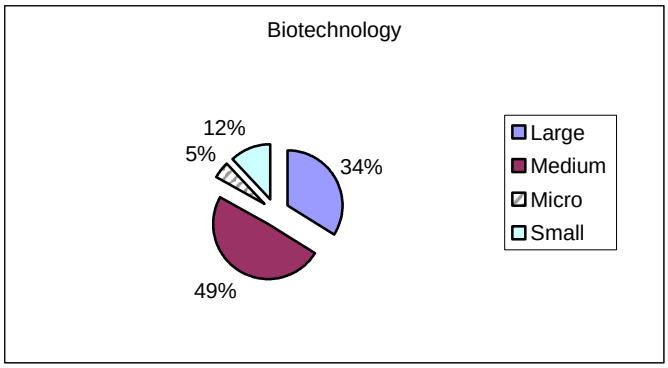


Figure 44b: Industry partners by size – ICT

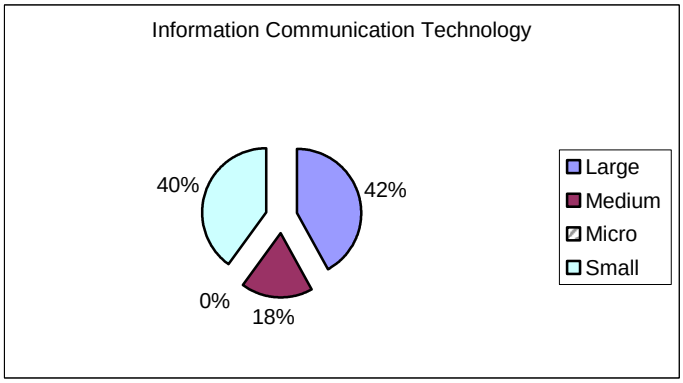
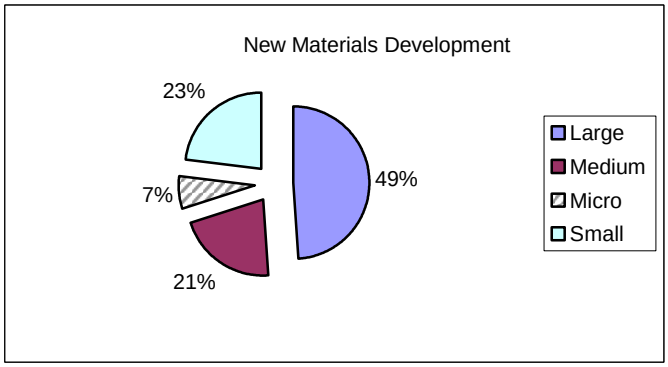


Figure 44c: Industry partners by size – new materials development



7.3 REASONS WHY INDUSTRY HAS PARTNERSHIPS WITH HE INSTITUTIONS

Industry respondents surveyed indicated (against a set of prescribed options) the reasons why their enterprise developed a partnership or partnerships with HE institutions. Contrary to expectations, items relating to financial gain and increased

profitability did not rank as the top two motivations for the relationship with HE institutions. The top two priorities relate to the issues of accessing research technology and research expertise not available within the company/industry but available at HE institutions.

Financial gain only ranks third, at the same level as ensuring equity in the enterprise's workforce through the training of black and female students in technological areas. Added technological value, sustained technological innovation and human resource development also rank highly. Factors appearing at the lower end of the ranking include the factors relating to direct industry gain such as tax rebates, company marketing and improved understanding amongst staff (Fig 45).

Industry respondents were then asked (in an open question) to indicate the perceived benefits of the relationship with HE institutions to their own enterprises and to the HE institutions. Industry perceptions of the benefits of the relationship to their own enterprises may be summed up in terms of three reasons, and are best illustrated in the following quotations:

Competitiveness and technological gain through research and development

'We have become a leader in our technology in South Africa within four years. Our product is of a high standard and we have gained international visibility through publications and exports';

'It permits increased capacity for industry related research and human resource development. It results in a broadening of research expertise, collaborations and synergy';

'It increases finance available for research, more competitive research and a better chance of products coming out of research';

'The linkage with higher education is important for our reputation and the development of advantage in our own particular market';

'Joint research links company strength with HE institution research expertise in biotechnology. As a technically oriented company, we wish to interact with HE institutions understanding leading-edge technology'.

Human resource development and employment opportunities

'[Company X] has limited R&D capacity and needs all the help it can get to advance technologically. We would like there to be a good pool of competent mining practitioners that we can employ or use as consultants';

'The relationship results in the development of specific skills that would otherwise have not been possible or would have been too costly. It helps gain access to suitably qualified previously disadvantaged personnel';

'[It exposes us] to top quality students for possible future employment at the enterprise. We have the knowledge to make an informed decision about students' abilities';

‘It permits growth in terms of offering a service to South African industry, which would normally be sought abroad. It helps us to train and educate manpower at a high level, especially trainees from technikons’.

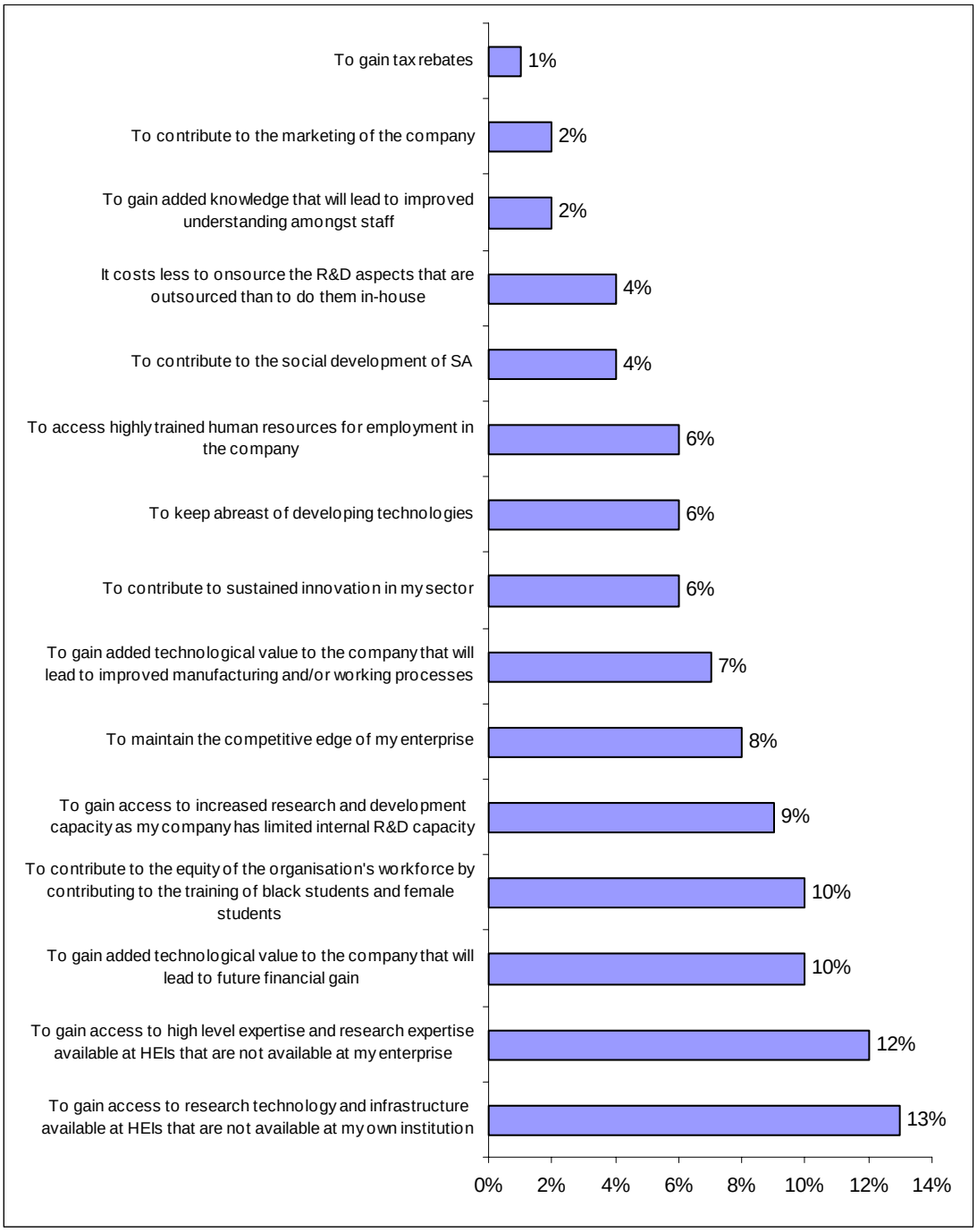
Benefits in terms of outputs of the relationship

‘Around 150 000 South Africans will be able to participate in gene therapy for retinal blinding conditions such as *Retinitis Pigmentosa*. [The research will] ensure that the genetic mutations causing retinal disease in all South African sufferers is identified timeously and that all have access to therapy’;

‘Crucial information on the safety of the potable water that my enterprise produces is obtained. It also fills a gap in our monitoring programme, as this type of technical expertise is not locally available’.

These perceptions suggest that industry beneficiaries have a strategic understanding of the possibilities of partnering and networks.

Figure 45: Reasons why industry has relationships with HEIs



7.4 NUMBER OF ENTERPRISES INVOLVED IN PROJECTS

The majority of THRIP and Innovation Fund projects involve more than one company and there are at least two projects where a total of 20 or more companies are involved (Fig 46).

THRIP has more companies involved per project than the Innovation Fund, probably as a result of the fact that THRIP places special emphasis on encouraging numerous partners to participate on each project and is willing to fund projects R1:R1 in cases where more than one industry partner is involved and where the second highest industry contribution is at least 10% of the highest industry contribution (Fig 47). All Innovation Fund projects have at least one or more industry partners per project, but there are no instances in which more than five industry partners are involved in any one project (Fig 48).

Figure 46: Number of companies involved in each project

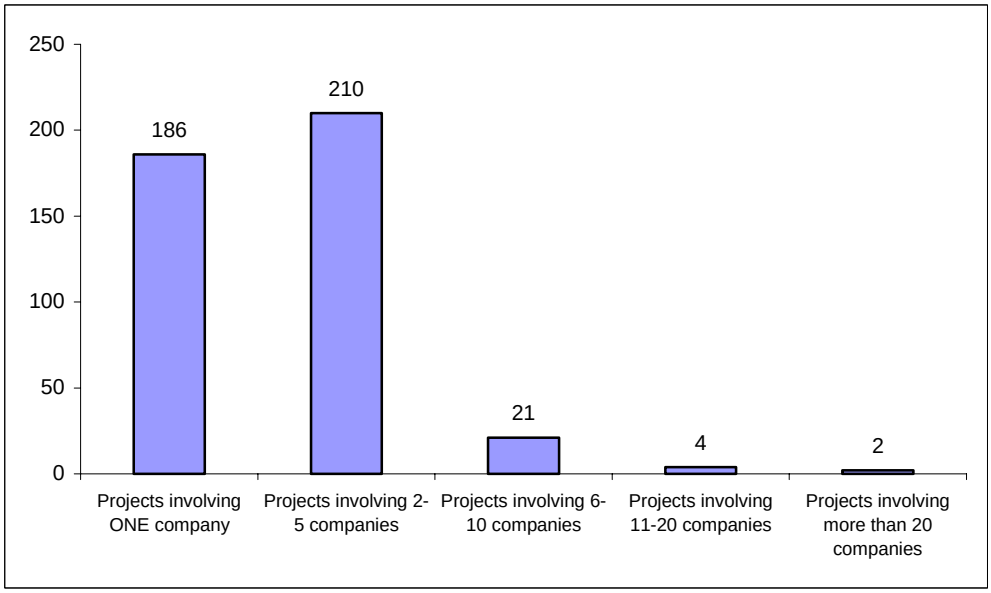


Figure 47: Number of companies involved in each project for THRIP

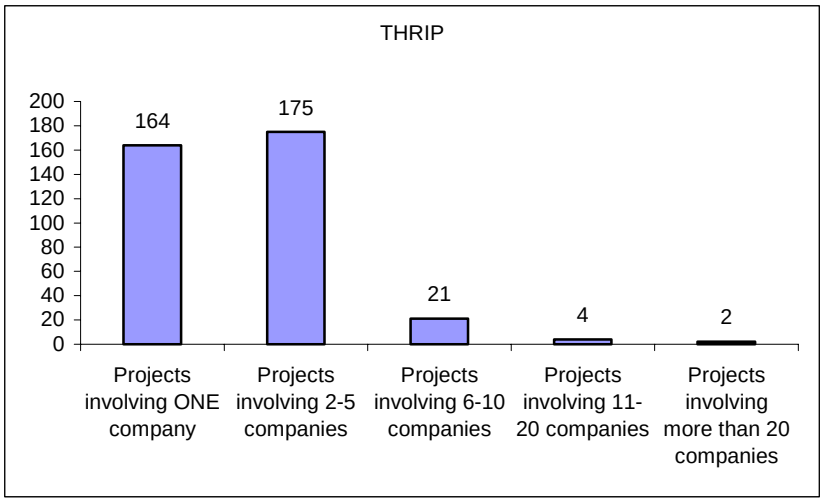
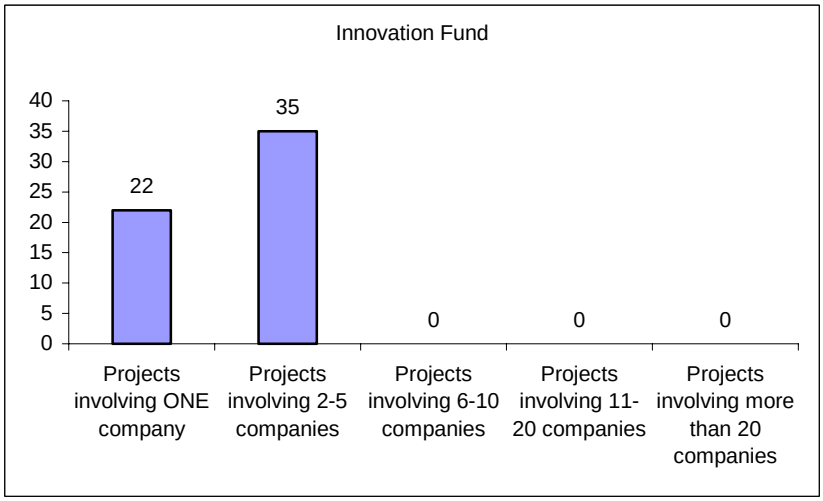


Figure 48: Number of companies involved in each project for the Innovation Fund



These findings provide strong evidence of Castells' (1996) notion of firms collaborating together to contribute to future competitiveness. Figure 52 provides an analysis of the type of companies that industry partners, in THRIP and Innovation Fund projects, are collaborating with. It shows that 46% of the industry partners reported that they had a previous relationship with the enterprise/s concerned and 42% reported that the relationship was based on the partner being involved in the same technological field (Fig 52). Only 12% of the respondents reported that they selected the partners specifically on the basis that they were not in the same technological field, so as to avoid direct competition. Data suggests that firms are collaborating, even with their competitors. It also suggests that firms have recognised that working in partnership with other enterprises can enhance rather than detract from the development of much needed cutting-edge technology.

7.5 NUMBER OF PROJECTS PER ENTERPRISE

The majority of enterprises are involved in one project and a high proportion are involved in between 2 and 5 projects. At least two enterprises are involved in a high total of 20 or more projects (Fig 49).

As with the total figures, most THRIP-industry partners are involved in one project but a high proportion are also involved in 2 to 5 projects at any one time. At least five enterprises are involved in up to 20 projects and 2 enterprises in even more than 20 projects (Fig 50). In the case of the Innovation Fund, almost all of the industry partners are linked to one project, with only two enterprises involved in between 2 and 5 projects (Fig 51).

This points to interesting questions about why certain companies have such a high level of participation in THRIP and Innovation Fund projects.

7.6 TOTAL NUMBER OF INDIVIDUALS INVOLVED FROM INDUSTRY PARTNERS

A total of 982 industry-based individuals are involved as either researchers/subject matter experts or as non-research staff in the 423 projects discussed here (Fig 53). This is an indicator of the high level of commitment to the partnerships on the part of industry.

A total of 841 of these are researchers or subject matter experts involved in the THRIP and Innovation Fund projects. Only seven companies (10%) indicated that there were no staff contributing at this level. Three companies indicated that they have at least 50 or more research/subject matter expert staff members involved in a partnership, indicating a high commitment of human resources to the project. At least 46% (32) of the companies have between two and five staff members working on the partnership project (Fig 54).

A total of 141 individuals are involved in THRIP or Innovation Fund partnerships at an administrative or non-research level from industry. This is also a significant indicator of commitment to the success of the projects outside of the research process itself and implies industry contributions to project management and communication (Fig 55).

Figure 49: Number of projects that companies are involved with

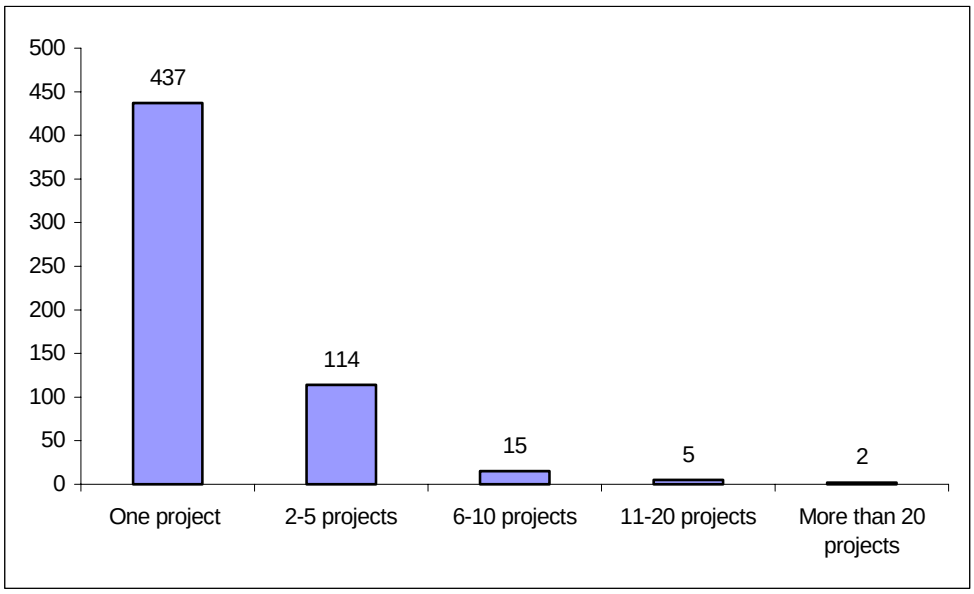


Figure 50: Number of projects that companies are involved with for THRIP

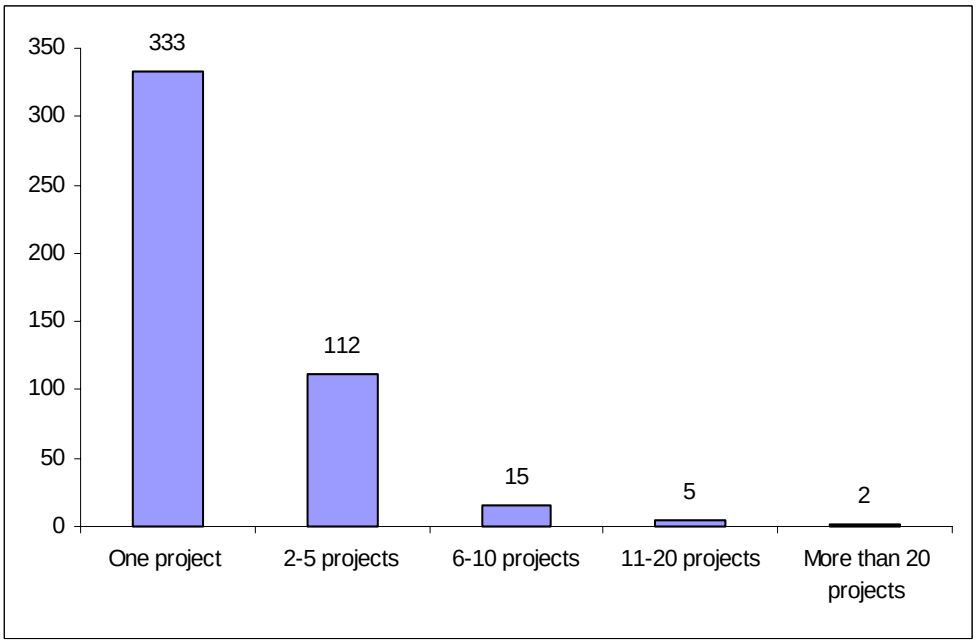


Figure 51: Number of projects that companies are involved with for the Innovation Fund

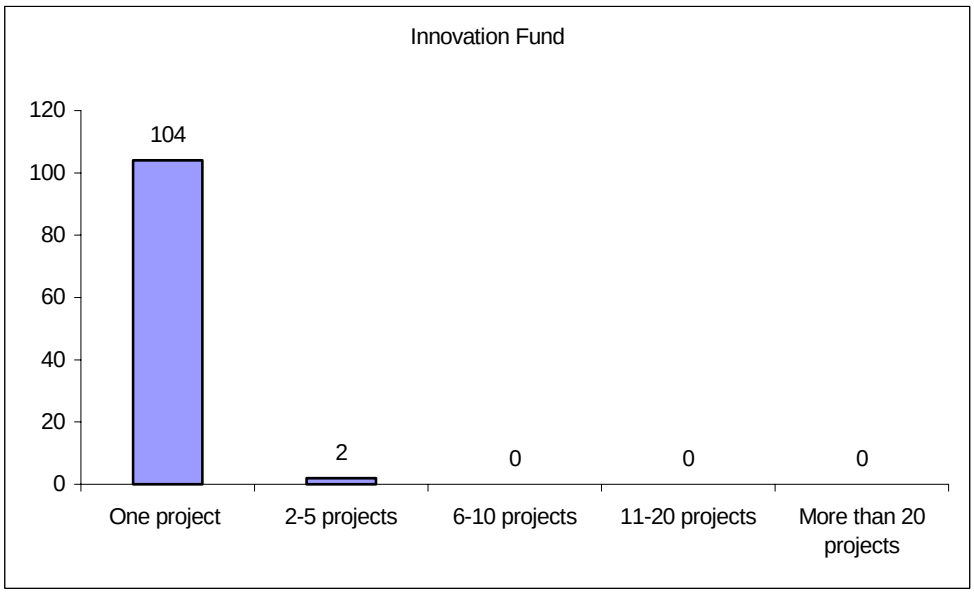
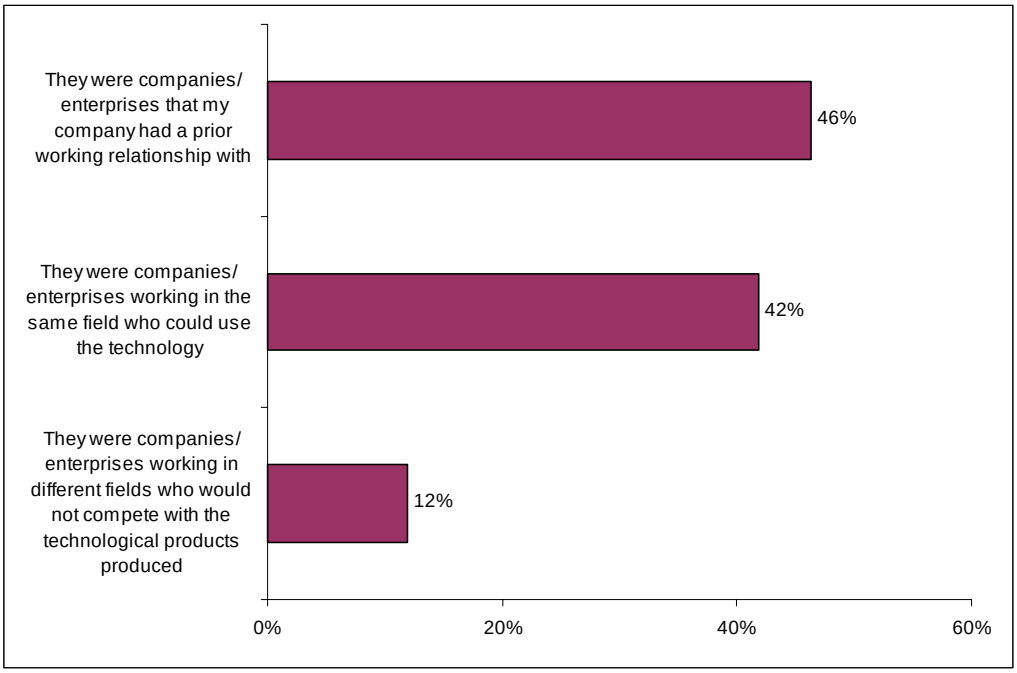


Figure 52: Motives for selecting the companies that they work with[15]



[15] Note that this data relates to the 49% of returned questionnaires that indicated they did select other industry partners. The remaining 51% indicated that they did not select other industry partners. In these instances, the HEI was most probably responsible for the selection of the participating partners.

Figure 53: Staff from industry involved in partnerships

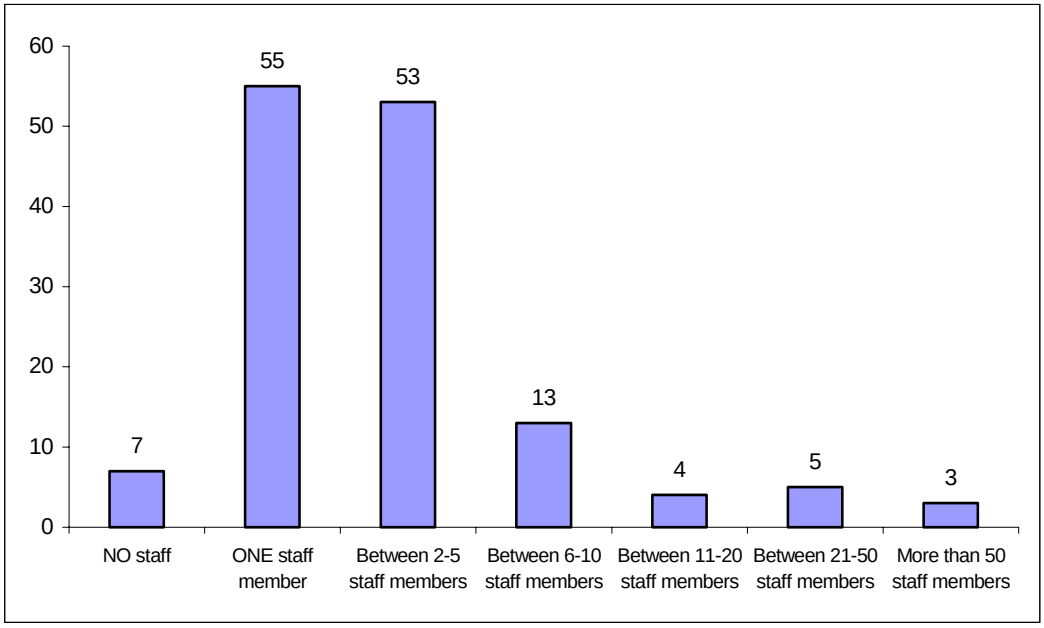


Figure 54: Researchers/subject matter experts from industry involved in partnerships

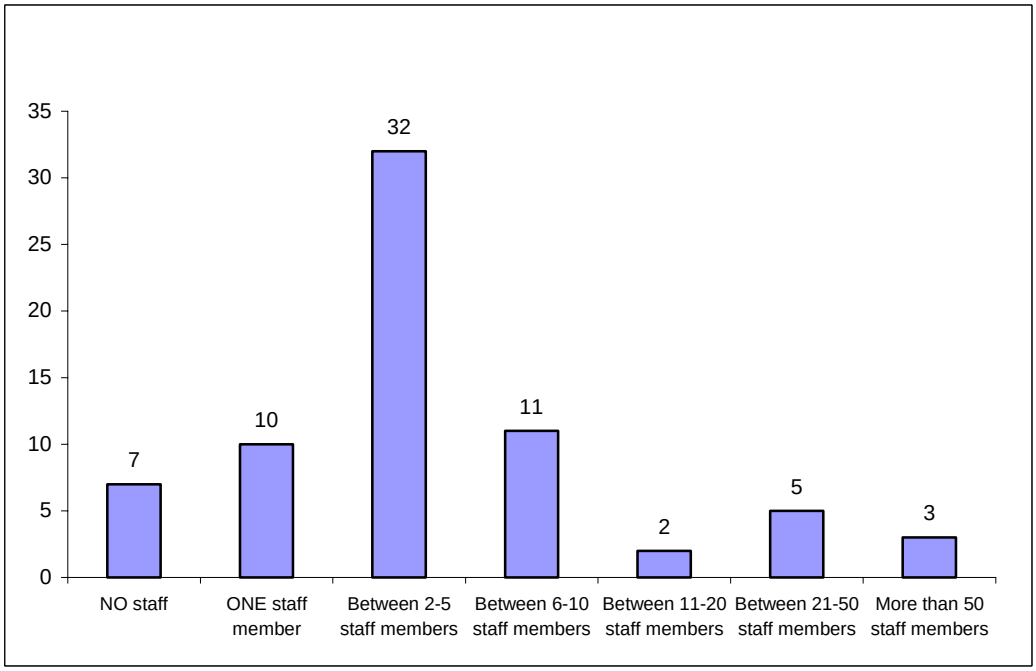
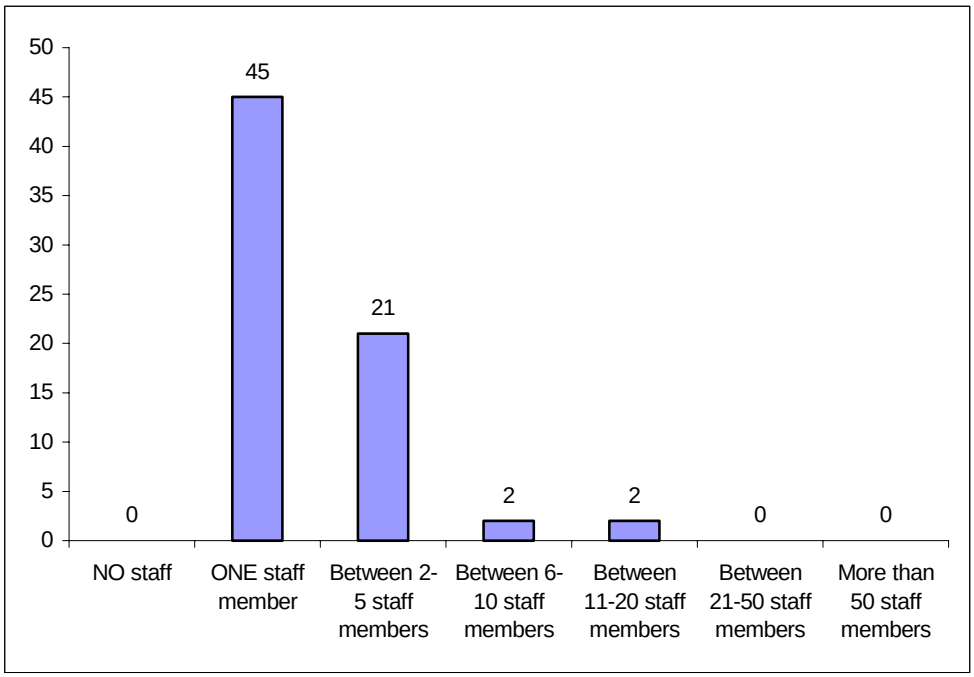


Figure 55: Non-research staff from industry involved in partnerships



7.7 CONCLUSION

This section illustrates that industry partners on THRIP and Innovation Fund projects show a high level of commitment to HE-industry partnerships in terms of the dedication of human resources (both subject matter experts and administrative staff) to these initiatives.

Moreover, industry motives for engaging in these partnerships are directly linked to issues such as access to research facilities and expertise and human resource development, rather than simply the narrower motives of financial gain and increased competitiveness. That the motives are understood in a complex manner suggests an appreciation of the benefits of networks, partnership and collaboration.

8

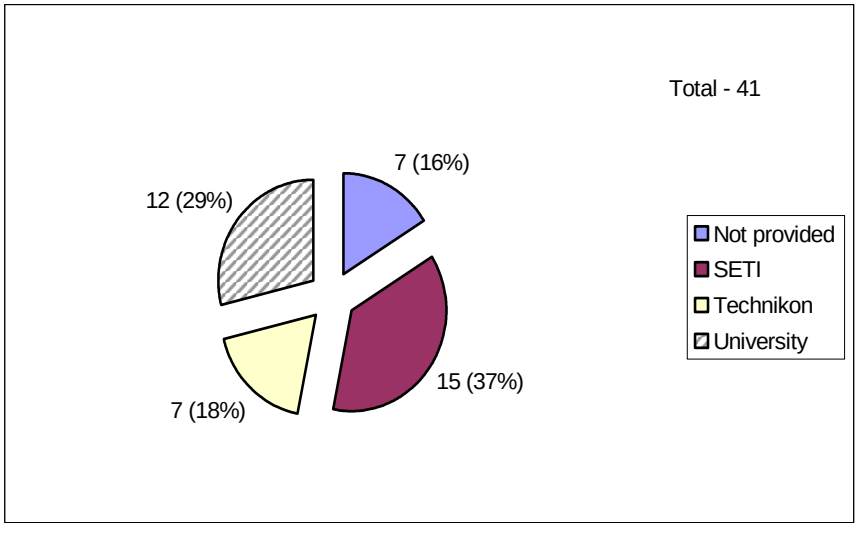
THE HIGHER EDUCATION PARTNERS

8.1 HE INSTITUTION PARTNERS IN THRIP AND INNOVATION FUND PROJECTS

A total of 41 HEIs/ SETIs are the primary beneficiaries of THRIP and Innovation Fund funding. Of these 37% are SETIs, 29% universities and 18% technikons (Fig 56). THRIP funds a total of 32 HEI/SETI beneficiaries. Of these, 50% are universities, 30% technikons and only 17% SETIs (Fig 57). In contrast to THRIP, the 15 Innovation Fund beneficiaries are largely SETIs (47%), followed by universities (20%) and no technikons (Fig 58).

Figure 59 illustrates the total number of partnerships by institutional type. As indicated, 309 (73%) of the projects are located in universities; 16% are located in SETIs; 9% are located in technikons and 2% have not been specified.

Figure 56: The HEI/SETI partners[16]



[16] The analysis is based on the HEI/SETI that are primary beneficiaries rather than HE institutions that are involved as part of the research team. The methodology section indicated that the primary beneficiary is the HEI/SETI with which the contract with THRIP or the Innovation Fund has been signed. Note that the term SETIs used in this report includes predominantly SETIs but also a small number of research units located in the NGO and in the private sectors.

Figure 57: The HE/SETI partners for THRIP[17]

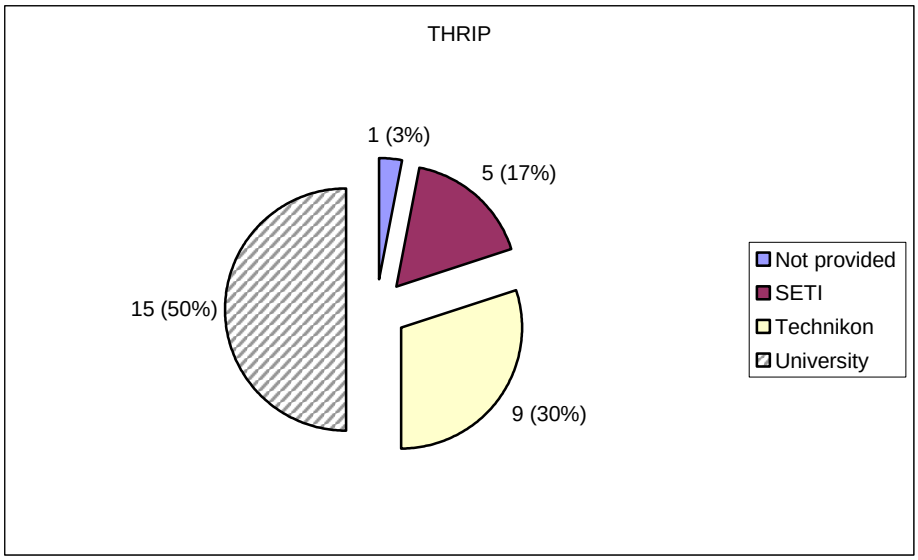
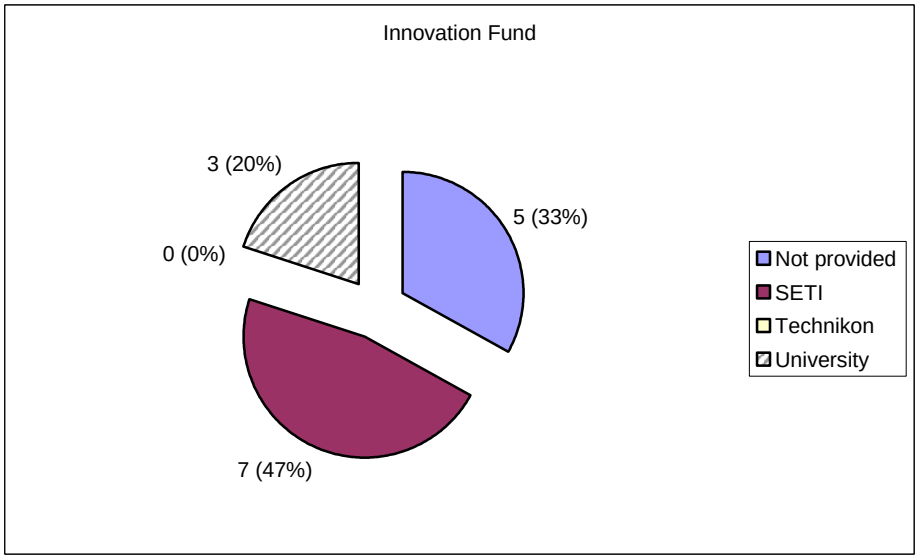
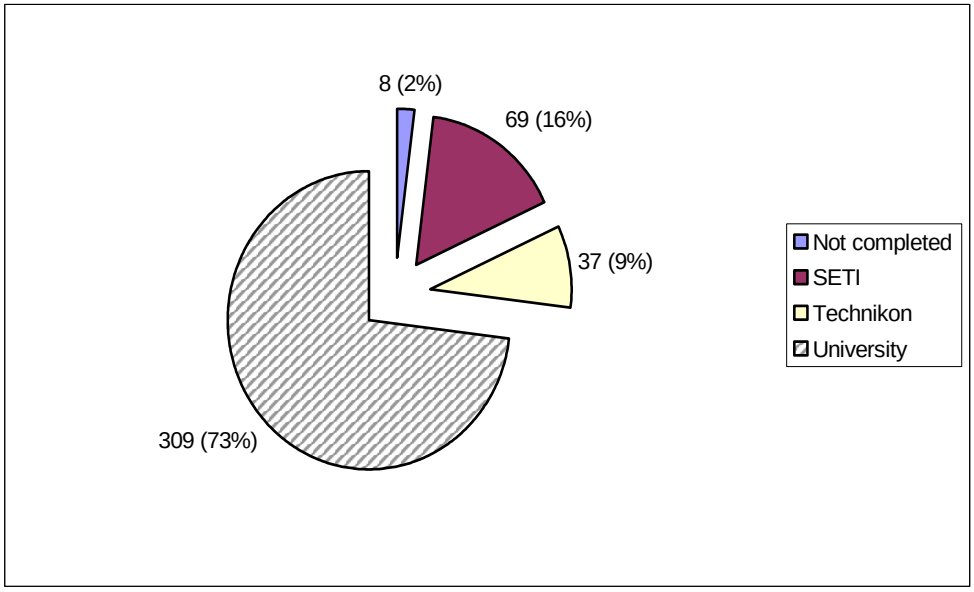


Figure 58: The HEI/SETI partners for the Innovation Fund



[17] Note that this section discusses a total of 41 HEI/ SETIs. When the primary institutions for THRIP and the Innovation Fund are added they total 46, which is greater than the total number of institutions. This is due to THRIP and the Innovation Fund funding the same HEIs/SETIs.

Figure 59: Total partnerships by institutional type[18]



8.2 HE INSTITUTION GRANT HOLDERS IN THRIP AND INNOVATION FUND PROJECTS

Figure 60 illustrates the total number of partnerships for which each institution is a grant holder. The University of Pretoria is a grant holder for 21% (72) of the total THRIP and Innovation Fund partnerships, followed by the University of Stellenbosch, which is grant holder for 19% (66) of the total number of projects, and the University of Cape Town, which is grant holder for 13% (45) of the total projects. Technikons are grant holders for 11% of the projects (this includes HWIs and HBIs). Historically black institutions (both universities and technikons) are grant holders for a total of 6% of the projects.

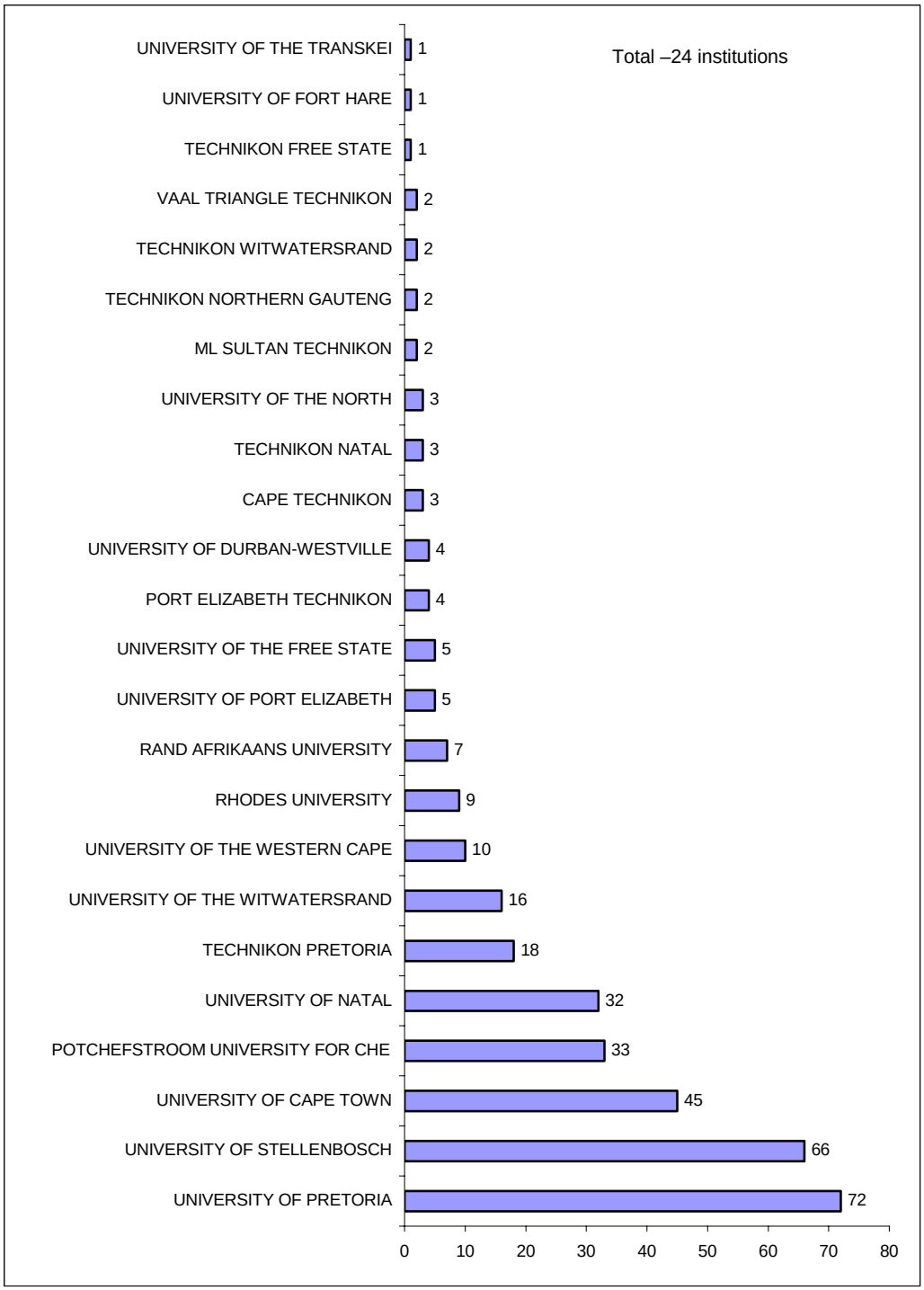
Figure 61 illustrates the number of projects that HE institutions are involved in either as grant holders or as research team members. The University of Stellenbosch is involved in the largest number of projects (23% of the total), followed by the University of Cape Town (16%) and the University of Pretoria (13%). Technikons are involved in 9% of the projects and historically black universities are involved in 5% of the projects.

Figures 62, 63 and 64 illustrate the grant holders for THRIP and Innovation Fund projects by the three technological bands. In the field of biotechnology, the majority of THRIP grant holders are universities, whilst for the Innovation Fund, the majority are SETIs. For both organisations combined, 56% of the grant holders are universities, 38% are SETIs and 6% are technikons (Fig 62). For ICT, the distribution is similar, with THRIP grant holders being mainly universities and Innovation Fund grant holders mainly SETIs. For both THRIP and the Innovation Fund combined, 55% of the ICT

[18] This figure includes all partnership projects, not only just those in the three technological bands.

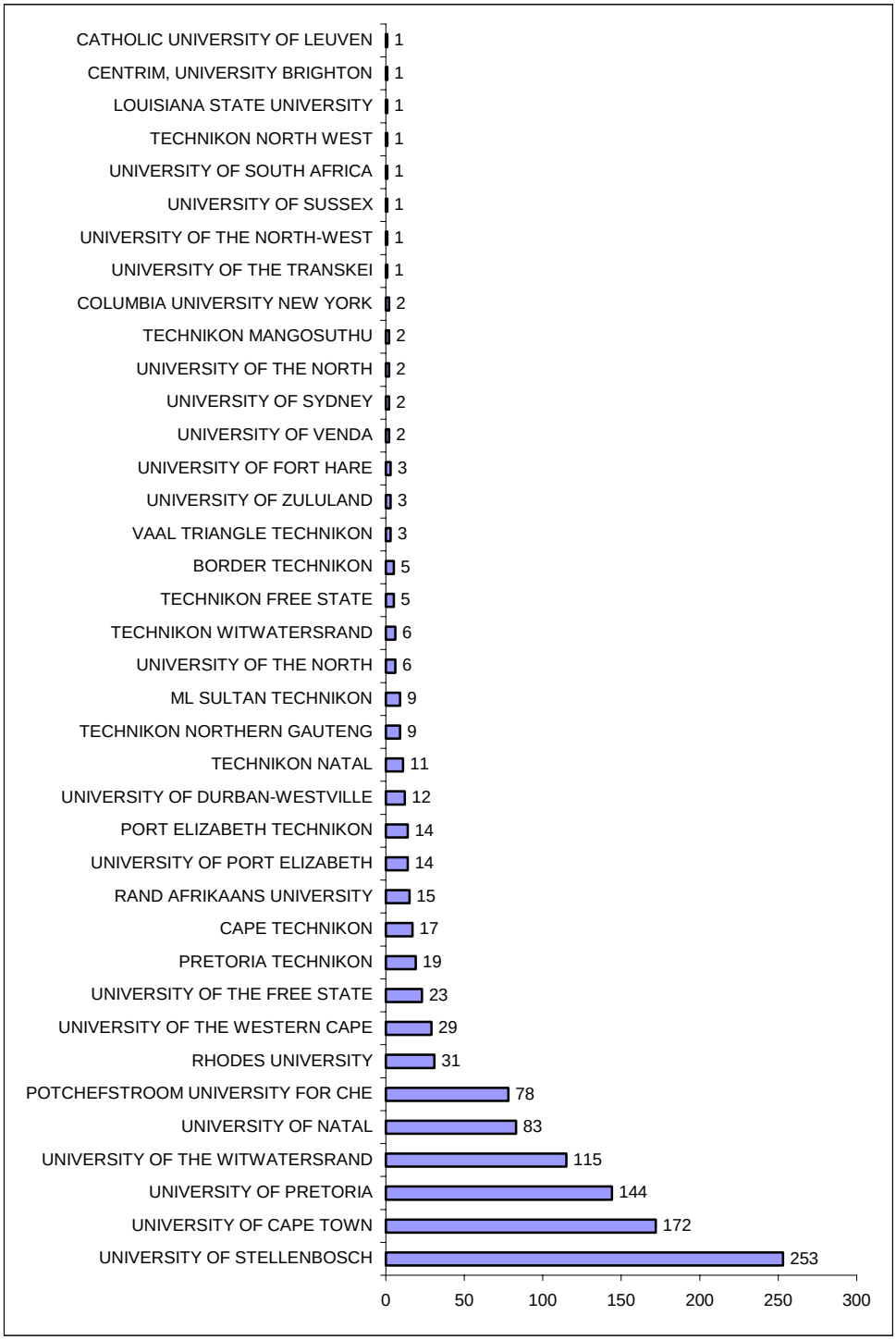
grant holders are universities, 35% SETIs and 10% technikons (Fig 63). In new materials development, universities once again dominate for THRIP projects and SETIs for Innovation Fund projects. For both THRIP and the Innovation Fund combined, 55% of the ICT grant holders are universities, 35% SETIs and 10% technikons (Fig 64).

Figure 60: Primary HEI funded by total number of projects for which HEIs are primary beneficiaries[19]



[19] This analysis is based on HEIs that are primary beneficiaries, in that they are the primary grant holder of the THRIP/ Innovation Fund project, and excludes the HEI of research team members.

Figure 61: The number of projects that HEIs are involved in (both grant holders and research team members)[20]

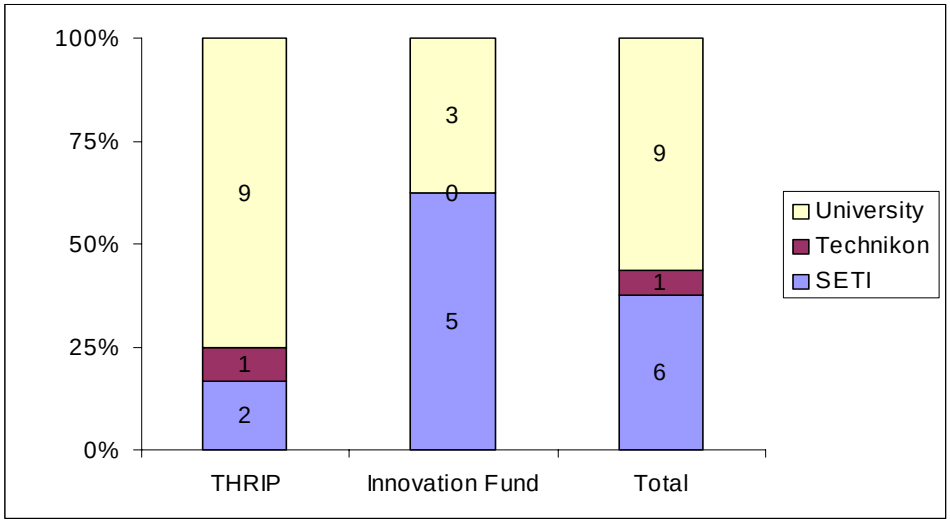


[20] This analysis is based on HEIs that are both primary and auxiliary beneficiaries, in that they are the primary grant holder of the THRIP/Innovation Fund project as well as involved in research projects for which they are not the grant holder. Please note that this analysis undercounts the Innovation Fund team members that were not located at the grant holders institution as this information was not available.

Figure 61a: Analysis of the HEIs involved as either grant holders and/or research team members

HAI / HDI	Technikons	Universities	Grand total
Historically advantaged institutions	12	11	**23**
Historically disadvantaged institutions	2	10	**12**
International universities	-	6	**6**
Grand total	**14**	**27**	**41**

Figure 62: The HE partners in biotechnology[21]



[21] Note that some higher education (or SETI and other type) institutions have partnerships in more than one of the three technological areas. As such, the institutions do not total a count of 50, but rather more than 50 because institutions are counted twice or more in the different technological areas. This applies to Figures 63, 64, 65, 66 and 67.

Figure 63: The HE partners in ICT

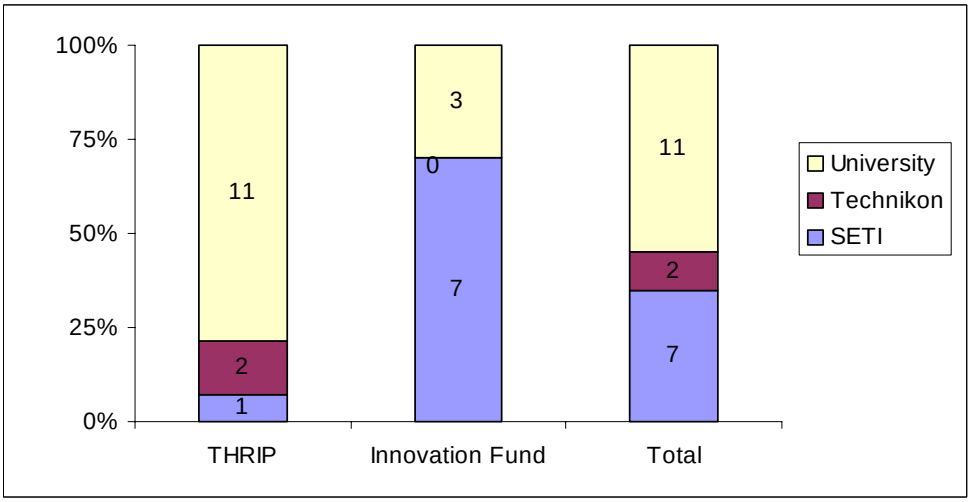
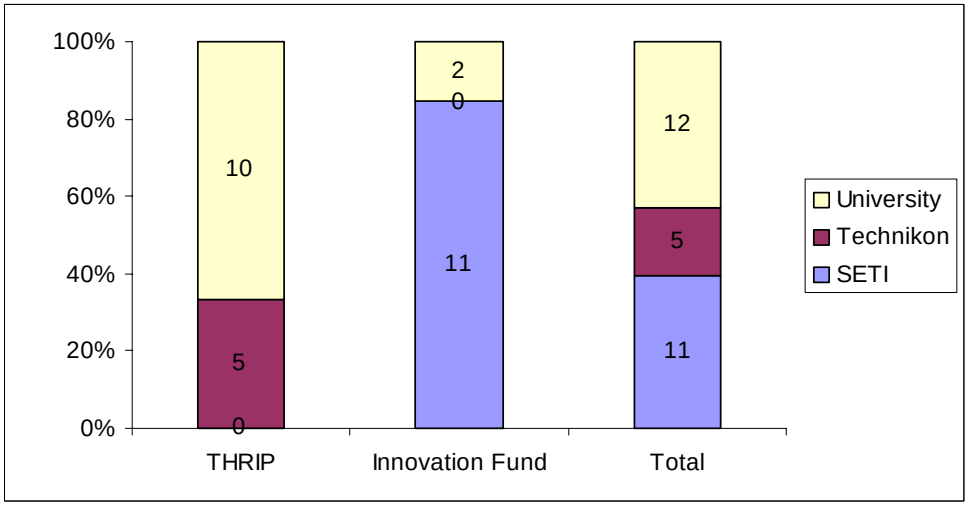


Figure 64: The HE partners in new materials development[1]



8.3 HEIs/SETIs BY THREE TECHNOLOGICAL BANDS

Figures 65, 66 and 67 illustrate the higher education partnerships by the three technological fields. As shown in Figure 65, the University of Pretoria is involved in a total of 17 biotechnology projects as the primary beneficiary and the University of Stellenbosch follows closely behind with 13 biotechnology projects. The University of the Western Cape, the only historically black institution, is the beneficiary of three biotechnology projects.

Figure 66 illustrates that the University of Cape Town leads as the beneficiary of ICT projects, followed by the Universities of Stellenbosch, Pretoria and Potchefstroom. The University of the Western Cape, the University of Fort Hare and the University of Durban-Westville, all historically disadvantaged institutions, are involved in a total of

four ICT projects. Three technikons, i.e., Pretoria, Witwatersrand and ML Sultan are also involved in ICT projects.

Figure 67 illustrates that the University of Pretoria leads as the beneficiary of materials development projects, as is the case with biotechnology projects. This is followed by the University of Cape Town and the University of Natal. The University of the Western Cape and the University of the North (HBUs) are involved in a total of three projects and technikons are involved in a total of six new materials development projects.

Figure 65: Higher education institutions by total number of projects in biotechnology

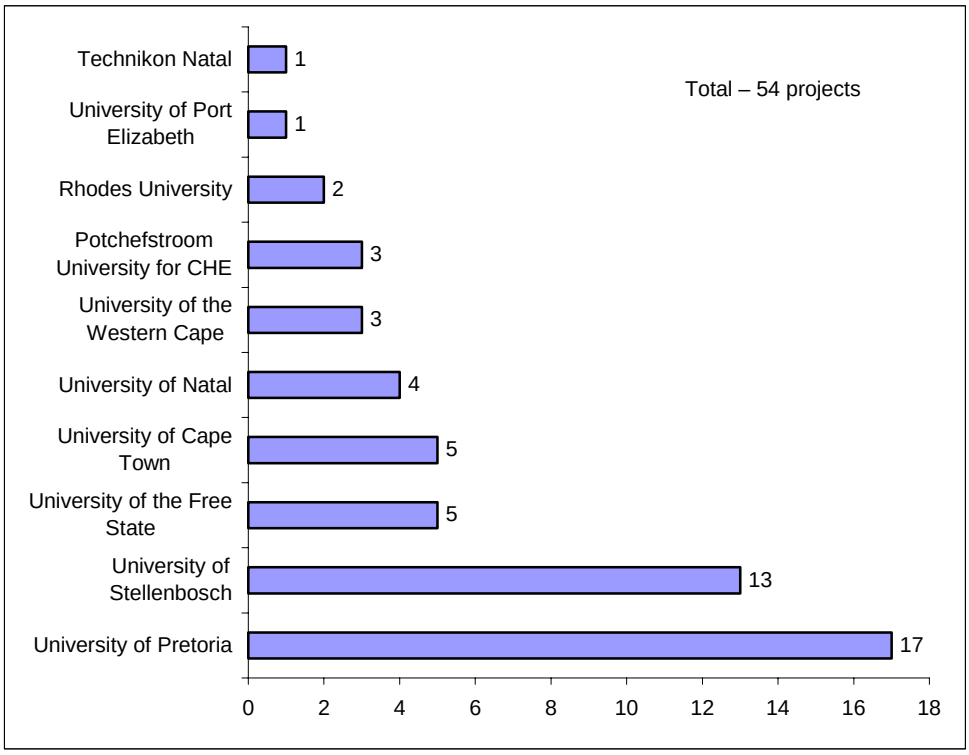


Figure 66: Higher education institutions by total number of projects in ICT

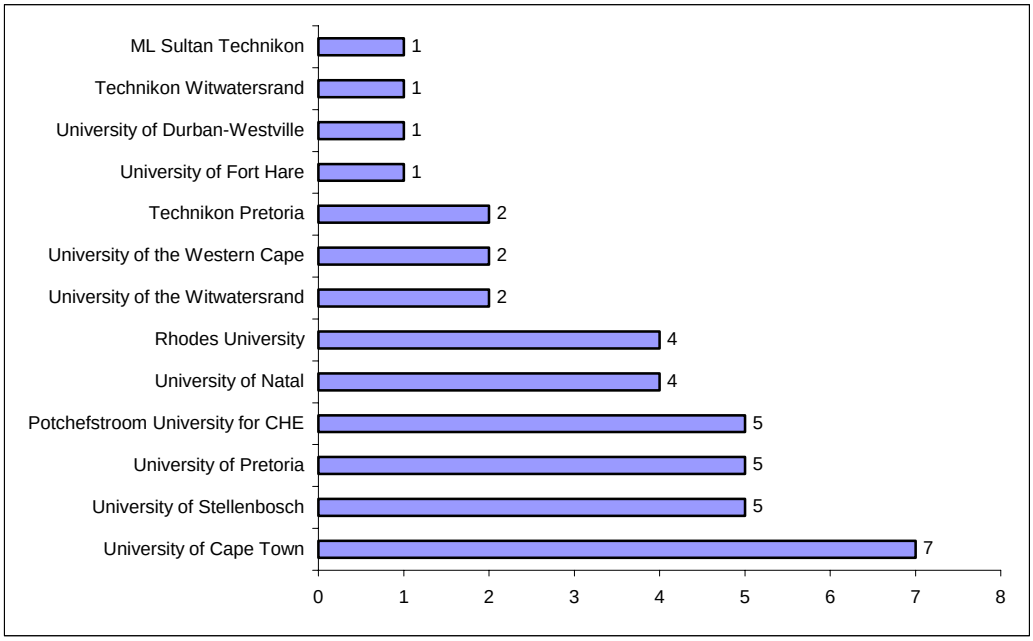
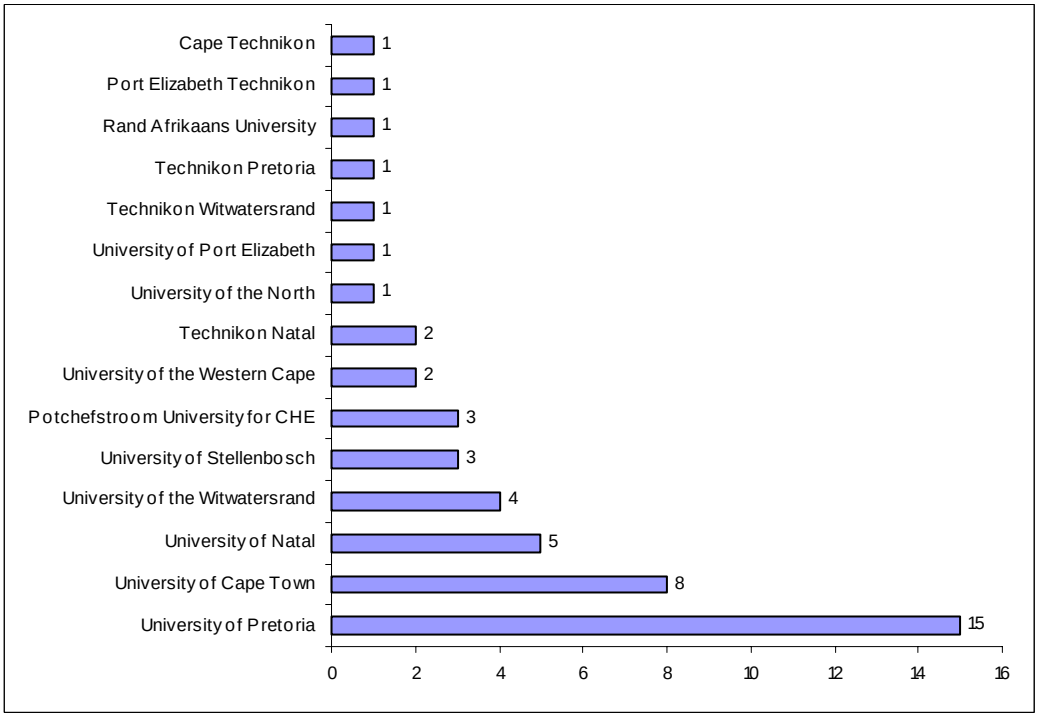


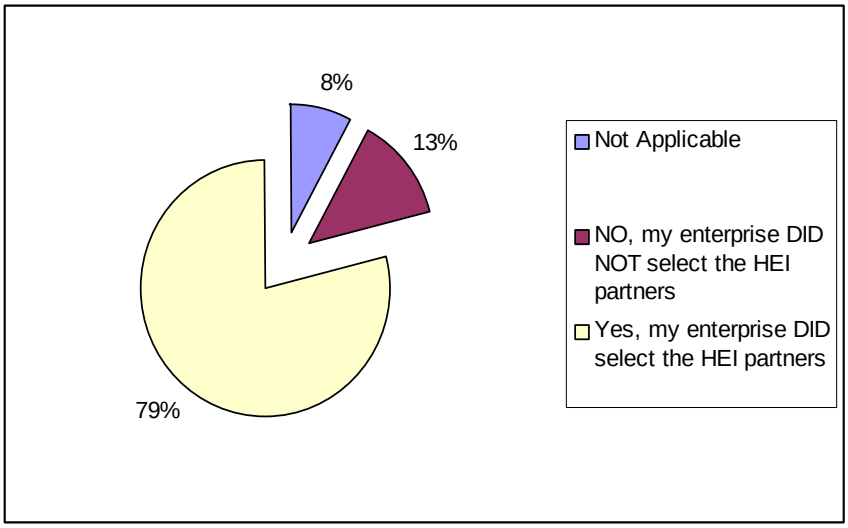
Figure 67: Higher education institutions by total number of projects in new materials development



8.4 INDUSTRY CRITERIA FOR SELECTING HE INSTITUTIONS

The industry survey requested respondents to indicate whether or not they selected their HE partners and, if so, the reasons for selecting those particular HE institutions as partners. The results indicate that 79% of the industry partners selected their HE partners (Fig 68).

Figure 68: Selection of HE partners



Of those that did select their industry partner, 52% indicated that this related specifically to the institution's research expertise; 17% said that the enterprise had a previous relationship with the institution; 13% indicated that the selection was due to the HE institution's physical and infrastructural resources; 6% selected the institution on the basis of their reputation; 4% based the decision on the appropriate cost of services or geographic location; 2% reported that the HE institution approached industry and 1% selected institutions on the basis that they were historically disadvantaged institutions (Fig 69).

It is interesting to note from the above that 17% of the enterprises selected HE institutions on the basis of a previous relationship. Figure 70 focuses specifically on the number of enterprises that either did have or did not have a previous relationship with the HE institution partner. As illustrated, 60% indicated that they had a prior relationship, whereas 40% indicated that they did not have a prior relationship. This is interesting in two respects. Firstly, the figure suggests that prior relationships are an indicator of the development of partnership relationships. Secondly, the figure indicates that THRIP and Innovation Fund projects are responsible for the generation of several new partnership relationships.

Figure 69: Those who did select HE partner, provided the following reasons for selecting HE institution

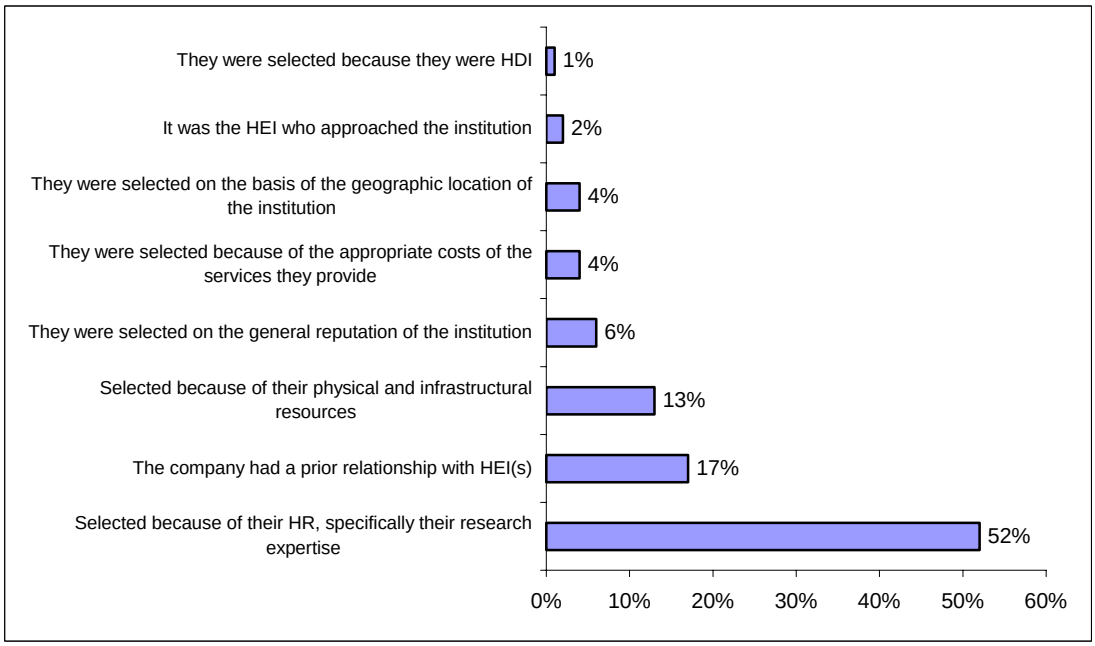
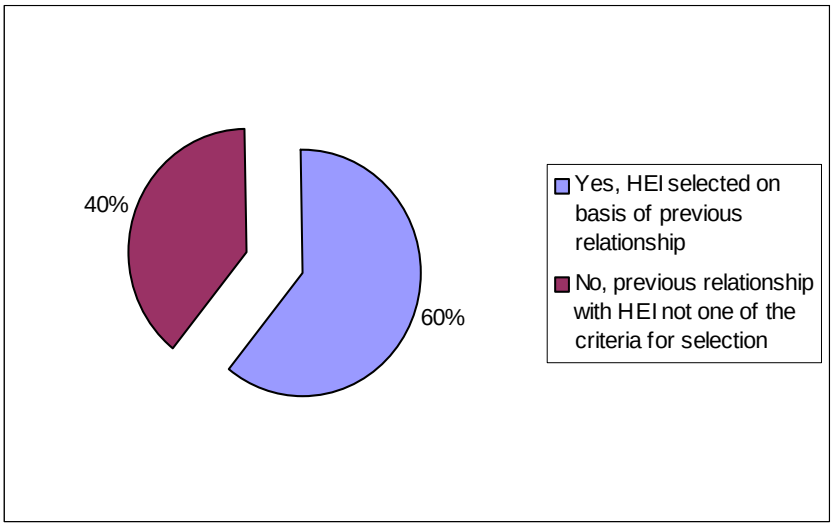


Figure 70: Prior relationships with HEIs



8.5 INDUSTRY MOTIVES FOR PARTNERSHIPS

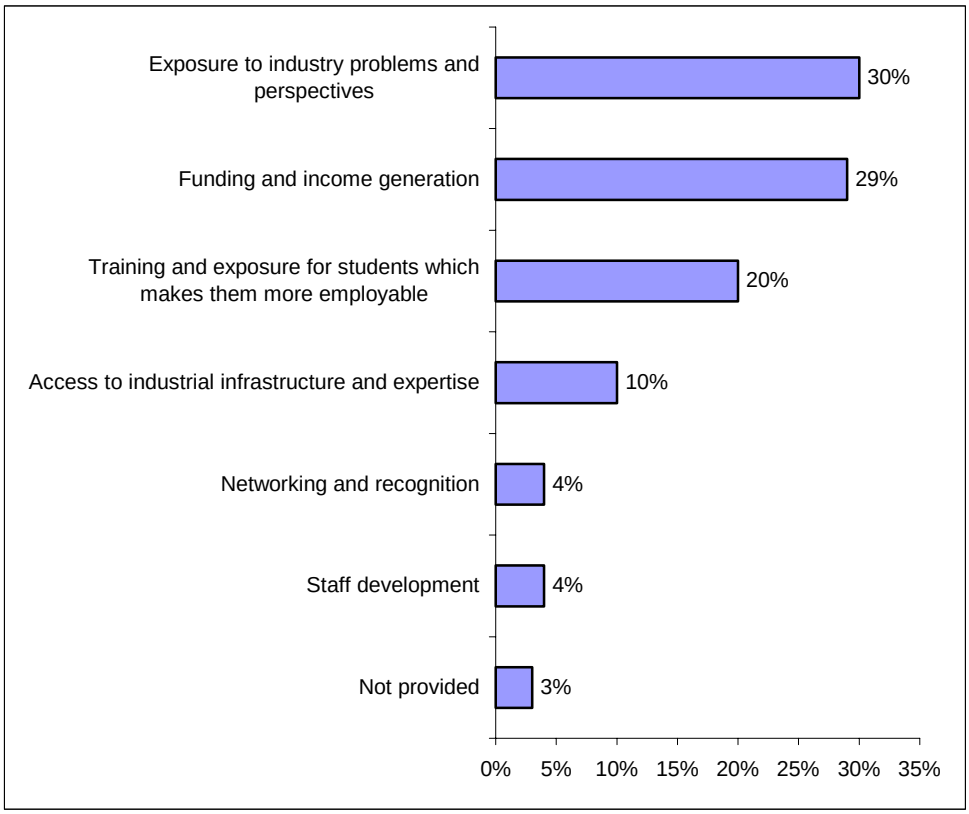
In the industry survey, respondents were requested to indicate their perceptions of the benefits of HE-industry partnerships to industry and to HE institutions. In the previous section, industry's perceptions of the benefits to their own enterprises were discussed. Figure 71 indicates industry's perceptions of the benefits of HE-industry partnerships to HE institutions. As illustrated, 30% of the respondents indicated that HE institutions benefit from such partnerships by being exposed to industry problems and perspectives in relation to technological developments. As one respondent commented,

'it allows academia to test the relevance of theories and to realise the extreme practical limitations encountered by industry. It provides academia with real world problems'.

A further 29% indicated that HE institutions benefit as a consequence of the funding allocated to the projects and the income generated by the projects. Twenty per cent indicated that HE institutions benefit by exposing students to different technological issues in industry, thus better preparing them for employment after graduation. As one respondent commented, linkages 'make the research undertaken by students more market-related and make science students more marketable in the private sector'.

Ten per cent stated that HE institutions benefit by gaining access to industry-based technological expertise and infrastructure. Just over 4% indicated that HE institutions benefit by being exposed to broader networks in the industrial sector and just under 4% argued that HE-industry partnerships result in HE staff development. 3% of the respondents did not provide information in this regard.

Figure 71: Industry perceptions of the benefits of partnerships for HE institutions

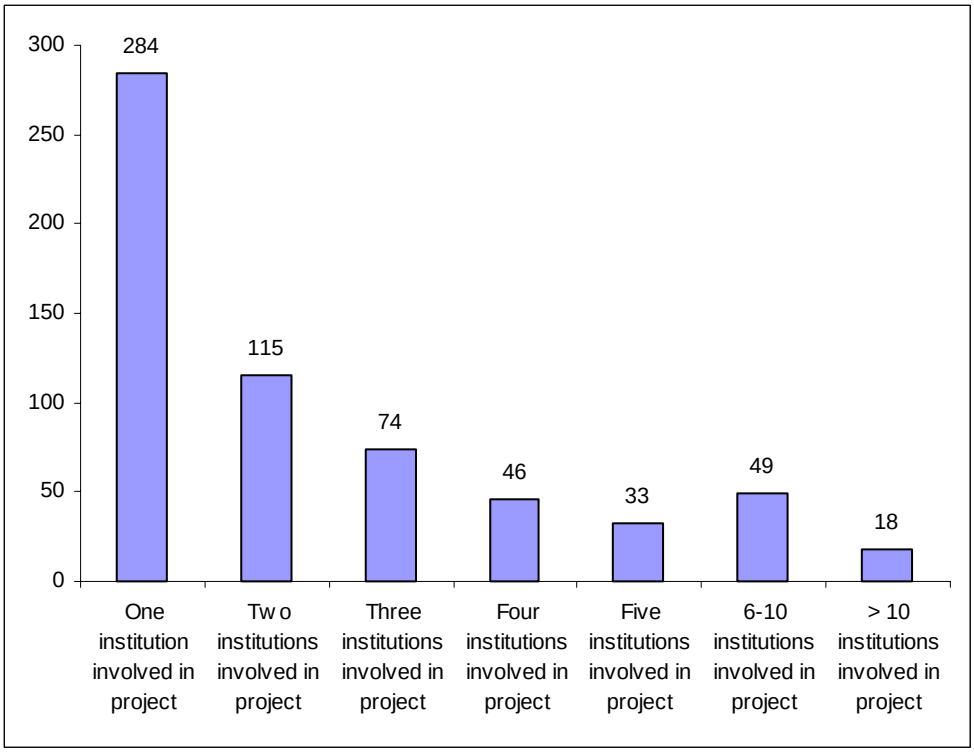


8.6 NUMBER OF HE INSTITUTIONS WORKING ON PROJECTS

Figure 72 illustrates the number of HE institutions working on THRIP and Innovation Fund partnerships. The graph provides some indication of networking between institutions within the framework of paradoxical relationships based on co-operation and competition or 'competitive collaboration' (see Castells 1996). The figure also points at the production of 'Mode 2' or transdisciplinary knowledge, wherein existing

knowledge is 'generated in the context of application' rather than in separate academic and application contexts (Gibbons et al 1994). The figure shows that in 33% of the cases, more than one HE institution is involved with individual THRIP or Innovation Fund projects. In 67% of the cases, only one HE institution is involved in each project. The data points to the emergence of collaboration between HE institutions, in their relationship with industry.

Figure 72: Number of HEI/SETI working on projects



8.7 CONCLUSION

This section indicates that universities, followed by SETIs, are the primary grant holders for the majority of THRIP and Innovation Fund partnerships. Technikons are the grant holders for only a few select partnership projects.

Industry motives for partnerships with HE institutions largely relate to the institution's research expertise and physical and infrastructural resources available at HE institutions. Significantly, many industry partners indicated that they had a previous relationship with the partnering HE institution, which formed the basis of their selection of particular institutions for THRIP and Innovation Fund projects.

Industry respondents indicated that HE institutions benefit from HE-industry partnerships by being exposed to industry problems and perspectives in relation to technological developments. In addition, HE institutions benefit from the funding generated through such partnerships and students benefit by being placed in industrial contexts for research and work experience.

9

THE RESEARCHERS

The data reveals that there are a total of 1 561 higher education-based researchers working on THRIP or Innovation Fund projects. These researchers are HE staff linked to HE institutions that are either higher education grant holders or auxiliary higher education beneficiaries.[22]

The total of 1 561 researchers does not double count those researchers who work in more than one capacity and those who work in multiple projects. The total of 1 561 researchers does not include Innovation Fund auxiliary researchers who are located at an institution other than the grant holders. Nor does it include industry-based researchers and higher education students who work either directly on the partnership projects or who are granted research funding through these projects.

As Table 2 illustrates, the Innovation Fund has 52 grant holders, one for each project. THRIP has 235 grant holders. These grant holders form the total body of grant holders for the 423 partnership projects funded by Innovation Fund and THRIP projects presented in Chapter 5.

Table 2: The researchers[23]

Type	Innovation Fund	THRIP	Grand total
Grant holders	52	235	287
Research team member	180	1 094	1 274
Grand total	232	1 329	1 561

9.1 RESEARCHERS BY RACE AND GENDER

An analysis of all researchers by race, indicates that 79% are white; 7% African; 4% Indian; 3% coloured and 0.1% Asian (Fig 73a). When a similar analysis is conducted for grant holders (rather than researchers), findings show that 75% of the grant holders are white and only 3% African (this data is shown in Table 1 in Appendix E).

[22] For definitions of primary, secondary and auxiliary beneficiaries, see the sample section in the methodology.
[23] Note that while there are 423 projects that there are only 287 grant holders. This is because some institutions are grant holders for more than one project. In such cases researchers involved in the projects have been counted only once.

An analysis of researchers by gender (Fig 73b) shows that 23% of the researchers are female and 72% are male. When analysed by grant holders (rather than researchers), the findings reveal that only 13% of the grant holders are female and 87% male (this data is attached in Appendix E).

9.2 RESEARCHERS IN THE THREE TECHNOLOGICAL BANDS

A total of 57% of the researchers are involved with projects that do not fall within the three bands. The remaining 43% are distributed across the three bands (Fig 74). Of these, 294 researchers (19%) are involved in projects in the field of biotechnology. A further 211 researchers (14%) are involved in the field of ICT and 159 researchers (10%) are involved in the field of new materials development (Fig 74).

Figure 73a: The researchers by race

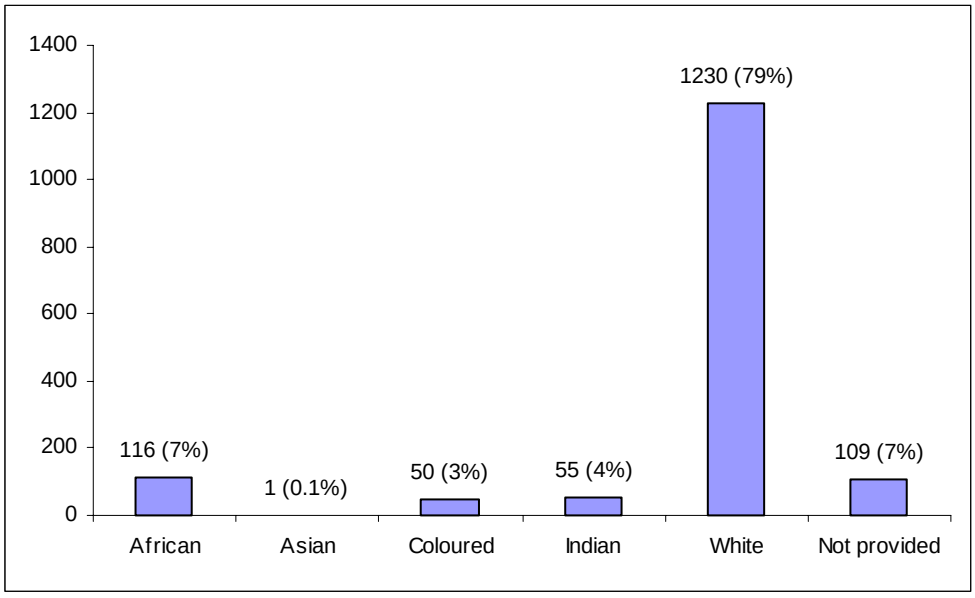


Figure 73b: The researchers by gender

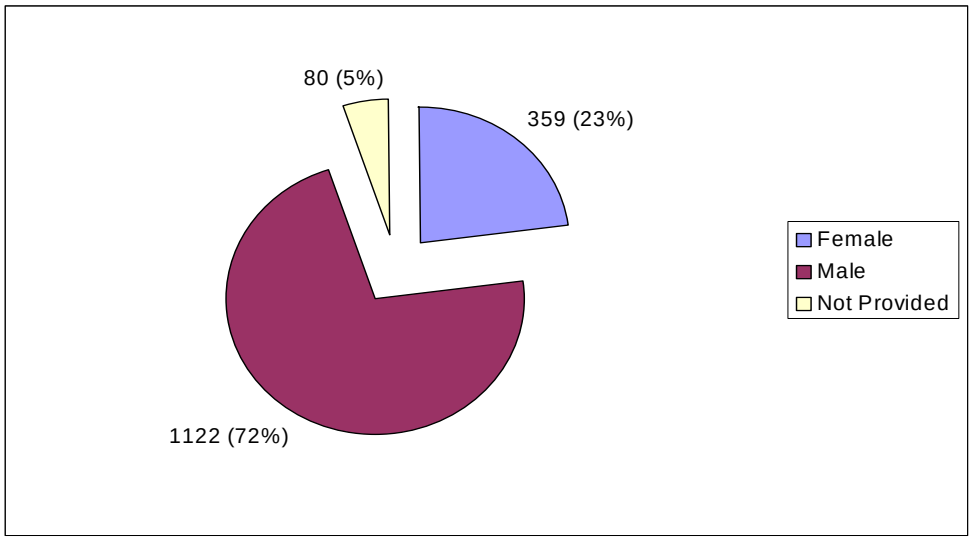
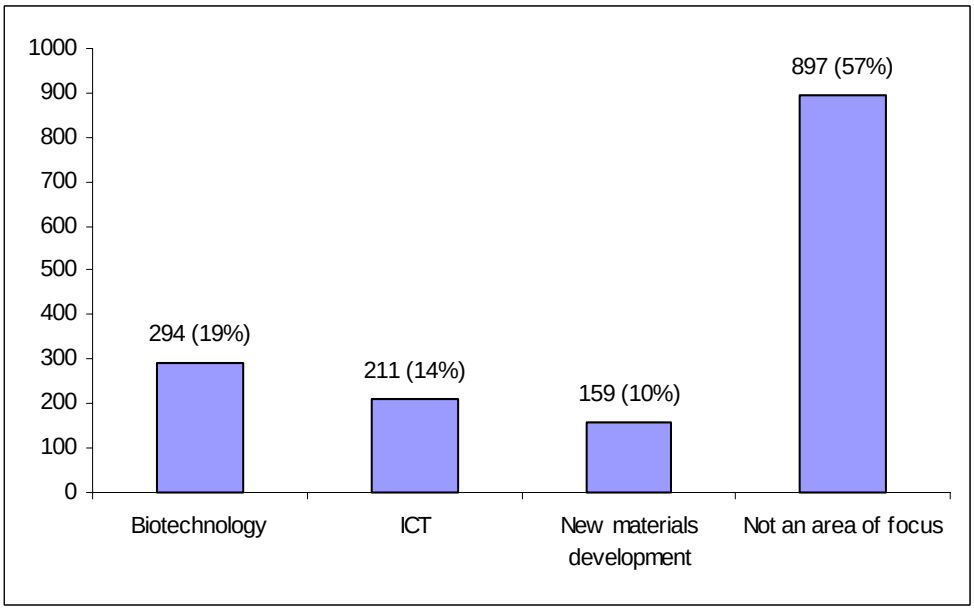


Figure 74: The researchers by three technological bands



9.3 NUMBERS OF RESEARCHERS WORKING ON PROJECTS

For the majority of THRIP and Innovation Fund projects (53%), between two and five researchers are involved in each project. Twenty-three per cent of the projects involve only one researcher (this refers only to either grand holder researchers and auxiliary researchers, and does not include industry-based and student researchers). Up to five projects have more than 20 researchers involved (Fig 75).

Figure 75: Number of researchers working on research projects (includes all three technological bands)

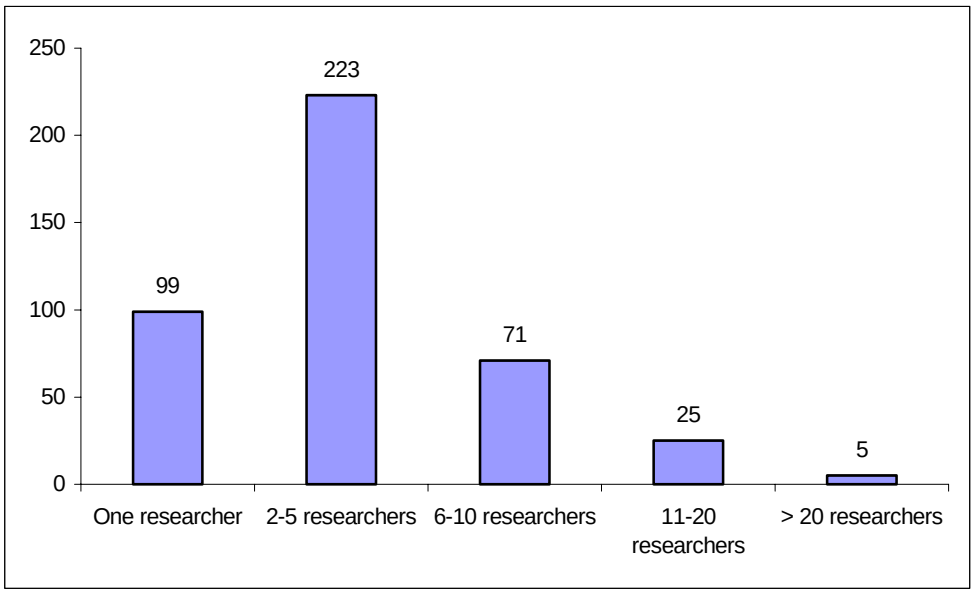


Figure 76 illustrates that the majority of projects in the field of biotechnology involve more than one researcher, with 47% of the projects involving at least between 2 and 5 researchers and 24% involving between 6 and 10 researchers. The researcher distribution for ICT projects is similar to that in the field of biotechnology. 24% of the projects involve only one researcher, 47% involve between 2 and 5 researchers and an additional 17% involve between 6 and 10 researchers (Fig 77). For new materials development, 40% of the projects involve only one researcher, which is a higher proportion than in the fields of biotechnology and ICT. A further 54% of new materials development projects involve between 2 and 5 researchers and a smaller percentage more than five researchers (Fig 78).

These findings suggest the emergence of research networks in the three technological bands as well as in other bands. It shows researchers working together in teams to provide, as Gibbons et al (1994) state, knowledge solutions to our economic and social problems. The complexity of the relationships between the researchers precluded further analysis of the research networks in this study. A detailed study of the networks that exist may further illuminate the nature and extent of such researcher networks.

Figure 76: Number of researchers working on research projects – biotechnology

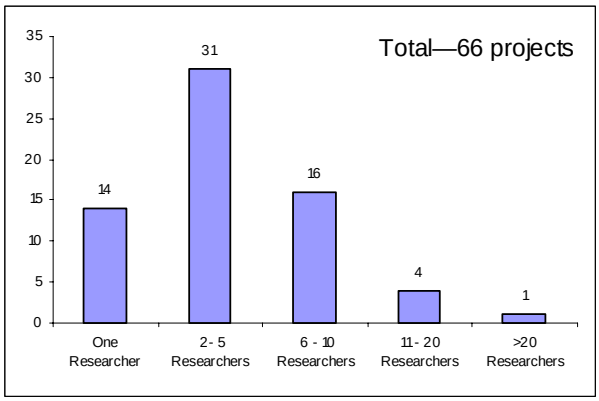


Figure 77: Number of researchers working on research projects – ICT

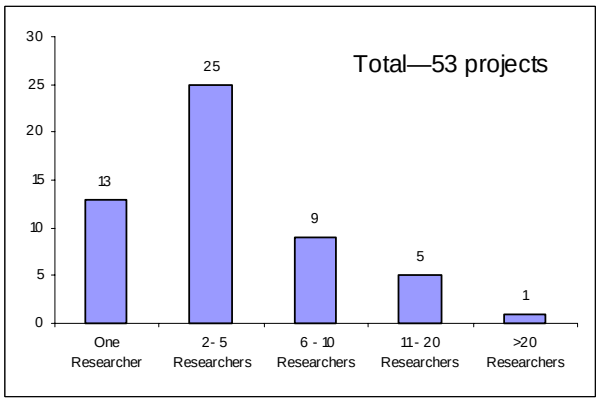
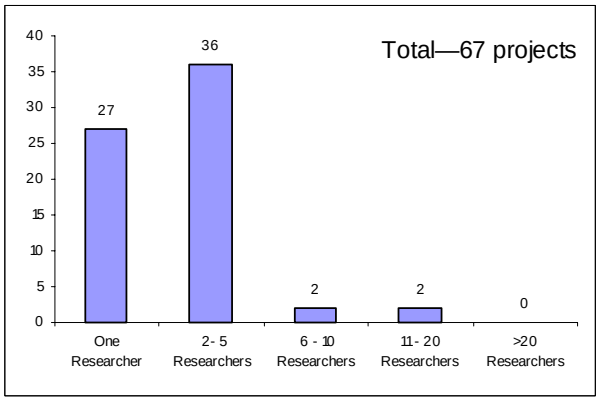


Figure 78: Number of researchers working on research projects – new materials development

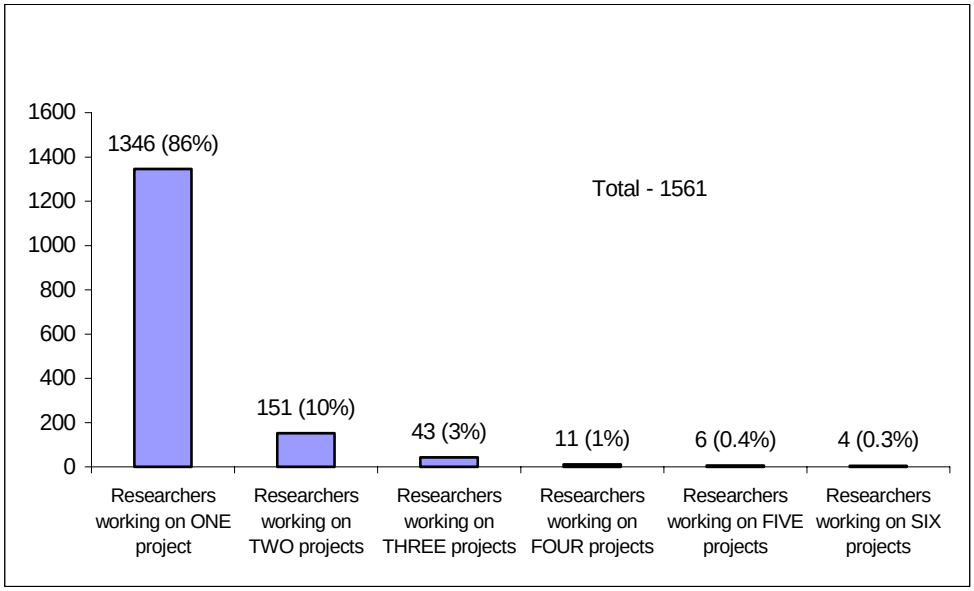


9.4 NUMBER OF PROJECTS THAT RESEARCHERS WORK ON

The vast majority of researchers (86%) are working on one Innovation Fund or THRIP project (Fig 79). 10% of the total number of researchers are working on two projects, 3% on 3 projects, 1% on 4 projects and even smaller numbers on more than 4 projects.

These findings suggest the possibility that a small number of researchers specialise in consulting to a wide number of partnership projects.

Figure 79: Number of projects that researchers are working on



While most researchers involved in partnership projects funded by THRIP and the Innovation Fund work on only one project, in biotechnology 26 researchers work on more than one project with 8 researchers working on three and more projects. In new materials development 12 researchers work on more than one project and in ICT 17 researchers work on more than one project (Table 3). These findings may suggest a layer of researchers who have a high level of expertise in either research area, or in the skill of networking itself. Few researchers in the three bands work on more than four projects.

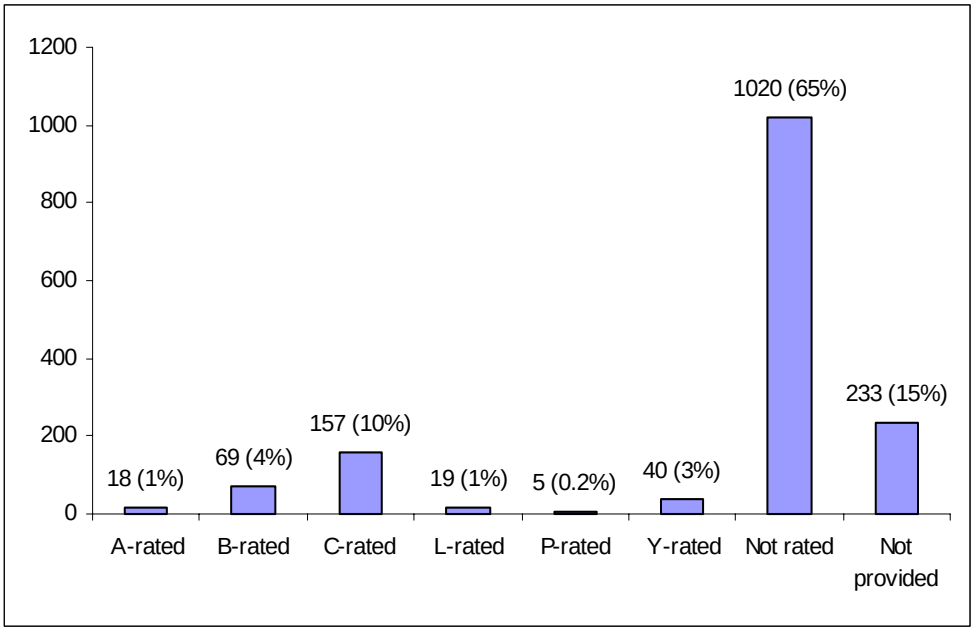
Table 3: Number of projects that researchers are working on – by technological bands

Number of projects being worked on by researcher	Technological bands			Total for 3 technological bands
	Biotechnology	ICT	New materials development	
TWO	18	14	9	41
THREE	6	1	1	8
FOUR	1	2	1	4
FIVE	1	0	0	1
SIX	0	0	1	1

9.5 RESEARCHERS BY NRF RATING

Figure 80 reviews THRIP researchers by the NRF ratings. This rating scale is provided in Table 4. As illustrated, the majority of researchers have not been rated but for those who have been, 10% are C-rated, 4% B-rated, 3% Y-rated and only 1% A-rated. Only 1% are L-rated, suggesting that few previously disadvantaged researchers are involved currently in research projects. These findings raise a number of questions about the research status of the researchers involved in the partnership projects. Specific questions include: (i) Are the researchers who are involved in the partnership projects the researchers who are the most frequently published in their discipline? (ii) Do the researchers who are working in the partnership projects have a specific expertise in networking and/or establishing partnerships? (iii) Do the researchers have status as well-known and reputable researchers in their area? Figure 81, by illustrating that the majority of researchers working on three or more projects are B- or C-rated researchers, i.e. researchers who have substantial expertise in their fields, begins to suggest answers to these questions. Only very small numbers of A- (top experts) and no Y-rated (young researchers) work on more than three projects.

Figure 80: The THRIP researchers by NRF rating[24]



[24] THRIP projects include a field on NRF rating of researchers. While the information was gathered for Innovation Fund projects, the data proved unreliable and has not been included in Figure 80. Lists of researchers by rating and by three technological bands are available on request.

Figure 81: Researchers working on three or more projects – analysed by NRF rating

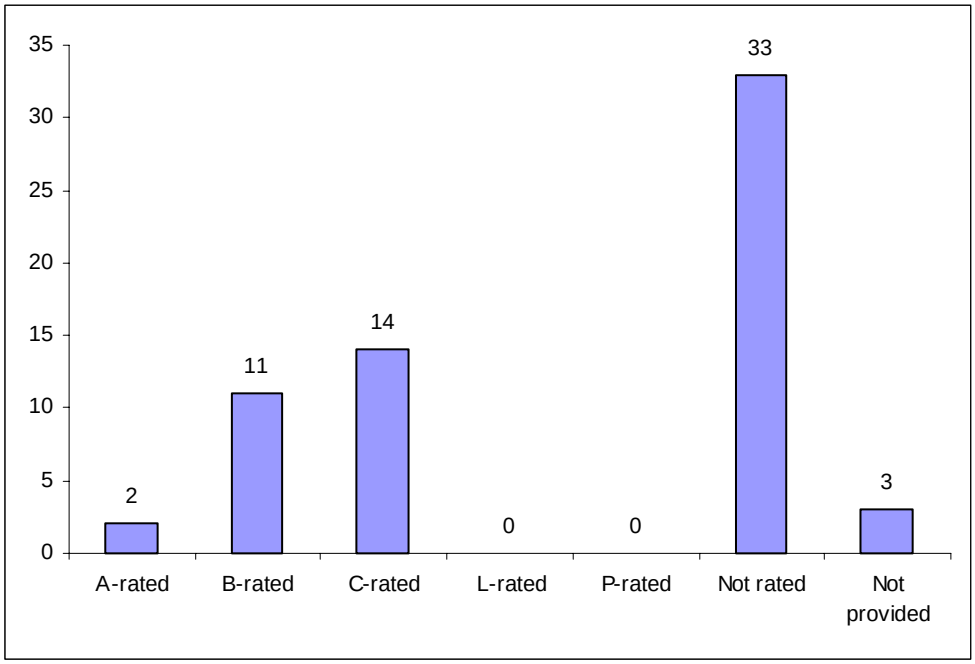


Table 4: NRF researcher rating scale

A	Researchers who are unequivocally recognised by their peers as leading international scholars in their field for the high quality and impact of the recent research outputs
B	Researchers who enjoy considerable international recognition by their peers for their recent research output
C	Established researchers with a sustained recent record of productivity in the field who are recognised by their peers as having * produced a body of quality work, the core of which has coherence and assets to ongoing engagement with the field * demonstrated the ability to conceptualise problems and apply research methods to investigating them
P	Young researchers (normally younger than 35 years of age), who have held the doctorate or equivalent qualification for less than five years at the time of application and who, on the basis of exceptional potential demonstrated in their published doctoral work and their research outputs in their early post-doctoral careers are considered likely to become future leaders in their field
Y	Young researchers (normally younger than 35 years of age), who have held the doctorate or equivalent qualification for less than five years at the time of application, and who are recognised as having the potential to establish themselves as researchers within a five-year period after evaluation, based on their performance and productivity as researchers during their doctoral studies and/or early post-doctoral careers
L	Persons (normally younger that 55 years) who were previously established as researchers or who previously demonstrated their potential through their own research products, and who are considered capable of fully established or re-establishing themselves as researchers within a five-year period after evaluation. Candidates should be South African citizens or foreign nationals who have been resident in South Africa for five years during which time they have been unable for practical reasons to realise potential as researchers. Candidates in this category include: * black researchers * female researchers * those employed in higher education institution that lacked a research enrolment * those who were previously established as researchers and have returned to the research environment

9.6 CONCLUSION

This chapter shows that a large number of researchers are involved in the partnership projects and that this involvement is frequently in the form of teams, rather than as single researchers. In the majority of THRIP and Innovation Fund projects, more than one HE institution-based researcher is involved in each research team (for all three technological bands). In a small number of cases, more than 20 HE institution-based researchers are involved in individual projects. The majority of researchers, however, are involved in only one project at a time.

The data illustrates that on current THRIP and Innovation Fund projects, the vast majority of HE institution-based research staff are white and male.