Constraints experienced in managing Triple Helix in South Africa

Doret Potgieter

20085885

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Supervisor: Mr J.A. Jordaan

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Innovation through diversity ™

NORTH-WEST UNIVERSITY
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ABSTRACT

Rapid changes in the global economy forces Industry to continuously seek competitive advantages; the University on the other hand pursue additional funding. Both Industry and University are trying to keep up with the accelerating pace of change, therefore partnership become critical in achieving key objectives.

Research collaborations become essential and offer direct benefits for University and company participants. The impact extends well beyond the direct partners. When potential partners have the resources and knowledge to accomplish individual goals, working with outside experts can improve the quality of the research and help to reduce costs. Industry-sponsored research allows the University to obtain financial support as well as Industry exposure for its educational and research missions.

The Technology and Human Resources for Industry Programme (THRIP) aims to boost South African Industry by supporting research and technology development, and by enhancing the quality and quantity of appropriately skilled people. THRIP brings together the best of South Africa's researchers, academics and industry players in funding partnerships that enable participants to improve the quality of their products, services and people. In 13 years it has become a powerful formula for stimulating innovation in South Africa - innovation leads to competitiveness and competition leads to growth.

There are many difficulties in managing projects across organisational boundaries; their cultures and their mission differ. The goal and the prime objective of the industries are to make a profit and build-value for shareholders. The universities' missions are to develop new knowledge and educate the next generation. Factors that may prevent research collaboration with Industry from being successfully accomplished are:

- The practical difficulties of managing a collaboration,
- Deleterious effects on faculty and students,
- Impact on the mission,
- Reputation and financing of the University.

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Industry needs to overcome the following hurdles in order to foster greater collaboration:

- Respect the value of research collaboration,
- Incorporate University research into product development,
- Management barriers.

Keywords: THRIP, Triple Helix, Innovation, Developing countries, Time-lag problems

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LIST OF ACRONYMS

ARC	:	The Agricultural Research Council
DST	:	Department of Science and Technology
HEI	:	Higher Education Institution
HSRC	:	Human Sciences Research Council
NRF	:	National Research Foundation
NWU	:	North-West University
R&D	:	Research & Development
RU	:	Rhodes University
SMME	:	Small, Medium and Micro Enterprises
THRIP	:	Technology and Human Resources for Industry Programme
TUT	:	Tshwane University of Technology
UCT	:	University of Cape Town
UFH	:	University of Fort Hare
UJ	:	University of Johannesburg
UKZN	:	University of KwaZulu-Natal
UP	:	University of Pretoria
WITS	:	University of the Witwatersrand

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GLOSSARY OF TERMS

Collaboration

Collaboration means people working with other people towards a common outcome. Collaboration is a recursive process where two or more people or organisations work together in an intersection of common goals - for example, an intellectual endeavour that is creative in nature - by sharing knowledge, learning and building consensus (Sampson, 2010:1).

Innovation

Marcus (Industrial innovation in SA, 2003:3) defines innovation in the South African context as the process of transforming an idea normally generated through research and development into a new or improved product, process or approach, which relates to the real needs of society and which involves scientific, technological, organisational or commercial activities.

Knowledge Transfer

Organisational knowledge is complex accumulated expertise that resides in individuals and its partially or largely inexpressible (Karlsen and Gottschalk, 2003:112). This is because organisations operate as distributed knowledge systems (Tsoukas, 1996:11) and contain within them various streams of knowledge (Von Krogh and Roos, 1995:57).

Inter-organisational knowledge transfer according to Argote and Ingram (2007:7) is the process in the organisation by which one unit (e.g. individual, group, department, division, etc.) is affected by the experience of another. This affects the performance of the recipient unit's knowledge repositories in general and the potential outcomes of knowledge transfer (Argote *et al.,* 2000:152).

The management of knowledge therefore includes the process of capturing, analysing, sharing and distributing knowledge, while technical expertise in many organisations has become a scarce and costly commodity; "expert transfer has become a convenient, workable and important way to share expertise that may be located anywhere in the world." (Karlsen and Gottshalck, 2003:112,117)

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Knowledge Society

A knowledge society is a society that is nurtured by its diversity and its capabilities. Every society has its own knowledge assets. It is therefore necessary to work towards connecting the forms of knowledge that societies already possess, and the new forms of development, and spread of knowledge by the knowledge economy model (Unesco, 2005:17).

Research and Development Innovation

The working definition employed for this research project is that innovation, as an interactive but non-linear activity, aims to transform entrepreneurial ideas through actionable R&D in order to introduce new need-meeting and benefit-providing product and service inventions to the commercial market.

Research and Development (R&D) Projects

According to the Frascati manual, research and experimental development is creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humanity, culture and society, and the use of this stock of knowledge to devise new applications (Kahn and Blankley, 2005:10).

A research and development project between a University and an industry partner can be seen as a complex effort to achieve a specific objective within a schedule and budget target, which typically cuts across organisational lines, is unique and is usually not repetitive (Cleland and King, 1983). One reason for this is that knowledge of one context is often applied (or fails to apply) to another and the knowledge is instinctively modified as it is applied within the new context, but this is by no means a simple process (Singley and Anderson, 1989:1).

Value chain

Brown (1997:28) defines the Value Chain as a tool to disaggregate a business into strategically relevant activities. This enables identification of the source of competitive advantage, by performing these activities cheaper or better than its competitors. The Value Chain is part of a larger flow of activities carried out by other members of the channel-suppliers, distributors and customers.

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CHAPTER 1: ORIENTATION AND STATEMENT OF PROBLEM

"A slow country!" said the Red Queen.
"Now here, you see, it takes all the running
you can do, to keep in the same place. If you
want to get somewhere else, you must run at
least twice as fast as that!"
-Lewis Carrol-

1.1 INTRODUCTION

Until the beginning of the 20th century, research was accomplished exclusively in the university environment, drawing on a rich tradition of academic freedom specialising in scientific freedom. In the early 1900s, when businesses began to introduce their own R&D programs, profit has been established as a new research driver (Jerome and Jordan, 2007:3). The current changes in South Africa can be traced to at least three developments:

- The new political dispensation in 1994, with the elections, which opened international doors,
- The advances in information and telecommunication systems driven by the Internet and e-commerce,
- A drift towards mixed financial systems which have made South Africa part of the global economy.

Competition has changed internationally over the last decade and has now become a case of financial conflict. As countries have prepared themselves for war in the past, they are now mobilising their universities, industries / businesses, and Governments in order to be competitive. In the same way that countries have protected themselves through their military units, (army, air force and navy), they are now protecting themselves by using a mechanism such as the Triple Helix to enable collaboration between the three role-players, namely the University, Industry and Government.

The Triple Helix comprises of three spirals, the University, Industry and Government, which operate in different economic sectors, but not independently of each other.

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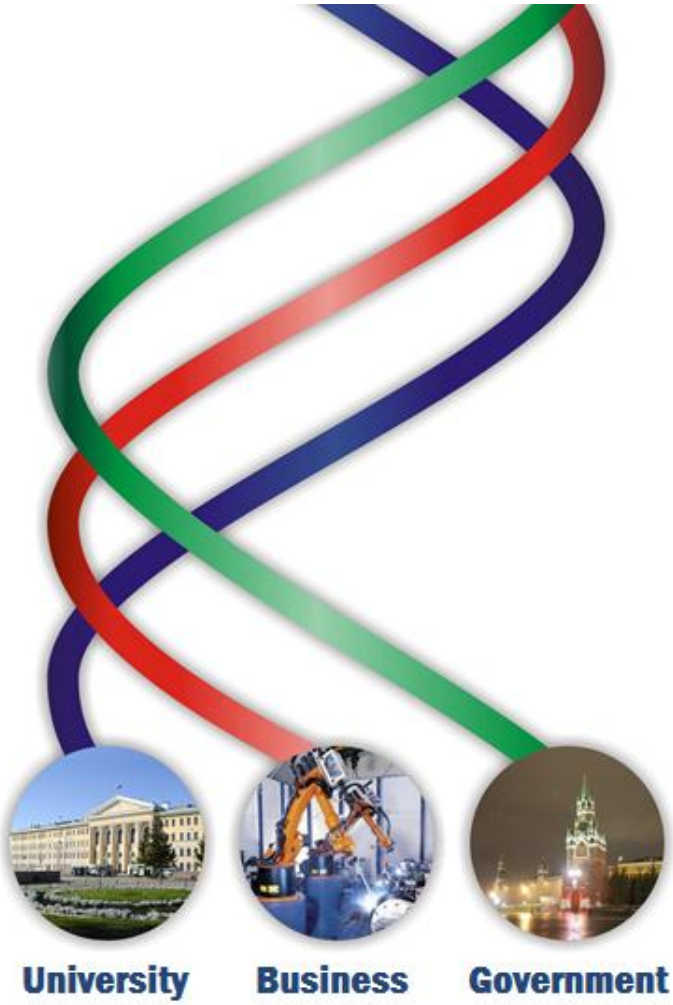
The cooperation evolved over time to maintain a competitive advantage to the country. Over time each spiral has had an impact on the other, and they have achieved synergy. The University and Industry align themselves to achieve common goals - the universities provide the knowledge that exists between academics and students and provide advice and support, with Industry consisting of entrepreneurs and other businesses driving the economy of the country. The Industry adds value by providing a service, and satisfying the needs of local, national or international markets. The Government provides guidance to the above processes through policies and budgetary resources.

Figure1.1: Triple Helix Model



Source: http://www.tusur.ru/en/enterprise/triple-helix

The advantages of the Triple Helix model lie in the relationship between the different "spheres", broadening the scope of research and development in a country and

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making a visible impact on the local, regional, and state economy. This increases education and employment opportunities for university students, and research opportunities for the Industry.

According to Lee (1996:857) close collaboration with Industry and Government will assist the University in many ways, such as that it provides an opportunity to make a noticeable impact on the local, regional, and state economy. It also enhances revenue streams with an increase in education and employment opportunities for the university's students. Therefore, the three entities, namely University, Industry and Government, no longer have to operate in isolation, but expect the Triple Helix dynamics to stay in balance, and evaluate the changing outputs (Leydesdorff, 2003:446). Figure 1.2 gives a graphical representation of the Triple Helix structure, showing how the three parties interact. The emerging system results in the overlapping area, A. The role of the University arises from several features in the knowledge society:

- Firstly, the recent addition, research and teaching, of the academic "third mission" of economic development (Etzkowitz, 2008:13),
- Secondly, the University's capacity to support students with new ideas, skills and entrepreneurial technique has become a significant asset in the knowledge society,
- Thirdly, the role of the University to promote technology, from the traditional history of human resources and expertise, to a new source of technology invention. This requires additional internal organisational capabilities to generate and transfer knowledge.

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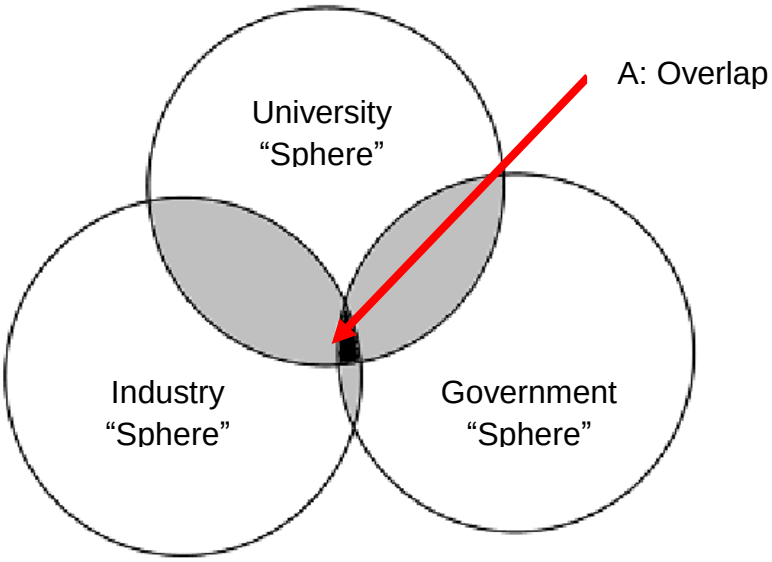
Figure 1.2: A Triple Helix structure with certain overlap among the sub-dynamics



Source: Leydesdorff. 2006:3

1.1.1. The Triple Helix as a collaboration model

There is a change in focus regarding patterns of collaboration among the University, Industry, and Government, with an emphasis on commercialisation (Asheim, Coenen and Moodysson, 2005:16). This collaboration addresses local and public interest through funded research programs, resulting in leveraging human and material resources. It improves the conditions for innovation and helps to create wealth in a knowledge-based society (Campbell, Koski, and Blumenthal, 2004:3).

The Triple Helix relationship is considered the first framework for establishing long-term organisational structures that allow for short-term benefits from collaboration (Campbell, 2005).

According to Shapira (2002:35), there are three compelling reasons to build flexible collaboration between University, Industry and Government:

- Social benefit,
- Economic efficiency,
- Sustainability.

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1.1.2. The role of the Government within the Triple Helix model

According to Etzkowitz *et al*. (2000:314), Governments are focusing on the potential of the University as an initiative to enhance innovation and develop a network of science-based economic development. There is growth toward a mixed system of market forces and Government incentives. The issue of overlapping and disbanding of relationships between the University, Industry, and Government offers numerous research possibilities, and in South Africa it promises increased collaboration.

Kahn and Blankley (2005:121) said that South Africa strives to become a knowledge-based economy, but that the building blocks are not in place for a smooth transition. There is a significant need to increase research funding. The contribution of the Technology and Human Resources for Industry Programme (THRIP), funded by the Department of Trade and Industry (DTI) and administered by the National Research Foundation (NRF), has made a significant contribution to qualified human resource development and applied research outcomes in the manufacturing sector (NRF, 2009:1).

There is evidence that relationships are emerging from new interactions between universities, industries and Government, such as new business spin-offs and incubator enterprises (Kruss, 2008: 9).

1.1.3. The role of the University within the Triple Helix model

The University's historical task was teaching and research, which provided humanity with skills, new understanding and ideas. Expectations have increased, and demands are originating from a much wider range of stakeholders who see universities as the key element of the innovation system, both as the source of human capital and a seedbed for new firms (Etzkowitz *et al.,* 2000:314-6, 320 and 329). Universities are now becoming increasingly prominent in the economic expansion, social development, and developing and transferring technology to business. The role of universities up until now has been inadequate, in both the developed and developing countries. New models such as Triple Helix show the evolution of universities, the development of entrepreneurial or specialised universities, large-scale excellence-driven environments or theory of developmental universities (Göransson and Brundenius, 2009:2).

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Within the Triple Helix model, the University assumes a critical and challenging role of leading change initiatives in knowledge-based societies (Etzkowitz *et al.,* 2000:314-6, 320 and 329). Kruss (2008:9) argues that universities from developing countries would need to develop flexible capabilities that allow them to create amongst themselves new and sensible change and continuity in sustainable form.

1.1.4. The role of the Industry within the Triple Helix model

It is necessary to bear in mind that the Industry provides a new opportunity for research and development, as they recognise the needs and benefits they can gain from using external R&D activities (Lee, 1996:849). Many innovations could not see the light without academic research outcomes.

1.1.5. THRIP as a Triple Helix movement

In South Africa, the Triple Helix model is managed under the name of THRIP (Technology and Human Resource for Industry Programme), by the National Research Foundation (NRF), on behalf of the Government, for the Department of Trade and Industry (DTI).

THRIP fosters collaboration among Industry, Higher Education Institutions (HEIs) and the Government's science, engineering and technology institutions (SETIs), as a means of contributing to the removal of previous inhibitions to joint activity among these three sectors.

In an interview with Hattingh (2012) he explains THRIP as an excellent collaboration mechanism for knowledge transfer between the different role-players. The model integrates the University as the centre of excellence with its academic-based research and development activities, Industry - as the provider of the consumer demand based on its business activities, and the Government as the policy maker and source of funding. This integration of the different role-players stimulates knowledge transfer and enhances the competitive advantage of economic development, local and national.

Collaboration between the Industry and universities has many obstacles as they are not natural partners, their cultures and their operations are often in conflict. The goal and the primary purpose of industries are to make a profit and create value for

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shareholders by serving customers (Meggison, Smart and Graham, 2010:6). The University's goal is to be a realistic teaching-learning and research institution and strives to impart its expertise in an innovative way. This institution will perform as it lives its values, strives for sound management and pursues change, while locally engage, nationally relevant and internationally recognized (NWU, 2012).

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1.2. BACKGROUND TO THE STUDY

There is a constant debate around the function of universities as the essential knowledge builder, the Industry as the driver of economic growth and the Government as the agent of regulation, enabling participation in a knowledge-based economy (Kruss, 2008:1). There has been external pressure on universities to be actively involved in the society and economy, due to the global recession, and increasing self-generated income streams (Srinivas and Viljamaa, 2006:4). Collaboration also provides a broader range of knowledge and technologies, than would be possible through internal development (Barnes, Pahsby and Gibbons, 2000:210).

The Triple Helix concept associated with University, Industry and Government partnership is not new, and universities are a valuable source of new knowledge to the Industry (Iqbal, Khan, Iqbal & Senin, 2011:59). The Triple Helix model emphasises the interaction linkages and collaboration, representing a radical departure from the normal development models, which separate the three institutional “spheres” from the University development area. Universities around the globe developing the internal organisational capabilities, formally transfer technologies and extend their teaching capabilities to individuals. Industries driven by the consumer and business world forced the Industry to find new ways to develop product and service innovations. Some of the aspects which justify the strong collaborative relationship between firms and research organisations are: the emergence of industries based on science, the use of science as a process of competitive advantage for industries, and the globalisation of the economy and internationalisation of technology. It is a well-known fact that the transfer of technology has played a key role in the commercial and business development of any country (Iqbal, *et al*., 2011:60).

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1.3. PROBLEM STATEMENT

In an interview with Hattingh (2012), he indicated that there are constraints due to the different agendas and systems of the three partners involved. Unique challenges are characterised by the implementation of the Triple Helix model in Third World countries (Irawati, 2006:12). One of the most common problems experienced while trying to get Triple Helix to work in South Africa is the time delay. According to Irawati (2006:12), the following external factors result in time delays:

- *Education and Training,*
- *Conflict of Intellectual Property,*
- *Leadership and Mentorship,*
- *Communication,*
- *Resource Availability,*
- *Information Systems,*
- *Knowledge and Know-how,*
- *Co-operation and Support,*
- *Culture and Behaviour,*
- *Awareness and Understanding,*
- *Objectives and Expectations,*
- *Organisational Structure,*
- *Location and Facilities,*
- *Funding and Budgets,*
- *Administration and Procedures,*
- *Policies and Programmes.*

Collaboration and co-operation between the University, Industry and Government requires synergy. There is on-going research to improve collaboration with the emphasis on social, economic, educational, commercial as well as political issues. The above mentioned factors have a direct impact on the relationship between the University, Industry and Government and their collaboration – it rarely achieves its full potential and often results in difficulties managing the collaboration projects.

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Limited research is available on the research topic in South Africa, but internationally numerous research reports are available. This study will shed light on constraints experienced in South Africa.

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1.4. OBJECTIVES OF THE STUDY

1.4.1. Primary objective

It is to identify and quantify the challenges experienced by the different role-players (Government, universities, and industry partners) during the implementation and supervision phase of the THRIP projects, and develops suggestions to a framework which will streamline the process and will attract more attention from the academic and Industry sector to get involved in THRIP.

1.4.2. Secondary objectives

The study will focus on the following factors:

- To identify the constraints affecting the collaboration between THRIP partners, through a theoretical study,
- To identify, document and compare the experience of the different role-players in the THRIP process,
- To make recommendations, as to where the system could be adjusted to streamline the THRIP process.

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1.5. SCOPE OF THE STUDY

The field of study is the maintenance of a collaborative environment, and the constraints experienced.

1.5.1. Scope and boundaries of the study

The paper dissects the collaboration environment of THRIP, amongst various universities, industries and the Government in South Africa, focussing on the management and constraints experienced. The problems experienced with collaboration by different sectors are included in the study:

- **Universities**

Stellenbosch	=	*University of Stellenbosch*
WITS	=	*University of the Witwatersrand*
ARC	=	*Agricultural Research Council*
NWU	=	*North-West University*
RU	=	*Rhodes University*
TUT	=	*Tshwane University of Technology*
UCT	=	*University of Cape Town*
UFH	=	*University of Fort Hare*
UJ	=	*University of Johannesburg*
UKZN	=	*University of KwaZulu-Natal*
UP	=	*University of Pretoria*

- **Industries**

Various industries, from different growth sectors of the DTI representing a
560 samples sourced from the restricted NRF database.

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1.6. RESEARCH METHODOLOGY

1.6.1 Literature / Theoretical Study

The purpose of the literature review defines the concepts - describing the role of the different role-players in the model, identifying their ideal position within the Triple Helix, and gaining knowledge regarding research on constraints experienced. To acquire information on the Triple Helix model and the challenges experienced within developed and developing countries, references will be cited regarding Triple Helix and THRIP. Thereafter the literature review will focus on the South African perspective. The research programme will aim to understand the different challenges experienced when leading a THRIP project.

The literature review will synthesize what frameworks are available to streamline the process. This will form the basis and departure of the research and an essential part of the research methodology (Mounton: 2011:5). The research considers various publications during the completion of the study. Literature regarding constraints experienced in the Triple Helix includes books related to the Triple Helix concept (Leydesdorff and Etzkowitz) as well as journals and websites amongst others those of the Department of Trade and Industry (DTI), National Research Foundation (NRF), Department of Science and Technology (DST), and Human Sciences Research Council (HSRC).

Topics that were of interest for this research include:

- Innovation,
- Universities and business knowledge exchange,
- The power of communication,
- Entrepreneurial universities,
- Marketing strategy,
- The rise of a network society,
- Importance of the Value Chain in collaboration,
- The Triple Helix model and how it applies in South Africa,
- The future of universities and the tendency to incubators,
- Organisational structures,
- Impact of culture on collaboration.

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1.7. EMPIRICAL STUDY

In order to examine the constraints experienced when managing THRIP in South Africa, the opinions of respondents were gathered through a structured internet-based survey instrument.

Designated employees directly involved in the THRIP programme at various universities and industries, answered an anonymous questionnaire regarding their experience when managing THRIP.

1.7.1. Construction of the questionnaire

The questionnaire content has been drawn from the literature in order to explore the elements regarding the constraints experienced when managing collaboration projects like the THRIP programme in South Africa.

In designing the survey, the following issues will be addressed:

- The expectations: NRF, University and Industry,
- The time-lag in decision-making between the different role-players,
- The extent of linkages between trade shareholders and decision-makers - NRF and whoever else forms part of a THRIP project,
- The frustration, challenges, and success factors that affect the success of the THRIP project.

The research paper focuses exclusively on the frustration and challenges mentioned in the last bullet.

The questionnaire was loaded on SurveyMonkey and distributed to the target sample - a PDF-version of the questionnaire is attached as Appendix A.

1.7.2. The study population

The target population who participated in the survey was current or past R&D collaborations with the University. Participants are NRF, THRIP office staff at all South African universities, as well as numerous business partners who have taken part in THRIP projects over the past 5 years.

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A NRF database, which included participants from different industries and universities in South Africa, was used to distribute the questionnaire. The members are all involved with collaboration between the University, Industry and Government, primarily through the THRIP programme. An online research questionnaire was used due to the participants' widespread geographical locations. Making use of the Internet provided security and confidentiality. The population group consists of 560 respondents. They represent a sizeable portion of the THRIP community, and it was anticipated that approximately 110 would take part in the research. 105 respondents received the questionnaire and 97 completed it.

1.7.3. Data gathering

Data has been gathered with the assistance of the NRF, who shared their database for the purpose of the research.

1.7.4. Statistical analysis

The data has been analysed by using appropriate statistical analysis tools. The sample size will be taken from the NRF database and the author will use descriptive and inferential statistics to analyse the data in order to calculate the mean median, draw a correlation and doing comparative T-tests of ANOVA, standard deviation of the population, and a regressive-analysis.

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1.8. LIMITATIONS OF THE STUDY

The limitations included:

- The study required commitment from people who might not be involved with THRIP anymore, which may have had an impact on the response rate and affect the accuracy of respondents completing the questionnaire,
- It is only applicable to South Africa and thus cannot be inferred to represent constraints experienced in other countries,
- A limited number of people have had experience with THRIP, which could reduce the population considerately.

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1.9. EXPECTED CONTRIBUTION OF THE STUDY

From the results of the study, the challenges, constraints, and barriers experienced during the implementation and management of THRIP by all role-players will be identified. A structure of best practice that will streamline the managing processes within Higher Education Institutions in South Africa, and contribute to the overall success of similar projects, will also be proposed.

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1.10. DIVISION OF CHAPTERS

CHAPTER 1: ORIENTATION AND STATEMENT OF PROBLEM

Chapter 1 introduces the research environment by providing a brief overview of the function of the NRF in South Africa. This chapter expounds on the Triple Helix model and THRIP model, as well as the challenges and frustrations experienced between the different role-players in South Africa, as well as in other countries.

CHAPTER 2: LITERATURE SURVEY

This chapter contains a literature review, focusing on current theories and models that describe the challenges experienced by the different role-players. The literature review includes an overview of books, journal articles, and Internet sources, which together form the published information in the field. Attention is given to challenges experienced in the South African environment as well as other developing countries and developed countries.

CHAPTER 3: EMPIRICAL RESEARCH DESIGN AND METHODOLOGY

Chapter 3 motivates the objectives and rationale for the research; it provides information on the model for data collection, and explains the on-going action plan employed in order to achieve research objectives.

It provides the initial articulation of the respondent's feedback regarding the challenges faced by the different role-players within the THRIP model. Using quantitative as well as qualitative methodology for the survey - which was the vehicle needed to collect the data - the author discusses the importance of the findings in this chapter.

The chapter contains exact descriptive statistical analysis of respondent information, including the research limitations. Some areas of future research is suggested and followed by concluding remarks based on the research findings.

CHAPTER 4: RECOMMENDATIONS AND CONCLUSION

This chapter will cover the interpretation of the data and a framework suggestion to streamline the management of THRIP projects.

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1.11. CHAPTER CONCLUSION

Chapter 1 explains the nature and extent of the study. In the next chapter, a literature review will be carried out, focusing on current theories and models that describe the challenges experienced by the different role-players. Attention is given to challenges experienced in the South African environment as well as other developing and developed countries.

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CHAPTER 2: LITERATURE REVIEW – TRIPLE HELIX IN SOUTH AFRICA

"If you have an apple and I have an apple and
we exchange these apples then you and I will still
each have one apple. But if you have an idea and
I have an idea and we exchange these ideas,
then each of us will have two ideas."
-George Bernard Shaw-

2.1. INTRODUCTION

This chapter contains a literature review on THRIP collaboration constraints experienced when managing projects in South Africa.

There are different viewpoints regarding the THRIP programme in South Africa, but no published literature is available regarding constraints experienced when managing THRIP projects.

The Triple Helix relationship is often considered the best model for establishing long-term organisational structures that allow for short-term benefits from collaboration experiences (Campbell, 2005). This collaboration, addresses local and public interest through funded research programs, resulting in leveraging human and physical resources. It improves the conditions for innovation and wealth creation in a knowledge-based society (Campbell, Koski and Blumenthal, 2004:3).

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2.2. BACKGROUND

In developing countries where industrial development plays a vital role, technology is necessary to improve the economy of a country. The universities play a vital role, because technology cannot simply be developed and handed over to the industry partner, they need to collaborate, and transfer technology from inception to the commercialisation stage. When knowledge-transfer takes place from the Industry to University and vice versa, it results in improved material and successful technology development (Lee, 2004:434).

Research collaboration plus cooperation between the University and the Industry, provide direct benefits to both parties, and this extends beyond the direct partners. The Industry, mentioned in the context, refers to the industrial partnership with which the collaboration takes place. When the resources and information are available to potential partners, different goals will be executed, and the benefits of working with outside experts will improve the quality of research with a cost reduction. The benefits for the University to collaborate with the Industry in sponsored research, are the external financial support, as well as business exposure for educational and research missions (Pertuzé, Calder, Greitzer & Lucas, 2010:83).

The Triple Helix is recognised as a new concept in some developing countries and exists of three “spheres”, namely the University, Industry and Government. With the Triple Helix interaction the Industry, universities, and Government each “take the role of the other” (meaning that their scope of research widens as well as supplying more innovative ideas), although they keep their primary roles and distinct identities (Etzkowitz, 2008:1). The collaboration between the University, Industry and Government, is the way to innovation and growth in a knowledge-based economy. The University is a major catalyst toward future economic growth, because of their research capabilities and the potential of students with their creative ideas. The Industry as the second leg of the Triple Helix context, acts as the provider of the customer base and the commercial activities as well as research and development. The Government as the third leg acts as the policy maker (Etzkowitz, 2008:1).

The Triple Helix model presents interaction of institutions at every stage of innovation product development. THRIP aims to gain maximum benefit from the collaboration in

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pre-commercial research between business and the public-funded research support, including universities and research institutions. THRIP also encourages and supports the development and mobility of research personnel and students among participating organisations (THRIP, 2012:2).

Collaboration between the Industry and universities has many obstacles as they are not natural partners. Their cultures and their mission differ - the primary objective of the Industry is to make a profit and build-value for the shareholders by serving customers, while the University's mission is to develop new knowledge and educate the next generation (Zemsky, Wegner, Massy, 2005). The vision of the North–West University is as follows: "To be a pre-eminent University in Africa, driven by the pursuit of knowledge and innovation." (NWU: 2012:1)
According to a research done by (Iqbal, *et al*., 2011:63), some crucial constraints that truly affect the collaboration between University and Industry are "education and training", "culture differences", "conflict of intellectual property", "time constraints" and "funding and financial difficulties".

The Value Chain approach views an organisation as a series of processes, each of which adds value to the product or service for each customer (Baltzan and Phillips 2010:21). For an organisation to create a competitive advantage the Value Chain needs to enable the company to create a unique value to its customers. There is more than one way in which the company will be able to create unique value for its customers, like lower costs, superior benefits or differentiation.

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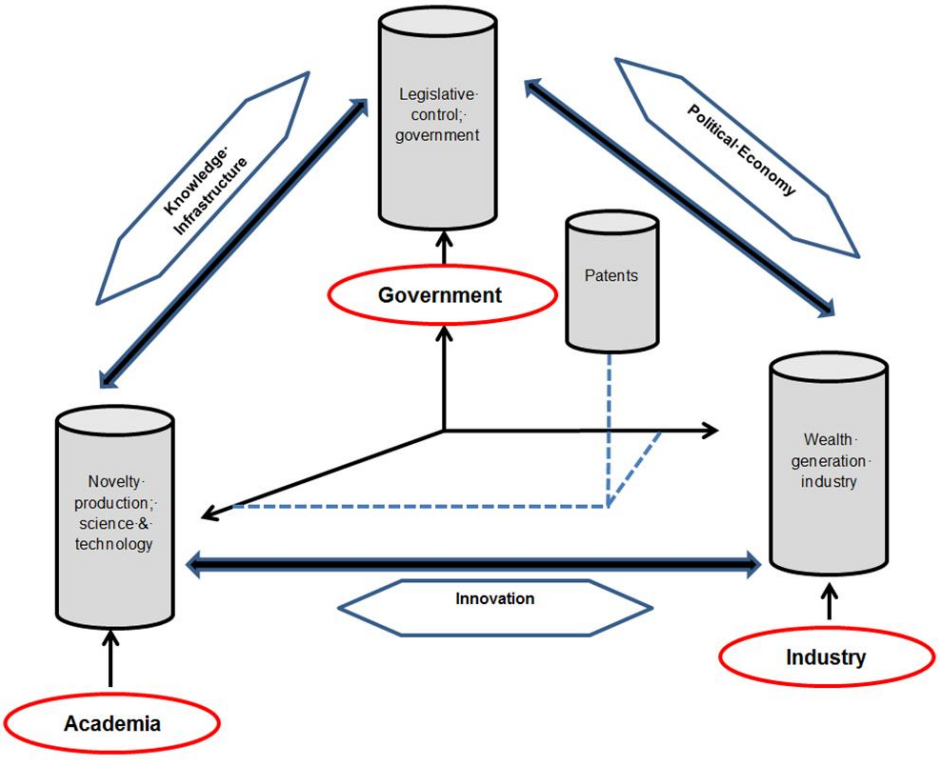
2.3. TRIPLE HELIX

As seen in Figure 1.2, the Triple Helix model, the one “sphere” may take the role of the other, for example if the University’s core competency is research and the Industry takes research as a second activity in order to make an innovative contribution to the performance of an innovative outcome. This normally happens at the overlapping (mark A in Chapter 1, Figure 1.2). The University, Industry and Government maintain their primary roles, as described below, and still keep their distinct identities. The University has a special mission of socialisation of youth and dissemination of knowledge even as they take on some business and governance functions. The Government is the provider of funding and sets the rules of the game; the Industry is the primary source of productive activities (Etzkowith, 2008:1).

Figure 2.1: Patents as events in the three-dimensional area of Triple Helix



Source: Leydesdorff, 2010

Patents are the output indicators, but for science and technology they serve as input into the economy (Leydesdorff, 2012:8). The main function of a patent is to provide legal protection for intellectual property.

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According to a survey done by (Iqbal, *et al*., 2011:64), the issue regarding the ownership of intellectual property always appears to be a quarrel between University and Industry collaboration. Researchers need protection of property rights for their inventions even before proceeding with the partnership, but it is more complex and difficult because Industry also expects ownership of intellectual property (IP) because of their investment.

2.3.1. Triple Helix: a Government perspective

The role of the Government is to support and encourage but not to control. The Government is the initiator of the Triple Helix model, and in all parts of the world, the Government focuses on the potential of the University as a resource to enhance innovation environments and create a regime of science based economic development (Etzkowitz *et al.,* 2000:314). Furthermore, Etzkowitz *et al.* (2000:320) states that the Government policy may strengthen and diffuse internal academia changes. There is a transition towards a mixed system of market forces and Government incentives, the interaction of Government, Industry and University are moving from silo operations into collaboration.

There is a need to increase research funding in South Africa, and the amount from Government should be enough to support an appropriate, comprehensive and sustainable strategy to boost the knowledge resources. The problem in South Africa is that the Government policy changes frequently which results in suspicion, and may have an impact on environmental laws, which will change the University's as well as the Industry's economic sustainability (Williams, 1998:175).

2.3.2. Triple Helix: a University perspective

The Triple Helix is based on the concept that University plays a prominent role in development of a collaborative environment with Government and Industry (Dzisah and Etzkowitz, 2008:104).

University is seen as the key element of innovation, a human capital provider and a seed-bed of new firms, but when focussing on the entrepreneurial University, there is a strong indication that University requires an enhanced ability for intelligence, monitoring and negotiation with Industry and Government (Etzkowitz *et al.,* 2000:314-316, 320 and 329).

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The main benefit of the Industry is the flexibility to adapt to market changes and the ability to make quick decisions and implementing a change if necessary. For the University to support this culture they need to become quicker, more flexible and more focused in reaction to expanding and changing demands (Clark, 1998:5, 103).

2.3.2.1. Entrepreneurial University

In the late 20th century there has been a paradigm shift from a traditional research University to an entrepreneurial University in order to encompass a third mission of economic development in addition to research and teaching (Readings, 1996:122).

This shift in the University arises from the internal and external development of the University and the external influences on the academic structures associated with the emergence of the knowledge-based innovation (Etskowitz *et al.,* 2000:313*).* Entrepreneurial activities are undertaken with the objective of improving regional or national economic performance as well as the University's financial advance and its faculty development. Many academics view the entrepreneurial paradigm as a threat to the rational integrity of the University (Kanellos and Esteva-Fabregat 1994:300). Many critics have stated that entrepreneurialism should be resisted or even captured in a special class of institution of higher learning (Brooks, 1993). The biggest fear is that the University may lose its role as independent critic of society (Krimsky, 1991:64). The separation of teaching, research and business activities becomes less sustainable, although there is a return to the historic ideal of a common academic format that meets the cultural and material needs of society (Geuna, 1998:9).

With the constant changing global economic environment, there is an emergence of the entrepreneurial University as a response to the increasing importance of knowledge in the national and regional innovation system, as well as the importance that the University is a cost effective and creative inventor and an agent of both knowledge and technology transfer. The Governments in all parts of the world are focusing on the potential of the University as a resource to enhance innovation and create an environment of science based economic development (Etzkowitz *et al.,* 2000:31).

2.3.3. Triple Helix: the Industry perspective

It is important to bear in mind that the Industry provides a new window of opportunity for research and support, and the recognition for pre-commercialization research is

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more accepted today, because universities are expected to be accountable to society economically (Lee, 1996:849).

Each stakeholder has a different perception of the meaning of collaboration partnership, and terms like collaboration relationship and professional relationship are included as definitions. The main success of these relationships stands on clearly and mutually defined needs and benefits, which should include matching contributions by both parties and team members (HSRC, 2003: 26-27).

Katz and Martin (1997:13) indicate that there are five factors that motivate Industry research collaboration:

- Cost escalating of fundamental science,
- Decrease of the cost of travel and communication, which leads to mobility among scientists,
- As a social institution, science depends on interaction and networks to grow,
- The need for specialization in certain fields such as biotechnology,
- Political factors, such as the growing integration of science in Western Europe, that promotes cross-national collaboration.

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2.4. SOUTH AFRICAN LANDSCAPE

The South African environment is driven by social ideology with the Reconstruction and Development Programme (RDP) released in 1994 by the ANC, COSATU and the SACP, as its key policy objective. One of the main merits of the RDP is that it gives a clear and comprehensive description of all the wrong and injustices which became part of the South African society during apartheid (Terreblance, 1999:1).

In the White Paper, (1995:4) the South African Government formulated a general framework suggestion which acts as guidelines for small business development and support. This White Paper outlines a national strategy for the development and promotion of small businesses in South Africa, where the Triple Helix concept is indirectly called for (Brundin, Wigren, Isaacs, Friedrich and Visser 2007:78). Addressing the economic imbalances of the past, the objectives of the national policy framework for South Africa are six-folded:

- To create an enabling environment for small enterprises,
- To facilitate greater equalization of income, financial and economic opportunities,
- To create long term jobs,
- To stimulate economic growth,
- To strengthen the linkage between small enterprises,
- To “level the playing fields” (i.e., creating levels of equality) between large and small businesses (Brundin, Wigren and Visser, 2007:78).

2.4.1. The Department of Trade and Industry

The driving force for the above mentioned framework in South Africa is the Reconstruction and Development Programme (RDP). A trade and industry policy incentive environment has been established between 1995 and 1998, when the DTI reorganised itself. All trade and industry support programmes underwent review and were restructured to provide support in three areas:

- Competitiveness (through a variety of supply-side measures),
- Export marketing and support,
- Industrial investment promotion.

The THRIP programme has made significant contributions to qualified human resource development and applied research outcomes in the industrial sector. THRIP

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has initiated focused support for SMMEs and BEE companies, together with sound governance and implementation processes, forming a consistent policy to cover the significant challenges.

THRIP promotes collaboration in pre-commercial research between the Industry and the research base (universities and research councils) - initiated in 1992; enhanced and incorporated into the DTI supply side measures by 1996. In 2006, THRIP was reviewed, and found to be successful in its objectives to:

- Increase the number of people with relevant science and technology skills,
- Promote interaction between Industry and higher education and SETIs, and
- Stimulate Industry and Government to increase their investment in R&D innovation and technology diffusion.

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2.5. THRIP

THRIP is a funding programme guided by the National Research Foundation on behalf of South Africa's Department of Trade and Industry (DTI), supporting scientific research, technology development and technology diffusion activities, as well as improving the Industry's competitiveness (THRIP, 2009:2).

The challenge is to stimulate South Africa's competitive participation in a global knowledge economy, while concurrently contributing to social upliftment, equity and sustainability.

THRIP is designed to enable South African businesses to obtain innovative responses and technological ability to build up a pool of highly qualified researchers and technology managers. Challenged by the South African needs Government's focus is:

- A rapidly evolving knowledge-based economy in a globally competitive environment,
- To make BEE companies more competitive,
- To increasing the number of students,
- For students to embark on technological and engineering careers,
- To facilitate firm collaboration,
- To enable SMME and BEE enterprises access to R&D,
- To develop and maintain SMMEs, and
- To develop knowledge, skills and R&D training.

THRIP plays a prominent role in fostering scientific and technological capacities essential in growing the financial performance of the country. It forms part of the Government's policy to intervene in opening up the economy, enhancing competitiveness, improving access to economic opportunities, as well as facilitating geographic balance (Pandor, 2012:1).

As seen in Graph 2.1, a concerning factor was the reduction in THRIP applications and R&D outputs. This may be the result of many issues ranging from the introduction of new funding ratios and the creation of new and competing research funding instruments, to the complexity and effectiveness of the granting process, as well as the current economic climate (NRF, 2009:5).

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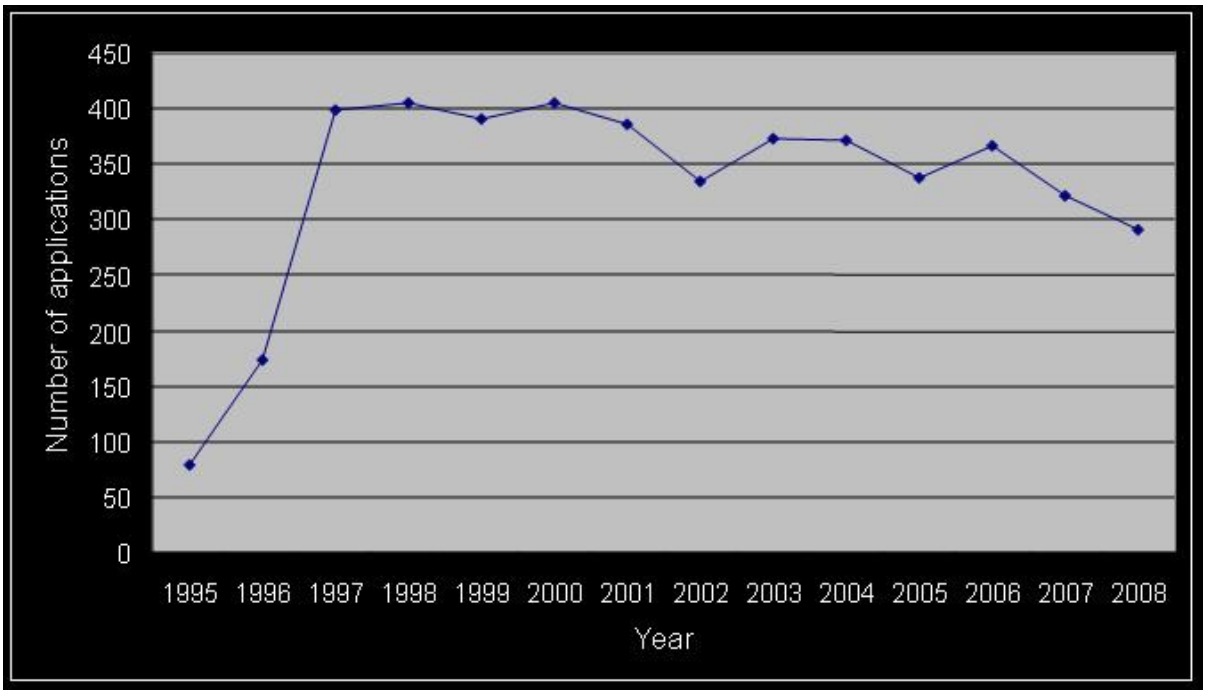
An immediate reaction has been to strive to understand and address the decline in the number of applications. Another significant challenge is the simultaneous delivery of both relevant research excellence and research-capacity building. On one hand, THRIP has to support the increasing national level of science, engineering and technology capabilities, while it is oversubscribed in terms of the limited funds for the programme. The focus will be on the development of science and technological skills partnered with employment generation and social upliftment. It is also imperative that THRIP should encourage the redevelopment of students into specialists, in order to increase the SMME sector. As it is necessary to address these challenges, THRIP will increasingly focus on support to SMMEs and BEE companies (THRIP, 2009:4).

Graph 2.1: Declining in THRIP applications



Source: http://thrip.nrf.ac.za

2.5.1. University

During the past decade higher education institutions in South Africa, and in developed and developing countries, are increasingly under pressure to become more responsive to the necessity of economic and social development. Higher education policy goals in South Africa are destabilised by a dual responsibility to contribute to the challenge of competitive integration into the global knowledge economy, and simultaneously, to contribute to equitable national economic and social development

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(Kruss, 2008:32). Since 1994, there is an increasing pressure on higher education to engage in research that is also relevant, applied and strategic, in partnership with Industry or science councils, and that also can contribute to a national system of innovation (DACST, 1996: 2002a). Differences experienced within the different structural dynamics, add to the complexity of the interface within the network, with the potential for conflict, pressure and control (Pillay, 2009:14). Castells (1996:2) states that a network's performance will depend on connecting a framework to enable communication between the University, Industry and Government, and sharing an interest between the network's goals, and the goals of the University, Industry and Government. A key question is to understand what drives participants to pursue a network - the structure, how they interact, how each one benefit, and what the limitations of the network are - against an understanding of the appropriate institutional context of University, Industry and Government. The driving forces for knowledge networks in South Africa are formed by the competitive dynamics of the Industry sector, by which a business operates and search for research networks. The University is the supportive partner, in terms of managerial, administrative, financial and intellectual property frameworks (HSRC, 2011:14).

The University plays a significant role by bringing research capability and function, including the students, to the network.

2.5.1.1. The changing role of the University

In the past, the traditional mission of the University was teaching and research. Currently innovation is an evolutionary process that involves the University, Industry and Government in society. Gibbons, Limoges, Scwartzman, Scott and Trow (1994:77) argue that we now see a fundamental change in the system of knowledge performance with new organisations and relations identified with key concepts such as reflexivity, trans-disciplinary and heterogeneity.

The relation between University, Industry, and Government is symbolised by a Triple Helix of evolving networks, in which the University can play an enhanced role in innovation. Florida (1999:370) argue that a key role of a University in the knowledge economy is as a collector of talent, thus acting as an important infrastructure for nations and regions in building capacity to survive and thrive in the knowledge economy. In a knowledge-based economy, the University then becomes a key

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element of the innovation system, both as a human capital provider and a seedbed of new firms (May and Perry, 2006:262).

2.5.2. Industry

Small businesses do not normally have the organisational structure occurrence that is present in large organisations. While small organisations employ staff to perform multiple tasks, large organisations prefer to use specialists who perform the same activity. Small organisations often break down their tasks into functional subsections and assign employees to the selected task. Only if the organisation is large enough is specialization economically feasible. If the SMME requires knowledge, it can be externally sourced, but experts are extremely expensive and in most cases not suitable for a SMME.

Boone and Kurtz (1996:125-127) explain that the freedom of small enterprises provides the following unique advantages:

- Innovation – Small organisations introduce new products to the market far quicker than large organisations,
- Better customer service – Small organisations are more flexible allowing them to create a product and services to the exact needs of potential and current customers,
- Lower cost – Small organisations can often produce products and services at a cheaper price, due to their lower overhead cost and smaller profits,
- Filling of niches – The size of large organisations can eliminate them from some markets and the small organisation can use this as an opportunity because of their lower overhead cost.

Small enterprises do however have a variety of disadvantages such as:

- Poor management – One of the most common reasons for the failure of small organisations, because of a lack of business education and learning. This often leads to bankruptcy. There are only a few small organisations' owners that possess the specialized knowledge of an attorney, a professional marketer or an accountant, meaning that most of the time outside professionals need to be sourced externally when needed,

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- Inadequate financing – Most organisations start with limited resources and quickly run into a cash flow constraint, and most often struggle to survive when economic times are tough, and even when the organisation is successful, it is difficult to grow,
- Government regulations – It is placing a financial burden on SMEs due to the amount of paperwork and the complexity thereof.

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2.6. DRIVERS OF COLLABORATION

For the University and Industry to build a sustainable, collaborative relationship, there must be mutual benefit from their interaction. The benefits from a University's approach of collaborative research with industrial partners include the following:

- Provide access to sources of research funding, other than their regular public sources - managers will thus be able to deepen their research competencies and increase the capacity of research undertaken,
- Increased access to proprietary technology held by Industry - this technology can generate equipment that increases capacity, speeds up the discovery time, or materials such as chemicals and compound libraries developed by Industry,
- Etzkowitz *et al.* (2000:325) highlighted that the ability to establish channels by which research output can be disseminated effectively to the community and contribute to the economic development of the country, depends on the perception as to whether it will make a direct contribution to the economy,
- The alignment between the University and industrial role-players are better, so is the transfer of knowledge between them better aligned. As a result of the alignment, research funding of the universities can be verified /validated more quickly by Industry and the Industry information fed back to the University.

Dooley and Kirk, (2007:320) describes the key drivers in University-Industry collaboration below:

- Access to support of scientific expertise built-up within the University through research funding. There is often world-class science in a niche area at the University - an area where the industry partner may be inadequate. This is true, especially where the complexity of the innovation process makes it increasingly difficult for any one organisation to contain all the necessary competencies,
- Access to knowledge that is developing within the research centre through decades of publicly funded research,
- Access to world-class academics that are both scientifically and industrially aware,

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- Access to better leads through faster channels than their competitors, thereby enhancing the product development process and adding to the competitive advantage,
- Access to rich sources of highly qualified researchers, which is also cost-effective, at the University, since universities may in most cases already have the infrastructure.
- The nature and purpose of the research, provide a window on the future, enhance internal expertise, and improve internal capacity, developing potential competing technologies.

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2.7. ORGANISATIONAL PRACTICES THAT PROMOTE COLLABORATION

The following practices promote effective, long-term University interaction.

2.7.1. Aligning strategically

Chatterji (1996:56) identified the most significant barrier to capturing external technology as the failure to recognise and control technology sourcing as a strategic business process. First determine the appropriate technologies, for University collaboration and then find the consistent partner. In many cases, this process is reversed, but the most successful partnerships begin with the following:

- Identify the research sourcing opportunities into the strategic technology planning process and define the criteria that will describe the partner,
- Describe each research opportunity,
- Try new research techniques.
- Identify prospective employees,
- Determine the scope or size of the project,
- The time frame is normally 3 years,
- Find the links between collaborative research and internal efforts,
- Develop Intellectual Property (IP).

The ultimate successful collaborative projects are those where the University and Industry, work towards a common goal.

Good collaborations involve the following:

- Placing value on the application of theory to practice and on a real-world experience to students,
- A significant amount of research support from the Industry,
- A track record of Industry participation in project planning,
- The history of intellectual property agreements favourable to companies while protecting University publication requirements.

Characteristics common to faculty members who participate successfully include:

- Curiosity about applications of basic research,
- Reliable communication skills,
- Industrial experience in their background,

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- The goals of the collaborative proposal must be directly aligned with the faculty research interests.

2.7.2. Managing collaboration

Governments are actively encouraging collaboration, improving innovation capability, enhancing wealth creation, and providing companies with the means of advanced technology, at a lower cost and with less inherent risk (Barnes, Pashby and Gibbons, 2000:210).

Since 1980, there is a growing trend toward collaboration, driven by the knowledge that the sharing of information and technology enhances the creation of innovation. The problem is that collaboration rarely achieves its full potential because of the difficulties experienced when managing across organisational boundaries (Barnes *et al.,* 2000: 210).

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2.8. CHALLENGES TO OVERCOME

There are clear benefits to both parties to interact, but there are also significant challenges that need to be overcome (Elmuti, Adebe and Nicolosi, 2005:115). These challenges include:

- The differing cultures of the organisations can hinder success. The two sectors operate on different timescales, have different objectives to fulfil and often have different value systems (Elmuti *et al.,* 2005:115). One of the biggest challenges is to get the proper balance to satisfy both stakeholders,
- The conflict regarding the desire of academia to publish, and Industry who want to protect the Intellectual Property (IP) in order to maintain their competitive advantage,
- The issues relating the ownership of Intellectual Property (IP) and the division of revenue amongst the parties is often an area of intense debate among collaborators. Disagreements are common in this area, with Industry claiming that IP from universities is overpriced and ignores the risks Industry is exposed to while commercialising it. Universities fear that Industry may steal their discoveries and generate revenue streams that rightly belong to the University. Only through defined processes and trust can this challenge be overcome,
- Organisations need to adapt their strategies in response to their external environment. These changes can result in the level of interaction between the University and Industry either increasing or decreasing in importance. Since much of the academic research is long-term in nature (López, and Piccaluga, 2000:136), weakness in Industry support can result in difficulties for the University in planning for the future.

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2.9. COLLABORATION CONSTRAINTS BETWEEN UNIVERSITY AND INDUSTRY

Countries retain a large amount of their annual budget for education, especially for research, since the importance of University-Industry research collaboration has risen steadily as a result of growing complexity. Every year a large amount of research activities are continuing in developed and developing countries, but all the researchers are not commercialised focussed, thus leaving weaknesses on the University-Industry collaboration (Iqbal, *et al*., 2011:60).

According to Iqbal *et al.* (2011:60) a University research centre is one of the most attractive external sources of technology for the Industry. There exists a strong collaboration between the University and Industry to facilitate the exchange of technology. In developing countries, it is recognised that the University and Industry research collaboration plays a significant role in economic growth and the development of living standards of their countries. Mainly due to the overlapping of the University-Industry collaboration as seen in Figure 2.1, the overlap results in some major constraints (Etzkwowitz, 2008:18). Collaborative relationships between universities and industries in developing countries enhance elements in which both are weak, such as developing an industrial, technological infrastructure. The University is mainly education based, and the Industry's demands are commercial based. It may seem that most of the research is useless and shelved in a library, whereas strong collaboration will prevent this problem (Barnes, Pashby and Gibbons, 2000:212).

It is clear that collaboration between the University and Industry requires synergy and the research investigates all the main constraints.

Iqbal *et a*l. (2011:63-65) identify the following constraints, with a direct impact on the success of the project:

- **Education and Training**

  A lack of *Education and Training* occurs because of the limitation between University-Industry collaboration. There is a requirement that technology should

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be transferred and maintained in the firm, with appropriate *Education and Training* needing to be developed.

- **Funds and Financial difficulties**

  The University depends on funds from the Industry in order to continue with their research, while the success and viability of their research is highly dependent on the financial support of the Industry and Government.

- **Conflict of Intellectual Property right**

  The ownership of Intellectual Property (IP) is one of the issues that need to be addressed, and most often the cause of mistrust. At the North-West University, the Industry wants to know that the IP belongs to them if they are the idea generator. The acquisition of this constitutional right is complex, difficult and multifaceted because both role-players require ownership of the (IP).

- **Time constraint**

  External factors having a direct impact on a THRIP project, that results in a time constraint. This is one of the biggest constraints between the University-Industry collaboration. Except for the external factors which may have an impact, the academic world takes time to publish research results without concerns towards market environment and expectation of the Industry. Industry wants immediate solutions of their problems and is not willing to wait until the result of research is available.

- **Cultural difference**

  Culture is another limitation in the University-Industry collaboration. The University and the Industry each have their own culture, which reflects in different goals, time orientation, basic assumptions, and characteristics. Universities focus on basic research and the Industry focus is on applied research. The universities have to develop advanced knowledge whereas the industries have to increase efficiency. The University generates new ideas while the Industry has to generate more profits. The University is known as an idea centre with an open framework and in contrast the Industry is known as a product centre with a closed frame work. It is clear that the University and Industry differ in opinion and vision.

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- **Technological competency**

  According Iqbal *et al.* (2011:60), 60% respondents from different research centres at the universities, stated insufficient technological competency in the industries as a barrier of University-Industry collaboration. Technical assistance is usually required by a firm that has less experience in operation and setting up of any productive activity, normal maintenance and repairs of machinery, obtaining specification, assistance in setting up production facilities, advice on process know-how, consultation with manufacturing, personnel training and testing final products. Time is already a constraint and therefore academics do not want more complexities in their tough schedule. This is one of the reasons why universities do not want to collaborate with industries where they need to provide technical assistance with technology.

In a research report carried out by the Council for Industry and Higher Education (CHE) and the Centre for Business Research (CBR) at Cambridge University, a number of key issues have arisen. The study has shown that:

- Universities and the academics within them, play different and varied roles in national and regional economies; the strengths of the University's depend on their location and the business structure in which they are embedded; all important and interdependent,
- Technology transfer is only one aspect of the knowledge exchange process and its role is relatively minor; the findings stress the interdependent and evolutionary nature of interactions,
- There are multiple knowledge exchange mechanisms; the most important of these involve people,
- Knowledge exchange is not easy; it may be costly, difficult to implement and take a long time to succeed; these issues may be particularly difficult for small and medium-sized enterprises,
- There are many potential barriers to collaborations, such as the lack of knowledge about potential partners and about possibilities for mutual interaction,
- Gate keeping is an important activity, and the way it is designed and filled is vital. Individuals or groups playing this role need a clear understanding, experience of

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both the academic and business environments, as well as the skills to overcome barriers and foster relationships,

- Aligning the interests of businesses and academics can be problematic and requires mutual understanding and trust; which only develop over time,
- Modes of interaction and project objectives are most likely to yield economic and social benefits if they are co-determined and they co-evolve; in some cases it is the co-creation of knowledge or the co-fostering of solutions that add the most value and reflects the respective strengths of the players,
- Academics are valued for their specialist expertise and in general, they are not considered as a means of expanding a company's own internal capacity; in some cases it is the wider complementary capabilities which may range from providing 'thought leadership' and management science to continuing professional development that are of value.

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2.10. THE VALUE CHAIN

The Value Chain provides insight in the management processes of the THRIP projects, and describes the activities within and around an organisation - this relates to an analysis of the competitive strength of the organisation (Kaplinsky and Morris, 2000:3). Therefore it evaluates each process that adds value to the THRIP collaboration.

Only when these processes are aligned and in harmony, will it add-value to the stakeholders, and are they willing to get involved with collaboration, which in the end adds a competitive advantage (Recklies, 2000:2).

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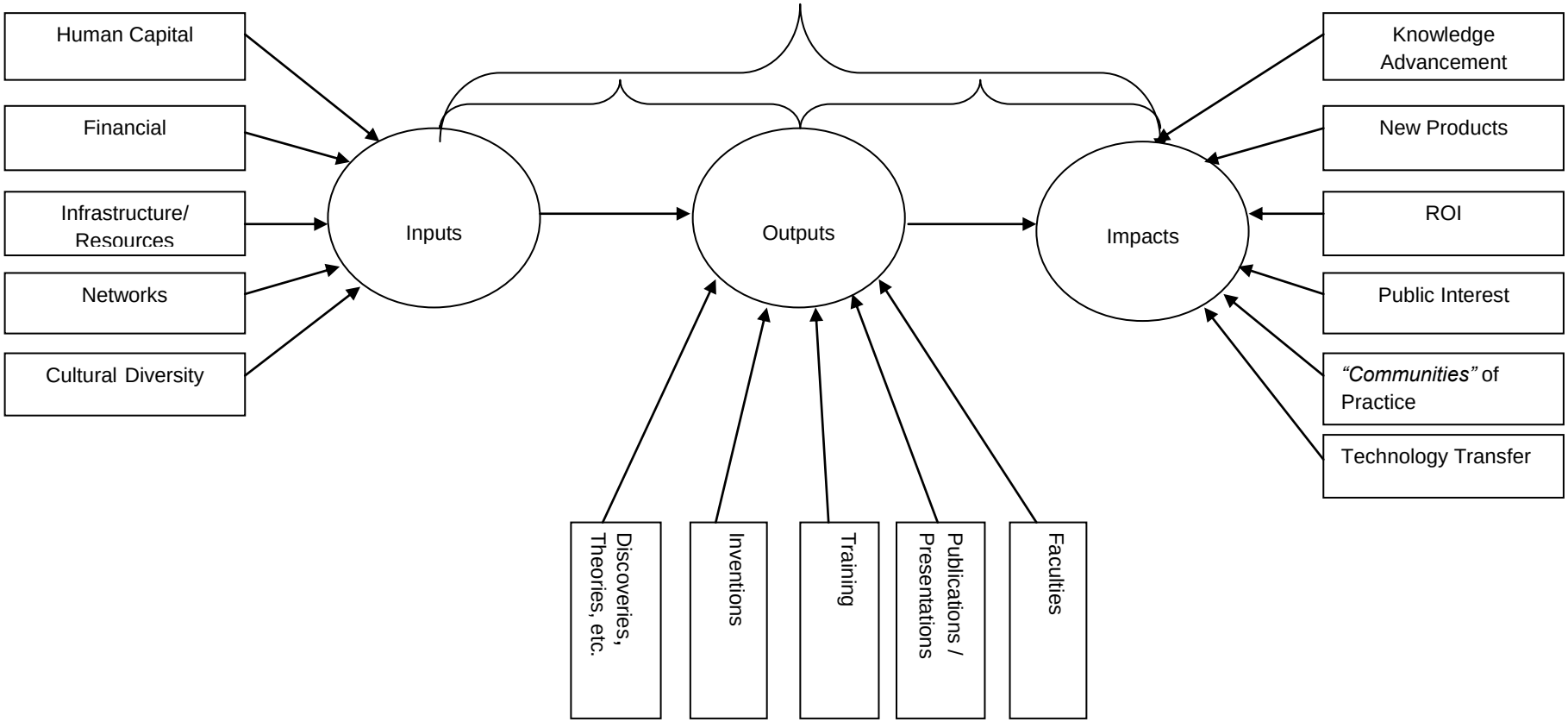
Figure 2.2: Relationship among inputs, outputs and impacts in Collaboration projects



Source: Jerome and Jordan, 2007

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Due to the interaction between the University, Industry and Government, the Value Chain is more complex than a normal Value Chain. Input measures have limitations, because they are concerned with intent rather than success (Figure 2.2). If we take the THRIP grants it is a good input, but there is no guarantee that the project output will be a success. As seen in Figure 2.2, there are various elements involved with the input, and each one of them may result in a constraint. The outputs are more easily measured, but if the elements involved with the inputs are not aligned, the outputs will not be as expected. The impact can be traced back to the University, Industry and Government as a result of its research innovation. According to Walters and Lancaster (2000:160), there are three important perspectives that emerge:

- The emphasis on relationship management between possible organisations in the value,
- The concerns about the need for the first to result in a competitive advantage,
- Identify the role of information to assess the nature of opportunities offered, to connect optional methods for competing and to coordinate the Value Chain's activities.

2.10.1. Value Analysis

The Value Chain drive views of organisations as a set of processes, of which each adds value to the product or service for each customer (Baltzan and Phillips, 2010:21). Organisations require a Value Chain to create a competitive advantage and enable the company to create a unique value to its customers. There is more than one way in which the company will be able to create unique value for its customers, like lower costs, higher benefits or differentiation.

The Value Chain analysis plays a key role in understanding the need and opportunity for systemic competitiveness. The analysis and identification of substance competences will lead to the organisation to identify weaknesses. They may choose to outsource those functions. The Value Chain analysis is noteworthy because it helps with the understanding of the advantages and disadvantages of the organisation, and treats the complete series of collaboration (Kaplinsky and Morris, 2000:12).

2.10.2. The Value Chain model

Porter (1985:52) invented a Value Chain comprising of nine value-adding activities - five primary and 4 secondary activities. These activities build the bridge between

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competitive strategy formulation and implementation (Dekker, 2003:5). The primary activities directly concerned with the day to day activities, group it into five key areas: inbound logistics, operations, outbound logistics, marketing and sales, and service. Each of these primary activities and their linking secondary activities help to improve the efficiency. There are four main areas of support activities - procurement, technology development (including R&D), human resource management, and infrastructure (planning, finance, quality, and information management).

Porter's Value Chain model is the framework for understanding the realities and forces of the external environment. Using this will help the organisation to understand their current position, determine the structure positively, or to establish a place where they can uniquely have a competitive advantage. Porter argues that strategy is a race to one ideal position, the creation of a distinctive and valuable position, where a firm can differentiate itself for the targeted customer and add-value by an asset of activities different than their competitors' (Porter, 1985:63).

The corporate value is an integral part of the value strategy and positioning system. Value productivity and coordination based on the argument of Walters *et. al.* (2000:161) in which they suggest value creation by identifying and understanding customer benefits and costs, and the combination of organisational knowledge and learning, together with organisational structures that facilitate response and delivery. Essentially this requires management of information and relationships - organisational structure management maximising knowledge generated in the Value Chain of collaborative partnerships leading to effective learning.

2.10.3. Value Chain process

A Value Chain is a business' instrument which creates end-user satisfaction and realises the objectives of other organisations. Value chain management is a coordinated management process in which all of the activities of role-players are required to achieve collaborative objectives. Two Important concepts of the Value Chain are knowledge management and relationship management (Walters *et.al,* 2000:178).

2.10.4 Value Chain principles in a multicultural environment

According to (Porter, 1985:36), an important purpose of a Value Chain is to develop and control linkages with buyers and suppliers, in this case the University and

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Industry. Shank (1989:50) defines the Value Chain as “the linked set of value-creating activities all the way from basic raw material sources for component suppliers through the ultimate end-use product delivered into the customer’s hands”.
In a Value Chain, different types of relationships can be distinguished between different industries - relationships between business units of the firm, and relationships between the organisation and its buyers and suppliers (Porter, 1985:38). The relationship between buyers and suppliers is referred to as "vertical linkages” and are concerned with the organisation’s internal Value Chain.

Linkages describe the performance of one activity and the impact on the performance of another activity. One can say that a linkage occurs when there is a measure of interdependence between activities (Dekker, 2002:5).
To achieve effective outcomes, this interdependence needs to be managed by a coordination mechanism. The stronger the linkages between two activities the more coordination will be required. A linkage between a buyer and a supplier will reveal how the supplier’s activities affect the buyer’s activities in terms of cost and differentiation, and vice versa. According to Porter (1985:11), managing linkages in the Value Chain can reduce cost and enhance differentiation.

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2.11. TRIGGERS AND BARRIERS IN A MULTICULTURAL, COLLABORATIVE PROJECT

The South African Government has formulated a national framework (White paper, 1995) which acts as a guide for existing and potential role-players and outlines a national strategy for the development and promotion of small businesses. In order to address the imbalances of the past, the objectives of the national policy framework for South Africa are six-fold:

- Create and enable an environment for small enterprises,
- Facilitate greater equalization of income, wealth and economic opportunities,
- Create long-term jobs,
- Stimulate economic growth,
- To strengthen the linkage between small enterprises,
- Level the playing field between large and small businesses.

General research has shown that no significant improvement in the SMME sector had taken place over a 12 year period. According to the Global Entrepreneurship Monitor Report (2004:25), there is a general agreement that the South African deficient entrepreneurial capacity can be assigned to three key elements in the environment namely, weaknesses in the education system, the Government's lack of support and difficulty in accessing financial resources. It is within the context of small entrepreneurial capacity that the model of Triple Helix is present as a nexus in the discourse of entrepreneurial development.

The difference between the University and Governmental bodies is that the outcome of the Industry is measured primarily in monetary terms, and the technical pressure to survive in the market is extensive. If one of the parties is not functioning at the minimum level of competence, there is a high probability that the project could fail. South Africa is lacking suitable, skilled employees to partner in the Triple Helix application. While academics are eager to get involved in and add-value to community projects, it is not wise to assume that universities take part in the cooperation without payback. The Industry is eager to start with the projects but is put off by the rules and regulations needed to launch them (Scott, 2003:55).

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2.12. MANAGING CHALLENGES IN MULTICULTURAL TEAMS

The challenges faced by the multicultural teams are more complex and often result in more serious consequences than the challenges faced by the same-culture teams. There are, however as outlined, four main similarities the teams share. These similarities represent fundamental, perhaps universal, aspects of teamwork. At the same time, they determine the additional complexity caused by cultural differences. Disrespect generated by differences in publicly, expressing or confronting different perspectives, results in anger, and the culture gap adds complexity.

2.12.1. Corporate Communication

A brief operation definition according to Van Riel et.al. (2007: 35-36), emphasizes that all corporate communication should be based on sound communication policy guidelines. They point out that traditional corporate communication guidelines help organisations to create an image, a strong brand, and ultimately, an appealing reputation. Organisational communication, in turn, has a long-term approach to reputation building, and encompasses functions such as public relations, public affairs, investors relations, environmental communication, corporate advertising, and employee communication (Van Riel et.al., 2007:14-15). The main concern is not on individual communication, but rather on the shared attitude towards communication within the company, and to the internal and external audiences (Argenti and Froman, 2002: 4).

2.12.2. Drivers of knowledge transfer

Schwartz (2004: 63-64) indicates that if industries and universities are observant and are able to support research and development (R&D) and convert more serious occurrences into opportunities, they may change an economy and the world. Industries and universities need to apply thinking strategies to their surroundings to strengthen collaborations and knowledge transfer, while ensuring that sufficient mutual benefits can be gained. The creation of knowledge management is a collection of processes (Newman, 1991:1).

Globalisation demands that society needs to move faster, work smarter and take more risks than at any time in their history. For both Industry and universities, it is learning and not understanding that is the primary source of value (Churner and Wilmott, 2000:208). South Africa is a community faced with immense, lingering effects of

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apartheid, but the changing world of work calls for adaptability (Van Zyl, Amadi-Echendu, and Bothma 2007:1). This spells out a need to stimulate intellectual curiosity about alternatives together with robust intellectual dialogue (O'Connel, 2006:8) between stakeholders in industries and their collaborating universities.

The manner in which knowledge flows between the University and Industry is complex and distinct. It is reasonable to assume that a relationship between the University and Industry (Kenny, 1986:73) seems to be blossoming in many forms all over the world, and South Africa is no exception. However, a large gap seems to exist in the expectations and perceptions of both industry partners and universities, probably as a result of a poor understanding of knowledge transfer mechanisms in their R&D collaborations. Drivers of knowledge transfer should provide some reasons why industry partners approach universities for R&D engagements and what issues Industry considers as essential. Having this knowledge could better prepare and allow universities and industrials to develop pro-active and appropriate decisions in their future collaborations (Van Zyl, Amadi-Echendu, and Bothma, 2007:2).

2.12.3. Collaboration Climate and Effectiveness

One of the main management issues for this country, is to make the knowledge worker more productive (Ducker, 1999). The organisation's ability to transfer knowledge from one unit to another and thereby contributing to the organisational performance of firms in the manufacturing (Epple, Argote and Murphy, 1996:176) and service sectors (Darr, Argote and Epple, 1995:150). The benefits of knowledge sharing are documented in various papers (Stewart, 2001), but the advantages varies considerably among organisations (Argote and Ingram, 2000:165).

The following processes are creating value and making knowledge transfer more effective: process design, office design, information sharing software, etc. This improves effectiveness and best practices in knowledge management circles. Nothing will help if the willingness to share with each other is not clear, thus a climate of trust needs to be improved which will increase the willingness to participate (Sveiby and Simons, 2002:4). Knowledge is not a distinct object; the most valuable knowledge is embedded in people. It is difficult to convey outside the immediate context, which generates a significant competitive advantage. Internal knowledge transfer is also

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difficult to achieve. One of the hardest barriers to overcome is the internal culture of resistance to share.

Collaboration and trust are seen as elements of an organisation's culture, but the idea of culture is untested and too broad to be a solid foundation. The main interest in the aspects of culture, values, beliefs and assumptions, is that it influences behaviour and the willingness to share knowledge (Sveiby and Simons, 2002:5).

2.12.4. Effective collaboration

Although there is an increase in R&D collaboration grants to universities, most research partnerships remain under-utilised as they neither target strategic technology nor function effectively. The results harvested are therefore not as effective as required. Companies need to develop organisational practices that are aligned strategically, managed collaboratively and evaluated constantly; learning when to work with the University, how to determine the correct partner, and how to evaluate and learn from the collaborative experience (Starbuck, 2001:42).

Starbucks (2001:40) states that all cost-effective University collaborations meet three criteria:

- Alignment with the technology strategy of the company,
- Managing time and budgets,
- Harvesting efficiently to impact products or processes.

This will be the case if the following exist in the company:

- Knowledge of the interaction with which universities selects collaborations based on identified strategic goals,
- The technology long-term strategy is sufficiently broad to consider collaboration not only for solving problems and regulatory requirements, but also provide windows on emerging technologies, tracking the evolution of ideas that could cause the company's key platform technology obsolete,
- A company's technical leaders know how to attract the best performance from faculty members over whom they have no official authority,
- The company's knowledge management system instantaneously integrates project results into the expertise base on the most appropriate team, using this knowledge or technology.

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It may appear unrealistic, but without collaboration, the Industry cannot realise the full potential of the University.

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2.13. FRAMEWORK FOR MANAGING MULTICULTURAL COLLABORATION MODEL

Barnes *et al.* (2000:5) developed a best practice model for effective University-Industry research collaboration, through the development of a framework management tool. The typical project management approach is used, whereby the collaboration (the project) begins with the formation of a project team and ends with the implementation of agreed targets.

2.13.1. Project manager selection

Start with the selection of high quality project managers to harmonise the differing objectives, perspectives and modes of operation of often diverse organisations. Collaboration should span organisational boundaries even though the project manager has no direct authority and must therefore rely on diplomacy to ensure that partners deliver, and those targets are achieved. Failure to maintain control, leads to disillusionment and loss of commitment to the project, particularly among industry partners. Familiarity with the research topic will be an advantage.

2.13.2 The University partner

The University should aim at resolving important issues associated with academic-Industry relations and project management effectiveness. Relations improve where the academic lead investigators share project management responsibility with their industrial partners.

2.13.3. Partner evaluation

Collaboration partners are the most important element influencing collaboration success, because experienced partners are better able to understand the capabilities and the limitations of a collaborative venture, and also tend to be more flexible, establishing trust. Corporate change or instability within organisations has been shown to have a profoundly negative influence on collaborative projects. Instability may occur by changes in personnel assigned to the project by the affected organisations. The presence of a collaboration champion such as an individual with a great enthusiasm for and commitment to the venture, that is also crucial and well-placed within the partner organisations, is a critical success factor.

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2.13.4. Project setup and execution

Careful consideration should be given to the setup and execution with respect to the effective use of available time and resources. Without clearly defined objectives, projects can become broad, whilst conversely, assigning clear roles and responsibilities to partners and developing a project work plan, breed success. Collaboration may involve partners that are geographically remote from each other, which makes direct contact on a regular basis complicated - for this reason effective communication is essential. Electronic data can enable virtual meetings to take place, but the real face to face contact is difficult to replicate. The framework encourages a robust communication strategy, combining formal mechanisms for strategic discussion and daily management with informal communications to build team spirit and faith.

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2.14 CHAPTER CONCLUSION

The management of collaboration has become very important in the 21st century, especially due to the rapid changing economic environment. Collaboration offers companies the opportunity to develop certain competencies in-house. Collaboration has shown to increase the generation of innovation, and there is strong evidence that innovating firms consistently out-perform non-innovating firms in terms of growth and profit.

But despite all the benefits and potential values of collaboration many projects fail to realise their full potential, mainly because collaboration are difficult to manage. The main reason is because partners enter into an agreement with different objectives in mind.

This chapter contains a literature review, focusing on current theories and models that describe the challenges experienced by the different role-players. The literature review includes an overview of books, journal articles, and Internet sources, which together form the published information in the field. Attention is paid to challenges experienced in the South African environment as well as other developing countries and developed countries.

The next chapter will motivate the objectives and rationale for the research; it provides information on the model for data collection, and explains the on-going action plan employed in order to achieve research objectives.

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CHAPTER 3: RESEARCH METHODOLOGY AND DISCUSSION OF RESULTS.

3.1. INTRODUCTION

The literature study in chapter two focuses on the existing constraints while managing Triple Helix. The empirical study has focused on the constraints experienced in South Africa, by means of a field study using an internet-based survey questionnaire. The questionnaire (Appendix A) draws from the literature in order to investigate the elements regarding the constraints experienced when managing THRIP in South Africa.

This chapter contains a detailed explanation of the research methodology followed to complete the empirical study. This includes the data gathering process, as well as an analysis of the findings and presentation of the results.

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3.2. THE RESEARCH METHODOLOGY

3.2.1. Literature / theoretical study

Literature or theoretical study forms part of the research methodology case studies, as well as other printed media, being the basis for the starting point of the research.

3.3. EMPIRICAL STUDY

Designated employees directly involved in the THRIP programme at various universities and industries have answered an anonymous questionnaire regarding their experience in managing THRIP, to determine their constraints experienced.

The group consists of 560 respondents, which represents a sizeable portion of the THRIP community. Anticipating that approximately 110 will take part in the research, 105 respondents started the questionnaire and 97 completed it.

3.3.1. Research Design

3.3.1.1. Method of data gathering

An Internet based questionnaire distributed to designated employees directly involved in the THRIP programme at various Universities and Industries, have been requested to answer an anonymous questionnaire regarding their experience concerning managing THRIP, to determine their constraints experienced.

3.3.2. Study of population

3.3.2.1. Population

The population of the study consists of individuals, groups, and organisations to which they are exposed. It was difficult with this research to examine every member of the population. The total population in question is termed the target sample, and the individuals within the sample called the actual sample (Welman, Kruger and Mitchell, 2005:52-56).

There are two different types of sampling: probability (random) and non-probability (non-random). A sample is a subset from a larger population, and this enables the researcher to estimate some of the unknown characteristics of the population.

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The decision about the size of the sample can be complex and influenced by the population characteristics, research objectives, time, statistical precision and judgement (Welman *et al*., 2005:70).

3.3.2.2. Target sample

The target population to participate in the survey has been respondents currently involved with R&D collaborations. The population has been divided into three groups:

- The University – South African universities involved with THRIP,
- The Industry – respondents from various industries,
- The Government – The THRIP office staff.

For this purpose, the database of the NRF was used to distribute the questionnaire, which includes participation from various industries and universities in South Africa. This database consists of 560 respondents, a representable size of the THRIP community.

3.3.2.3. Actual sample

The respondents are representative throughout South Africa, and apart from national representation, presenting each province. Including the following universities in the research:

3.3.2.3.1. Calculation of required sample size

Table 3.1: List of Universities

Stellenbosch	WITS	ARC= Agricultural Research Council
NWU	RU	TUT
UCT	UFH	UJ
UKZN	UP	Other

The sample size is an important feature of any empirical study in which the goal is to make inferences about the population from a sample. In practice, the sample size used in a study is determined based on the expense of data collection, and the need to sufficient statistical power. The sample size for sampling with replacement can be calculated by the following formula:

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Equation 3.1: Sample size: $n = \frac{Z^2 \pi (1-\pi)}{e^2}$

For sampling without replacement (as was the case in this research) we calculate a "new sample size *n*", by including the finite population correction factor, using the following formula:

$$new\ n = \frac{n}{1 + \left(\frac{n}{N}\right)}$$

Where:

n	=	sample size given parameters and infinite population (*how many people are there to choose your random sample from*)
new *n*	=	sample size required taking into account sample size
Z	=	1.96: The factor used for a 95% confidence level
π	=	proportion of sample of interest (*a value of 0.5 maximises the sample size, minimise the error, the response distribution*)
e	=	error allowable, in this case 10% (*the amount of error that can be tolerated*)
N	=	population size

The study is limited to the population of South Africa that could be reached. The actual sample has been a simple random sample, thus we cannot generalise, and the focus is on practical significance. Practical significance has measured the effect size independent of the sample size. These should be considered when the populations are small and statistical inference and p values are not relevant. Statistical inference draws conclusions about the population from which a random sample has been taken, using the descriptive measures to do the calculations. Practical significance can be understood as a large enough difference to have an effect in practice (Ellis and Steyn, 2003).

The questionnaire has been distributed to 560 potential respondents via email; the number of replies according to Equation 3.1 needed for the analysis should be 83. The number of responses received from the population was 97 and these participants form the sample (*n*) that is analysed in this chapter. The questionnaire is attached in Appendix A.

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3.3.3. Descriptive Statistics

Descriptive statistics are used to describe the basic features of the study; they provide simple summaries about the sample and the measures. Together with simple graphics analyses, descriptive statistics form the basis of virtually every quantitative analysis of data. In order to analyse the data collected from the respondents in the survey, there are some attributes of descriptive statistics that first need to be explained, such as:

3.3.3.1. Mean

The mean value is the most common measure of central tendency. The equation for calculating the mean is as follows:

Equation 3.2: Mean calculation

$$Mean = \frac{\sum x}{n}$$

Where:

$\sum x$ = the sum of all the individual numbers

n = the sample size given parameters and infinite population (*how many people are there to choose your random sample from*)

3.3.3.2. Standard Deviation

The correlation coefficient (r) can be viewed as the effect size and for the purpose of this study, used to determine the significance of the relationship between variables.

Standard deviation for the population is the square root of the sum of the squared differences around the mean, divided by the sample size. In order to calculate the standard deviation using the following equation:

Equation 3.3: Standard deviation for population

$$SD = \sqrt{\frac{\sum(x - \bar{x})2}{n - 1}}$$

Where:

x = the individual data items;

$\bar{x}$ = the mean;

n = the sample size.

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3.3.3.3. Effect Size,

The effect size is independent of the sample size and measures the practical significance. The effect size defined shows whether there is a significant difference between means, for the relationship in two-way frequency tables and also a multiple regression fit. The calculation for effect size is as follows:

Equation 3.4: Effect size

$$d = \frac{|(x1 - x2)|}{S\max}$$

Where:

$|(x1 - x2)|$ = the absolute difference between two means.

$S\max$ = the maximum estimate for standard deviation.

Standard deviation for the population is the square root of the sum of the squared differences around the mean, divided by the sample size minus one. The formula for calculating the standard deviation of the sample is slightly different from that of the population, as shown below:

3.3.4. Measurement Instrument / Questionnaire

3.3.4.1 Purpose

The purpose of the research is to identify and quantify the challenges experienced by the different role-players (Government, Universities, and Industry Partners) during the implementation and management period of THRIP projects.

Having knowledge of constraints experienced by all the different partners could help to develop a framework of best practice, which will streamline the process and will attract more interest from the academic and industry side to get involved in THRIP.

3.3.4.2 Development

The questionnaire has been compiled specifically for employees working with THRIP, taking into account the primary and secondary objectives set out in chapter one. The objectives in chapter one have been incorporated and aligned within the objectives of the questionnaire. The main objective is to identify and quantify the challenges experienced by the different role-players (Government, Universities, and Industry Partners) during the implementation and management period of the THRIP projects.

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The complexity and challenges developed at the interface with the three “spheres” and can be expected to exhibit all kinds of chaotic behaviour, such as unintended consequences, crisis, niche formation and self-organisation, and the model is multi-structural and multi-functional (Leydesdorff and Etzkowitz, 2001:1,9).

The questionnaire has been developed with the help of Statistical Consultation Services of the North-West University, Potchefstroom campus. The SPSS Version 20 of 2011 has been used.

In designing the survey, the following issues have been addressed:

- The expectations of the NRF, Industry and University,
- The time-lag in decision making between the different role-players,
- The extent of linkages between Industry shareholders and decision makers, NRF and University, who form part of a THRIP project,
- The frustration, challenges, and success factors that affect the success of the THRIP project.

The research dissertation focuses solely on the frustrations and challenges mentioned above. One of the most common problems experienced while trying to make Triple Helix work in South Africa, is the time lag (Parkinson, 2006:4). The time lag is a direct impact due to external factors affecting collaboration. External factors include:

- *Education and Training,*
- *Conflict of Intellectual Property,*
- *Leadership and Mentorship,*
- *Communication,*
- *Resource Availability,*
- *Information Systems,*
- *Knowledge and Know-how,*
- *Co-operation and Support,*
- *Culture and Behaviour,*
- *Awareness and Understanding,*
- *Objectives and Expectations,*
- *Organisational Structure,*
- *Location and Facilities,*
- *Funding and Budgets,*

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- *Administration and Procedures,*
- *Policies and Programmes.*

Researching the constraints experienced managing THRIP in South Africa will help to understand and identify the constraints which have a negative impact on the success of THRIP projects.

Identifying the constraints could help to streamline the processes by implementing a best practice framework.

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3.4. DATA ANALYSIS

The statistical analysis has been conducted with the assistance of the Statistical Consultation Services of the North-West University by means of Statistical Package for the Social Sciences Incorporated (SPPS Inc.) Version 20 of 2011.

The data gathered has been analysed using descriptive statistics, ANOVA and inferential statistics (T-test) in order to reach the objectives of this study. Data gathered are presented and discussed in the sections below.

The data have been represented in tables and graphs, both display different perspectives on the information.

3.4.1. Biographic information of respondents

The respondents have been asked biographical information in the questionnaire (Appendix A) in order to get a clear understanding of the demographic detail. For the purpose of this study, splitting of demographic information has been done as seen in Table 3.1

Table 3.2: Respondent demographic detail

Item	Category	Frequency	Valid Percentage
Gender	NA	1	1.20
	Female	21	25.90
	Male	59	72.80
Age	NA	1	1.20
	21-29	15	18.50
	30-39	11	13.60
	40-49	25	30.90
	50-59	22	27.20
	60+	7	8.60
Employed at	Industry	36	37.10
	Government	5	5.20
	University	45	46.40

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	Other	1	11.30
University Interface	ARC	0	0.00
	TUT	4	4.20
	UKZN	2	2.10
	NWU	41	42.70
	UCT	4	4.20
	UP	14	14.60
	RU	6	6.30
	UFH	3	3.10
	WITS	1	1.00
	Stellenbosch	11	11.50
	UJ	2	2.10
	Other universities	8	8.30
Respondent's Role	Administrator	15	16.50
	Manager	5	5.50
	Researcher	17	18.70
	Custodian	4	4.40
	Mentor	2	2.20
	Sponsor	9	9.90
	Decision-maker	9	9.90
	Policy-maker	1	1.10
	Supporter	5	5.50
	Developer	2	2.20
	Project Manager	6	6.60
	Team Leader	1	1.10
	Expert Advisor	3	3.30

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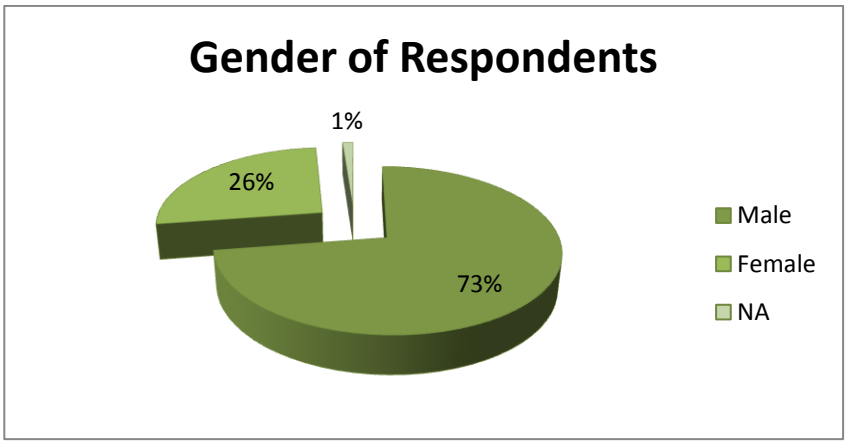
	Promoter	6	6.60
	Thought Leader	6	6.60
Years of experience	<1 year	21	21.60
	1 year	5	5.20
	2 year	9	9.30
	3 year	10	10.30
	4 year	11	11.30
	5 year	10	10.30
	6 year	6	6.20
	7 year	2	2.10
	8 year	1	1.00
	9 year	1	1.00
	10+ year	21	21.60

The following conclusion has been drawn from Table 3.2: the study population is represented by a majority of males. The majority of the study population fall within three age categories, ranging from 40-49 years, 30.9% of the population, 50-59, 27.2% of the population and 21-29 years, 18.5% of the population, representing 76.6% of the population, see Graph 3.1 and Graph 3.2.

3.4.1.1. Gender of respondents

Graph 3.1: Respondent's gender



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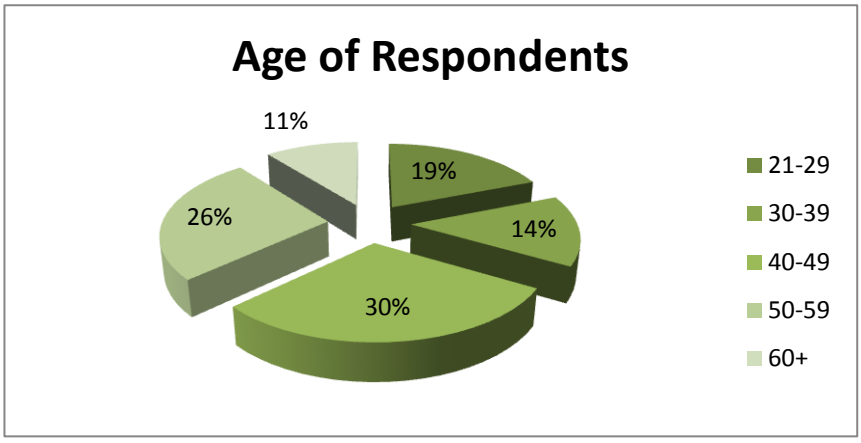
3.4.1.2. Age of respondents

Graph 3.2: Respondent's age



An interesting sign is that the age distribution is bimodal. A positive sign is the upswing in the age group 21-29 years, which indicates that there is a younger generation getting involved with THRIP. This upswing will directly result in a longer relationship with THRIP if negative factors can be minimised. Possible reasons for this are discussed in Chapter 4.

The sample is represented by 37.1% respondents from the *Industry* and 46.4% respondents from various universities, while only 5% of the respondents that participated in the survey represent *Government*, which is approximately proportional to the actual number of participants directly involved with THRIP.

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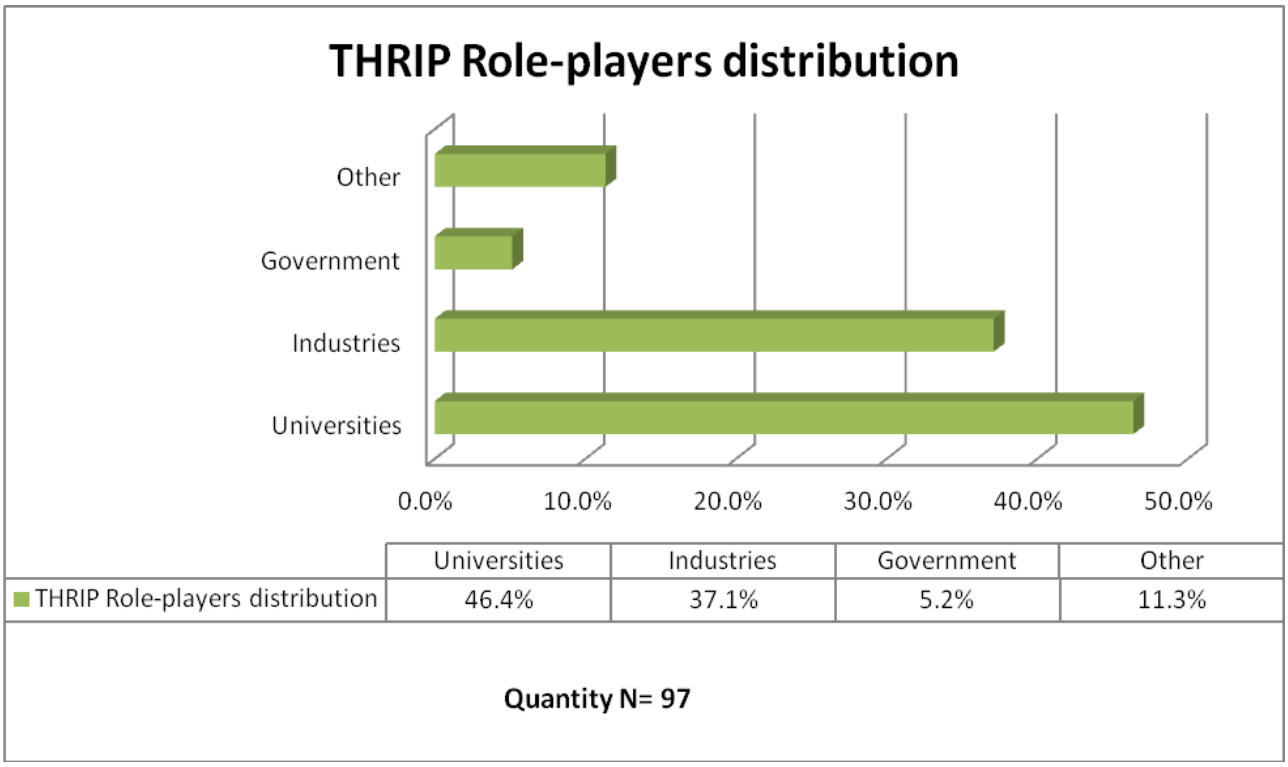
3.4.1.3. Employed at

Graph 3.3: THRIP role-players distribution



From the 105 questionnaires received, a total of 97 respondents have completed the questionnaire. The respondents are representative of the *University*, *Industry* and *Government*. Graph 3.3 and Table 3.2 above indicates that the university has the biggest representation with 45 respondents, the *Industry* has 36 respondents, *Government* 5 and *Other* 11. "*Other*" represents every person answering the questionnaire, who does not fit in the categories stated.

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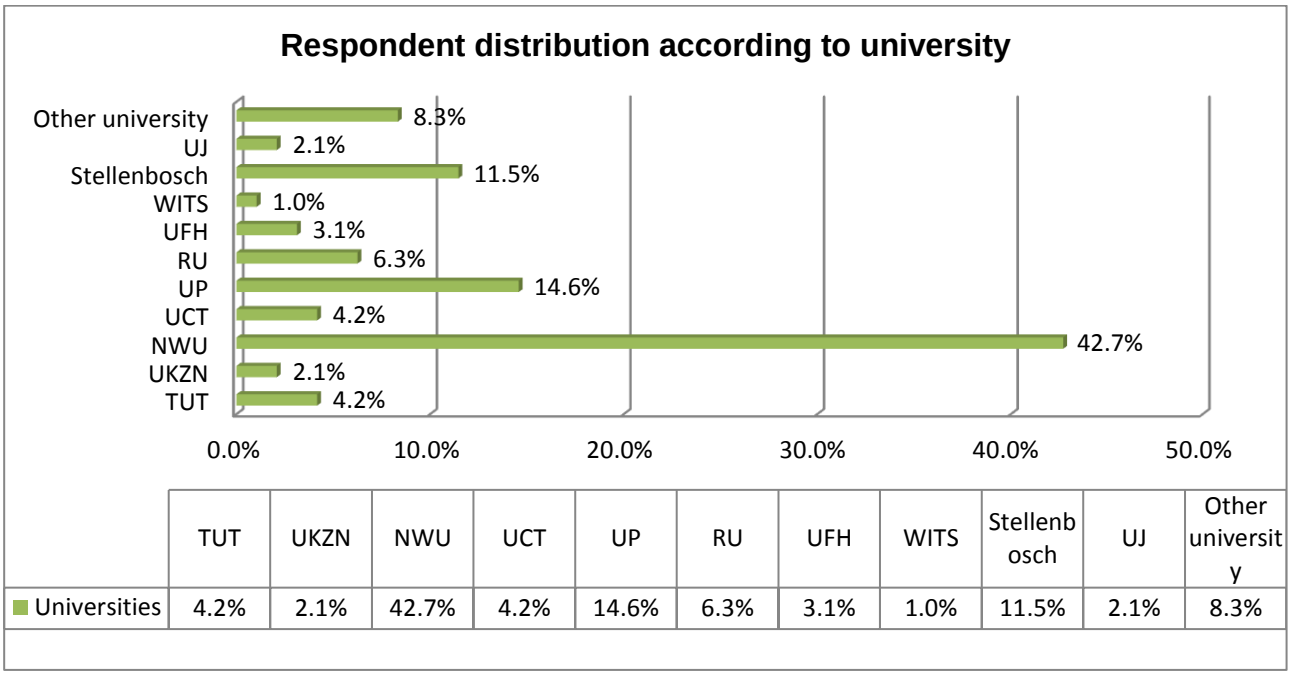
3.4.1.4. University Interface

Graph 3.4: Distributions of the Universities



	TUT	UKZN	NWU	UCT	UP	RU	UFH	WITS	Stellenbosch	UJ	Other university
Universities	4.2%	2.1%	42.7%	4.2%	14.6%	6.3%	3.1%	1.0%	11.5%	2.1%	8.3%

The actual representation of the universities has been 46.4% of the total target sample, if we analyse the universities. The following universities have been represented in the sample as seen in Graph 3.4.

In Graph 3.4 a total of 97 respondents have started the survey and 1 respondent did not continue. The North-West University makes up 42.7% of the university sample, University of Pretoria 14.6%, and Stellenbosch 11.5%. Values below 8% have been categorised under "*Other*" for any further analysis, because of the insignificance of the sample size - see Table 3.3.

As stated in Table 3.1, adding "*Other"* to the universities was due to the insignificant sample size.

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Table 3.3 : Respondents added to Other

UCT = 4.2	Wits = 1.0	RU = 6.3
UJ = 2.1	UKZN = 2.1	TUT = 4.2
UFH = 3.1		

Various economic sectors have been included under the category *Industry* - the different roles that respondents fulfil are seen in Graph 3.4.

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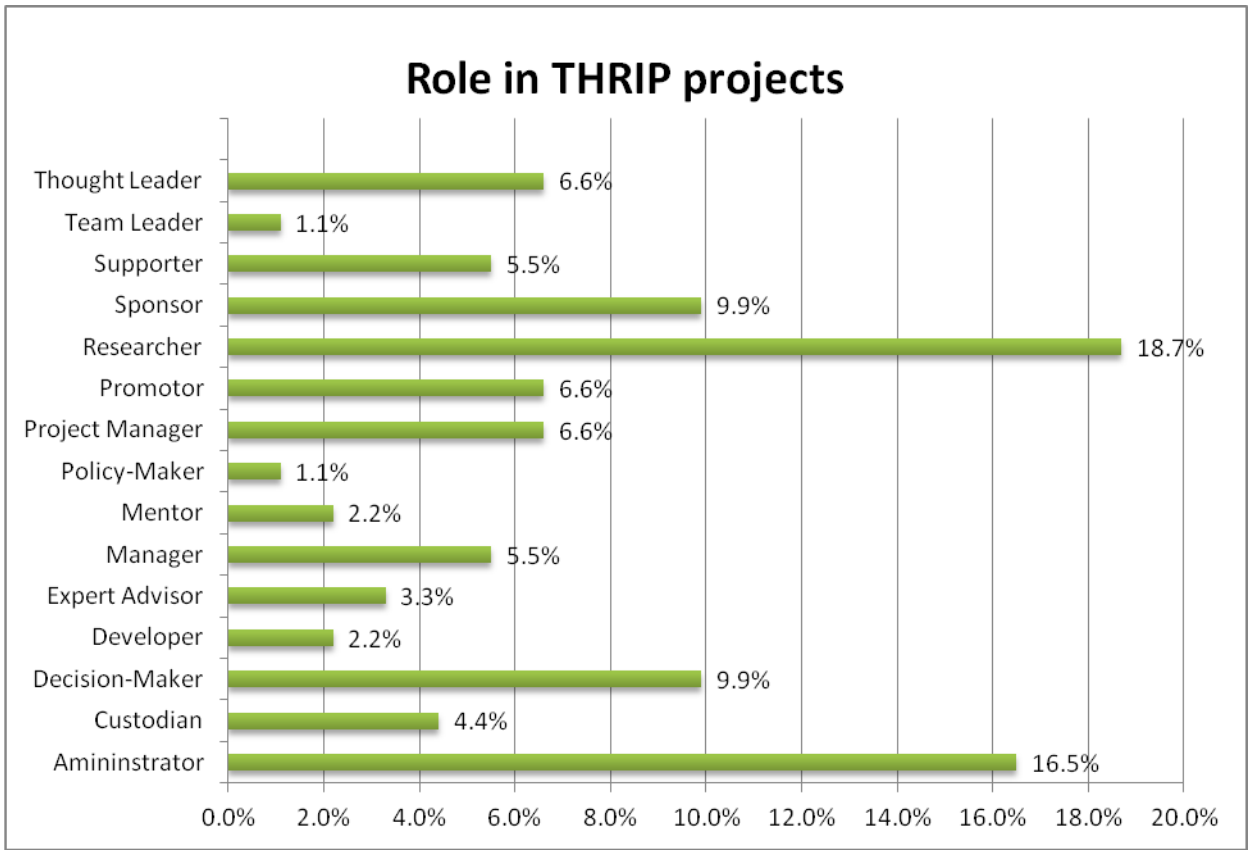
3.4.1.5. Respondent's role

Graph 3.5: Role in THRIP projects



Graph 3.5 represents the role of the respondents involved in THRIP - please note that the role-players have been allowed to choose more than 1 role. According to Graph 3.5, the valid percentage is:

- *Researchers* *18.7%,*
- *Administrators* *16.5%,*
- *Sponsors and Decision-Makers* *9.9%,*
- *Thought Leader* *6.6%,*
- *Promoter* *6.6%*
- *Project Manager* 6.6%.

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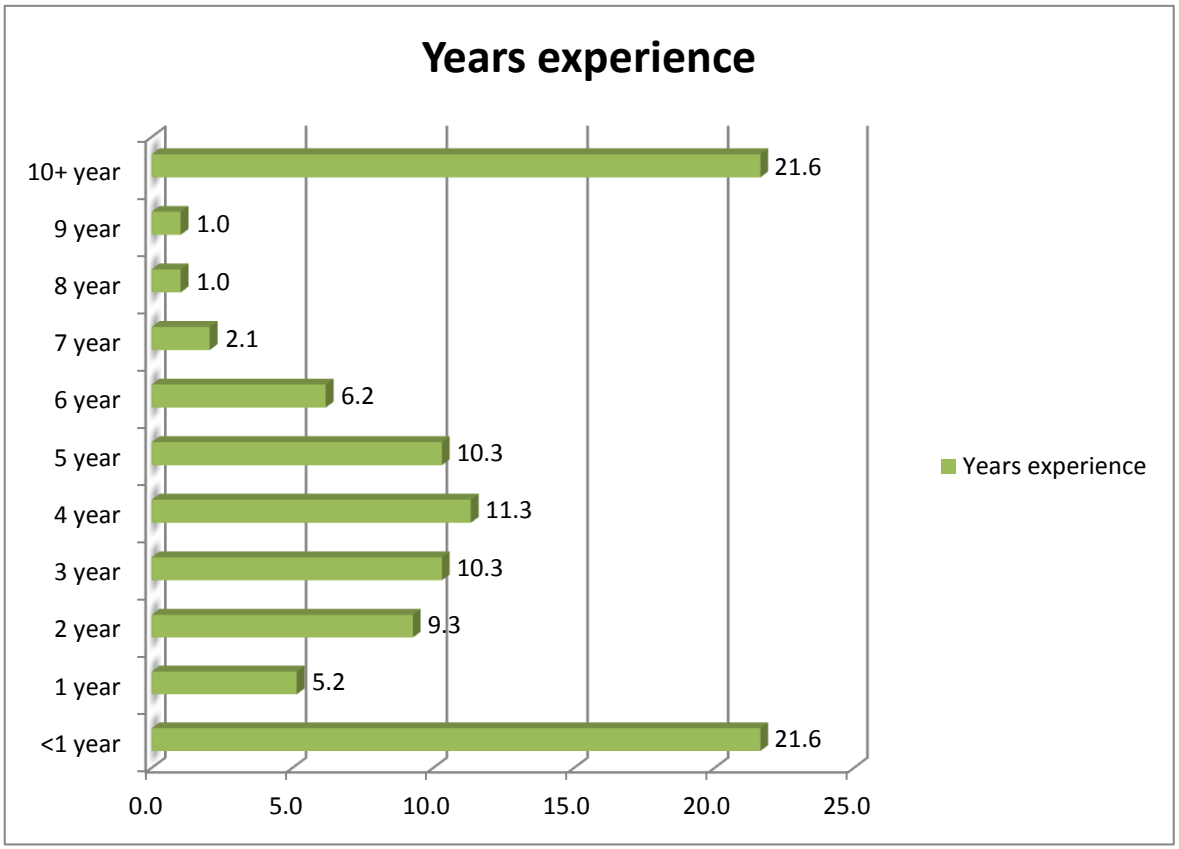
3.4.1.6. Years' of experience

Graph 3.6: Respondent's years' experience



The frequency distributions allow us to draw conclusions about the major characteristics of the data (Levine, Stephan, Krehbiel & Berenson, 2008:45). See Appendix B for complete frequency tables.

Some interesting results have come from some of the individual questions in the questionnaire. These are discussed individually.

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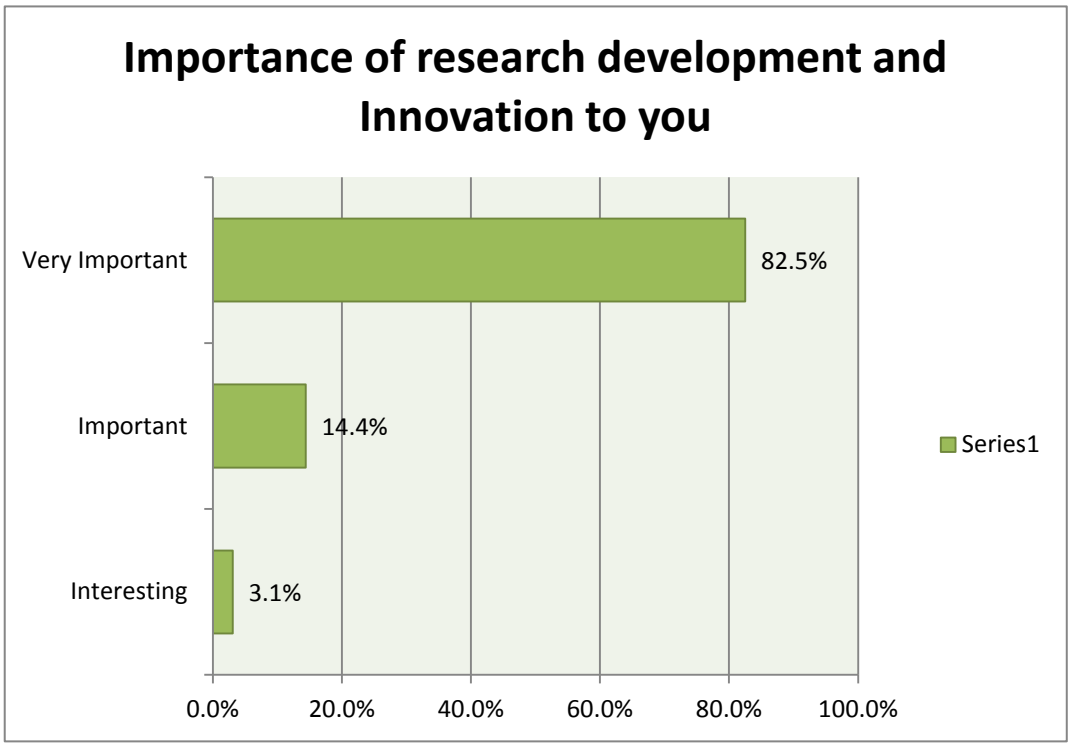
3.4.1.7. "How important is R&D and innovation to you?"

Table 3.4: Importance of R&D to you

	Frequency	Percentage	Valid Percentage
Interesting	3	3.10	3.10
Important	14	14.40	14.40
Very Important	80	82.50	82.50
Total	97	100.00	100.00

Graph 3.7: Importance of R&D and innovation



When looking at frequency Table 3.4 and Graph 3.7 below, 82.5% of the respondents in the sample indicate that R&D and innovation are important to them.

Innovation is not only significant at the level of individual enterprise, but also increasingly for national economic growth (Tidd and Bessant, 2009:5). In a book of Baumal, he states that "virtually all of the economic growth that has occurred since the eighteenth century is ultimately attributable to innovation". Innovation contributes in

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several ways. Research evidence suggests a strong correlation between market performance and new products (Tidd and Bessant, 2009:6).

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3.4.1.8. "How important is R&D and innovation to your organisation?"

Table 3.5: R&D and innovation's importance to organisation

	Frequency	Per cent	Valid Per cent
Interesting	3	3.10	3.10
Important	17	17.50	17.50
Very important	77	79.40	79.40
Total Valid	97	100.00	100.00

According to frequency Table 3.5, respondents feel that R&D and innovation is slightly less important to their organisation (79.4%) than to themselves (82.5%).

Innovation is the mechanism by which organisations produce new products, processes and systems required for adapting to changing markets, technologies and modes of competition (D'Aveni, 1994; Dougherty & Hardy, 1996).

Innovation plays a crucial role in South Africa and the strategic plan of THRIP for 2009-2013 - outlining the context leads directly to two key strategic goals for this period:

- To respond to declining THRIP participation by successfully engaging with SMMEs and BEE companies, while retaining the support of large *Industry*, and
- To extend R&D and innovative research application, paying attention to broader inclusion across gender and geographic location (NRF, 2009:5).

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3.4.1.9. General analysis of results: Method of response ranking

This question ranked in five categories 1=Most, 2, 3, 4, 5=Less. In Table 3.6, each category is analysed in order to achieve an overall conclusion. Please take note that the top 5 scores in each category is included in the analysis.

For each of the categories, the top five ranked variables have been normalised to get a weighted average ranking. This theoretical value could range from -2.25 to +7.5.

The above method has been used for each of the questions where the respondents have been asked to rank the relative importance of variables.

3.4.1.9.1. "Who gain the most from THRIP projects?"

Table 3.6: Who is gaining the most from THRIP projects?

0 = No rank assigned

		Frequency							
	Missing	**0**	**1**	**2**	**3**	**4**	**5**	**Mean**	**Std. Deviation**
Universities	6	23	22	16	12	6	12	1.910	1.691
Industry	6	28	14	19	11	10	9	1.870	1.688
Business	6	36	13	6	14	8	14	1.860	1.907
South Africa	6	51	13	6	4	7	10	1.260	1.794
University Students	6	33	11	17	18	9	3	1.650	1.537
Entrepreneurs	6	58	5	6	7	7	8	1.160	1.765
Communities	6	60	4	4	8	10	5	1.110	1.716
Government Bodies	6	68	1	2	6	8	6	0.930	1.705
Government Officials	6	82		1		3	5	0.430	1.335
University Staff	6	52	4	10	6	9	10	1.410	1.862
Investors	6	75	2	2	2	5	5	0.630	1.481
Industry Staff	6	80	1	1	1	5	3	0.450	1.293
Industry Managers	6	82	1	1	2	3	2	0.340	1.108

According to Table 3.6 category 1 the normalised ranking was as follows:

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“Who gain the most from THRIP projects”: Normalised scores

Table 3.7: “Who gain the most from THRIP projects”: Normalised scores

	1=most	2	3=neutral	4	5=less	Total
Universities	5.00	1.50	0.00	-0.25	-0.80	**5.45**
Industry	4.00	2.50	0.00	-1.25	-0.40	**4.85**
University students	2.00	2.00	0.00	-1.00	0.00	**3.00**
South Africa	3.00	1.00	0.00	-0.50	-0.60	**2.90**
Business	3.00	1.00	0.00	-0.75	-1.00	**2.25**
Entrepreneurs	1.00	1.00	0.00	-0.5	-0.20	**1.30**
University Staff	0.00	1.00	0.00	-1.00	-0.60	**0.60**
Government	0.00	0.00	0.00	-0.75	0.00	**-0.75**
Communities	0.00	0.00	0.00	-1.25	0.00	**-1.25**

According to this ranking the respondents rank it as follows:

- *Universities* 5.45,
- *Industry* 4.85,
- *University Students* 3.00,
- *South Africa* 2.90,
- *Business* 2.25.

It is interesting to see that this result is in line with the strategic aim of the NRF.

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3.4.1.9.2. "Which factors have the most negative impact on the success of THRIP projects?"

Table 3.8: "Which 5 factors have the most negative impact on the success of THRIP?"

0 = No rank assigned

			Frequency							
		Missing	**0**	**1**	**2**	**3**	**4**	**5**	**Mean**	**Std Dev**
Q13.1	Information system	6	73		1	3	3	5	4.000	1.045
Q13.2	Communication	6	53	5	5	5	8	9	3.344	1.451
Q13.3	Resource Availability	6	49	7	13	7	4	5	2.639	1.313
Q13.4	Knowledge and know-how	6	63		6	1	8	7	3.727	1.202
Q13.5	Culture and Behaviour	6	62	4	2	2	8	7	3.522	1.473
Q13.6	Awareness and understanding	6	61	6	6	7	2	3	2.583	1.316
Q13.7	Objectives and Expectations	6	67	2	3	6	4	3	3.167	1.249
Q13.8	Management and Coordination	6	61	4	4	6	5	5	3.125	1.393
Q13.9	Location and Facilities	6	75	3		2	3	2	3.100	1.595
Q13.10	Administration and procedure	6	39	18	7	11	8	2	2.326	1.283
Q13.11	Leadership and Mentorship	6	70		1	5	5	4	3.800	0.941
Q13.12	Education and training	6	79	1		1		4	4.000	1.673
Q13.13	Organisational structure	6	69	2	2	2	9	1	3.313	1.196
Q13.14	Co-operation and Support	6	69		4	4	5	3	3.438	1.094
Q13.15	Funding and budgets	6	35	17	12	10	6	5	2.400	1.340
Q13.16	Intellectual Property Issues	6	58	8	5	1	3	10	3.074	1.752
Q13.17	Policies and Programmes	6	63	4	9	4	2	3	2.591	1.297
Q13.18	Project application	6	61	4	5	7	2	6	3.042	1.429

The five factors that have the most negative impact in each category are seen in Table 3.8. The first three factors agree with the constraints experienced in the literature:

- *Policies and Programmes*,
- *Funding and Budgets*,
- *Awareness and Understanding*.

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Through own experience, the following factors have been added and the respondents rate them as factors that negatively influence THRIP:

- *Administration and Procedures*
- *Resource Availability*.

Negative factors impacting on the success of THRIP: Normalised scores

Table 3.9: Negative factors impacting on the success of THRIP projects

	1=most	2	3=neutral	4	5=less	Total
Administration and procedures	5.00	1.00	0.00	-1.00		**5.00**
Resource Availability	3.00	2.50	0.00	-0.50		**5.00**
Funding and budgets	4.00	2.00	0.00	-0.75		**4.01**
Awareness and understanding	2.00					**2.00**
Policies and Programmes		1.50				**1.50**
Objectives and Expectations			0.00	1.00		**1.00**
Communication	1.00			-1.00		**0.00**
Knowledge and know-how		0.50		-1.00	-0.60	**-0.10**
Information Systems					-0.20	**-0.20**
Project application					-0.40	**-0.40**
Leadership and Mentorship			0.00	-0.50		**-0.50**
Management and Coordination			0.00	-0.50	-0.20	**-0.70**
Co-operation and Support			0.00		-0.80	**-0.80**
Culture and Behaviour				-1.00		**-1.00**
Organisational structure				-1.25		**-1.25**
Intellectual Property Issues					-1.00	**-1.00**

`

The results in Table 3.9 indicate that the following constraints are having a negative impact on the success of the THRIP projects (in decreasing order of impact:

- *Administration and Procedures* 5.00
- *Resources Availability* 5.00
- *Funding and Budgets* 4.01
- *Awareness and Understanding* 2.00
- *Policies and Programmes* 1.50
- *Objective and Expectations* 1.00

It is interesting to note that “Administration & Procedures” and “Resources Availability” have the highest score.

From here on the research will focus mainly on these constraints stated above.

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3.4.1.10. "Which areas of constraints do you believe can be improved or fixed?"

Table 3.10: Constraints that can be improved or fixed

	Frequency		
	Missing	**0**	**1**
Administration and Procedures	16	36	45
Funding and Budgets	16	40	41
Communication	16	47	33
Awareness and Understanding	16	59	22
Objectives and Expectations	16	60	21
Project Application	16	61	20
Resources Availability	16	62	19
Management and Coordination	16	64	17
Co-operation and Support	16	64	17
Knowledge and Know-how	16	65	16
Intellectual Property Issues	16	66	15
Policies and Programmes	16	68	13
Culture and Behaviour	16	69	12
Leadership and Mentorship	16	72	9
Information Systems	16	73	8
Organisational structure	16	73	8
Education and Training	16	74	7
Location and Facilities	16	78	3

For the sake of this discussion the focus will be on the ranking under category 1=most. According to the respondents the following constraints will be fixable:

`

3.4.1.11. "Which areas do you believe to be totally flawed and CANNOT be fixed?"

See Appendix C for the areas which are believed to be totally flawed. The following areas have been identified, but the response rate was very low and therefore not applicable to the outcome of this research:

- *Culture and Behaviour* 7/90
- *Administration and Procedures* 5/92
- *Awareness and Understanding* 3/94
- *Project Application* 3/94
- *Policies and Programmes* 3/94
- *Management and Coordination* 2/95
- *Funding and Budgets* 2/95
- *Communication* 1/96
- *Objectives and Expectations* 1/96

The reason for the low response rate is that most of the respondents believe that these factors can be improved.

If we compare Table 3.9, the results of the constraints, against Table 3.10, constraints that can be improved, it is clear that all respondents feel that the constraints listed in Table 3.9 can be improved in Table 3.10, except for *Policies and Programmes*.

3.4.2. Exploratory Analysis

In analysing the data, there are various statistical significance tests that have been used in order to indicate whether there is a significant difference between the values being tested - these significance test are discussed in the sections to follow. One of the decisive factors in the significance test is the p-value. A small p-value (smaller than 0.05) is considered as sufficient evidence that the result is statistically significant. This does not, however, imply that the result is important in practice, as these tests have a tendency to yield small p-values as the sizes of the data set increases (Ellis & Steyn, 2005:51).

Please note that the sample in this study is a convenience sample, and not a random sample. Since convenience sampling has been used, the relevance of p-values is questioned. The data in the sample can be seen as a small population about which

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conclusions are drawn, rather than using statistical inference to generalize to the study population. In this case effect sizes can be used to test for differences that are practically significant. Practical significance can be understood as a large enough difference to have an effect in practice (Ellis & Steyn, 2003:52–53). In this study, both p-values and effect sizes are presented for the sake of completeness. It is important to note that the emphasis should fall on effect size and practical significance. The test in this study has been performed with the effect sizes as given by Cohen (1988:42) as guidelines for the interpretation of the effect sizes:

Table 3.11: Interpretation table for practical significance

Aim	Test	Effect size	Small	Practically visible (Medium)	Practically significant (Large)
Correlation/ Assessment between 2 questions	Spearman's rho (Non-parametric) Pearson (Parametric)	R(ρ)	(±)0.1	(±)0.3	(±)0.5
Comparison of 2 means	Independent T-test-test (Parametric) Nann-Whitney (Non Parametric)	d	0.2	0.5	0.8
Comparison of groups (categories)	Cross Tabs Chi-square (Nonparametric)	Phi (2x2) Cramer's V	0.1	0.3	0.5

`

Parametric tests are used to investigate the statistical significance in differences between group means. These tests are only valid under the assumption that the observations are independent, observations are drawn from normally distributed population, and the population must have the same variance. Non-parametric tests, on the other hand, are less sensitive to deviations from normality and homogeneity of variance. Non-parametric tests protect against some violations of assumptions and not others (SPSS Inc. 2011).

There are a number of different types of T-test: the two that have been used in the statistical analysis including the independent-samples T-test and paired-sample T-test. Use of the independent-samples T-test is done when comparing the mean score of two different groups. Use of the paired-samples T-test is done when comparing the mean scores of the same group. The two samples T-test, a parametric test, requires four assumptions namely, interval data, normality, equal variance and independence for data. More precise information can be obtained by performing one of the tests of normality to determine the probability that the sample came from a normally distributed population of observations. The Games-Howell test is used with unequal variances and also takes into account unequal group sizes. The Games-Howell test, which is designed for unequal variances, based on Welch's correction to df with the T-test and uses the standarised range statistics. The Mann-Whitney *U*-test or Mann-Whitney-Wilcoxon, evaluates whether the medians on a test variable differ significantly between two groups (SPSS Inc. 2011).

The analysis of variance (ANOVA) is used when analysing numerical variable and certain assumptions, and compare the means of two or more groups. The Brown-Forsythe and Welsh are preferable when the assumption of the homogeneity of variance is disrupted.

3.4.3. Data Correlation

Correlation analysis is used to describe the strength and direction of the linear relationship between two variables. For the sake of this research, the Pearson product-moment (parametric technique) which is designed for interval level (continuous) variables, have been used. The Spearman rank order correlation (designed for use with ordinal level or ranked data) is covered in the chapter on non-parametric techniques (SPSS Inc. 2011).

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3.4.3.1. Pearson correlation - Parametric

In order to test whether there are any correlations between different questions, the Pearson correlation method has been used. The Pearson correlation is a parametric test or a parametric statistic. To use this test, the data should adhere to the following assumptions:

- A normal distribution must exist,
- There must be a homogenous variance,
- Data sets must be typically ratio or interval,
- Can draw more conclusions,
- Data must be on interval level,
- A linear relationship must exist.

The distribution must be similar, but if they are skewed they must be skewed in the same direction, but preferable normal.

This method will also point out any level of significance. Pearson is designed for interval level (continuous) variables. It can also be used if you have one continuous variable (e.g. scores on a measure of self-esteem) and one dichotomous variable (e.g. sex: M/F). Pearson correlation coefficients can only take on values from -1 to +1. The sign indicates whether the correlation is positive (as one variable increases, so too does the other) or negative correlation (as one variable increases, the other decreases). The size of the absolute value (ignoring the sign) provides an indication of the strength of the relationship. A perfect correlation of 1 or -1 indicates that the value of one variable can be determined exactly by knowing the value on the other variable. A scatterplot will show a straight line. A correlation of 0 indicates no relationship between the two variables (SPSS Inc. 2011).

The reader should take note that within this study the *not selected* options in question 10 and 13 has been dropped in order to use these questions within the correlation analysis. The option *Government* in question 6 has been combined with *Other*. The following universities were added to *Other* due to the insignificance of respondents' response - RU, TUT, UCT, UFH, UJ, UKZN, WITS.

Given the assumptions, the sample is large enough for the central limit theorem - the parametric Pearson correlation will be used and discussed in detail.

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**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 3.12: Pearson Parametric correlation coefficient (r)

	Compare / correlation	r - value	p-value	n
Q20 vs. Q3	Age vs. Years' experience	0.504**	0.000	80
Q20 vs. Q10.5	Q20 Age vs. Government Officials	0.730*	0.040	8
Q20 vs.Q10.8	Age vs. Industry staff	0.917**	0.010	7
Q20 vs. Q13.2	Age vs. Communication	0.445*	0.015	29
Q1 vs. Q2	Innovation to you vs. Innovation to your organisation	0.408**	0.000	97
Q1 vs. Q3	Innovation to you vs. Years' experience	0.225*	0.027	97
Q1 vs. Q4	Innovation to you vs. Last involved	-0.249*	0.022	85
Q1 vs. Q10.9	Innovation to you vs. Investors	0.570*	0.021	16
Q1 vs. Q10.13	Innovation to you vs. University students	0.264*	0.045	58
Q1 vs. Q13.16	Innovation to you vs. Intellectual Property	-0.414*	0.032	27
Q2 vs. Q13.5	Innovation to organisation vs. Culture and Behaviour	0.429	0.041	23
Q3 vs. Q13.16	Years' experience vs. Intellectual Property	-0.396*	0.041	27
Q4 vs. Q5	Last involved vs. Q5 Interface with organisations	-0.312**	0.005	78
Q4 vs. Q10.12	Last involved vs. Q10.12 University staff	-0.596*	0.019	15
Q4 vs. Q10.13	Last involved vs. Q10.13 University students	-0.310*	0.021	55
Q5 vs. Q10.10	Interface with organisations vs. South Africa	-0.358*	0.029	37
Q5 vs. Q10.11	Interface with organisations vs. Universities	0.340**	0.008	60
Q10.1 vs. Q10.10	Business vs. South Africa	-0.653**	0.002	20
Q10.2 vs. Q10.11	Communities vs. Universities	-0.687**	0.002	18
Q10.4 vs. Q13.14	Government Bodies vs. Co-operation and Support	-.902*	0.014	6
Q10.5 vs. Q13.3	Government Officials vs. Resources	-0.943	0.057	4

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	Availability			
Q10.6 vs. Q10.9	Industry vs. Investors	-0.596*	0.041	12
Q10.6 vs. Q13.3	Industry vs. Resource Availability	0.394*	0.046	26
Q10.8 vs. Q10.11	Industry staff vs. Universities	-0.812*	0.050	6
Q10.9 vs. Q13.3	Investors vs. Resource Availability	-0.744*	0.021	9
Q10.10 vs. Q10.11	South Africa vs. Universities	-0.489**	0.004	32
Q10.10 vs. Q10.13	South Africa vs. University students	-0.505**	0.006	28
Q10.12 vs. Q13.3	University Staff vs. Resource Availability	-0.642*	0.013	14
Q10.12 vs. Q13.11	University Staff vs. Leadership and Mentorship	-0.872*	0.010	7
Q10.12 vs. Q13.17	University Staff vs. Policies and Programmes	-0.664**	0.005	16
Q13.1 vs. Q13.15	Information Systems vs. Funding and budgets	-0.826	0.022	7
Q13.15 vs. Q13.10	Funding and Budgets vs. Administration and procedures	-0.522	0.004	28
Q13.17 vs. Q13.6	Policies and Programmes vs. Awareness and Understanding	-0.903	0.036	5

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3.4.3.1.1. Age

The relationship between Q20 (*Age* of people working in the THRIP environment) and Q 3 (*Years' experience)* has been investigated using Pearson product-moment correlation coefficient: There is a strong, practical, significant, positive correlation between the variables (r = 0.504; p = 0.000; n = 80), with high levels of the *Age* of people working in the THRIP environment, but with higher levels of *Years' experience*. The p-value of <0.05 indicates that there is almost zero chance of measuring a difference of larger than what have been observed here as a consequence of the sample. The difference between the two groups is statistical significant**.** ***The respondents perceive that the older you are the more experience you have obtained.***

The relationship between Q20 (*Age* of people working in the THRIP environment) and Q 10.5 (*Government Officials)*: There is a strong, practical, significant, positive correlation between the variables (r = 0.730; p = 0.040; n = 8), with ***high levels of the age of people working in the THRIP environment being mainly Government Officials***. The reader must bear in mind that the sample size for *Government* was only 5. The p-value of <0.05 indicates that there is a 4% chance of measuring a difference larger than what has been observed here as a consequence of the sample. The difference between the two groups is statistical significant. The responses indicate that the ***older respondents perceive that Government Officials gain more from THRIP projects****.*

The relationship between Q20 (*Age* of people working in the THRIP environment) and Q 10.8 (*Industry Staff)* has been investigated using Pearson product-moment correlation coefficient. There is almost a linear, positive correlation between the variables (r = 0.917; p = 0.01; n = 7), with high levels of the *Age* of people working with THRIP with higher levels of *Industry Staff*. The p-value of 0.01 indicates statistical significance. The responses indicate that the ***older respondents perceive that Industry Staff gains the most from THRIP projects.***

The relationship between Q20 (*Age*) and Q13.2 (*Communication)* has been investigated using Pearson product-moment correlation coefficient. There is an almost practical significant, positive correlation between the variables (r = 0.445; p = 0.0015;

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n = 29), with high levels of the *Age* of people working with THRIP with higher levels of *Communication.* The difference between the two groups is statistically significant. The responses indicate that the ***older respondents perceive that Communication has the most negative impact on the success of THRIP projects.***

3.4.3.1.2. R&D and innovation importance for you

The relationship between Q1 (*Whether R&D and innovation is important to you)* and Q2 (*How important is R&D and innovation to your organisation)* has been investigated using Pearson product-moment correlation coefficient. There is a positive, almost practical, significant correlation between the variables (r = 0.408; p = 0.000; n = 97), with high levels of *innovation importan*ce *to you* with higher levels of *innovation importance to your organisation*. The difference between the two groups is statistically significant. The responses indicate that the ***respondents selecting R&D and innovation as important to themselves, more likely perceive that innovation is important to their organisation****.*

The relationship between Q1 (Whether *R&D and innovation is important to you)* and Q3 (*Years' experience)* has been investigated using Pearson product-moment correlation coefficient. There is an almost medium, positive visible significant correlation between the variables (r = 0.225; p = 0.027; n = 97), with high levels of *whether innovation is important to you* with higher levels of *years' experience*. The difference between the two groups is statistical significant. The responses indicate that the respondents that select ***R&D and innovation as important to themselves have more experience of working with THRIP***.

The relationship between Q1 (*Whether R&D and innovation is important to you)* and Q4 (*Involvement in THRIP projects)* has been investigated using Pearson product-moment correlation coefficient. There is an almost medium, negative visible significance correlation between the variables (r = -0.249; p = 0.022; n = 85), with high levels *whether innovation is important to you* with lower levels of *involvement with THRIP*. The difference between the two groups is statistical significant. The responses indicate that it is ***more likely that respondents will rate R&D and innovation as interesting, if involvement with THRIP is more than 3 years ago***.

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The relationship between Q1 (*Whether R&D and innovation is important to you) and* Q10.9 (*Investors gain the most from THRIP projects) has been* investigated using Pearson product-moment correlation coefficient. There is a strong, positive, practical, significant correlation between the variables (r = 0.570; p = 0.021; n = 16), with high levels *whether innovation is important to you* with *higher levels of Investors gain the most from THRIP*. The difference between the two groups is statistical significant. When respondents select ***innovation is important to themselves, they strongly perceive that investors gain the most from THRIP projects.***

The relationship between Q1 (*Whether R&D and innovation is important to you)* and Q10.13 (*University Students)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a positive, visible significant correlation between the variables (r = 0.264; p = 0.045; n = 58), with high levels of *innovation importance to you* with medium levels of *University Students*. The difference between the two groups is statistical significant. The respondents indicating ***that innovation is interesting to themselves, indicate that University Students gain the most from THRIP projects.***

The relationship between Q1 (*Whether R&D and innovation is important to you)* and Q13.16 (*Intellectual Property Issues)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a relatively strong, negative practical significance between the variables (r = -0.414; p = 0.032; n = 27), with high levels of *innovation importance to you* with lower levels of *Intellectual property Issues.* The difference between the two groups is statistical significant. ***When innovation is important to the respondent, there is an impact on the Intellectual Property Issues, which negatively influence the success of THRIP projects, for the main reason that the respondent wants to know that their innovative idea is protected.***

The relationship between Q1 (*Whether R&D and innovation is important to you)* and Q13.17 (*Objectives & Expectations)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a

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relatively strong, positive practical significance between the variables (r = 0.406; p = 0.061; n = 22), with high levels of *innovation importance to the respondent* with higher levels of *Objectives & Expectations*. There is an indication that when ***R&D and innovation is important to the respondent, objectives & expectations can be seen as a most negative factor regarding the success of THRIP projects.***

3.4.3.1.3. R&D and innovation importance to your organisation

The relationship between Q2 *(Whether R&D and innovation is important for your Organisation)* and Q13.5 (*Culture and Behaviour as a negative influence)* has b een investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a relatively strong, positive practical significance between the variables (r = 0.429; p = 0.041; n = 23), with high levels of *R&D and innovation importance to your organisation*, with higher levels of *Culture and Behaviour* as a negative constraint. The difference between the two groups is statistical significant. The responses indicate that when ***R&D and innovation is important to your organisation, Culture and Behaviour has the most negative impact on the success of THRIP projects.***

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3.4.3.1.4. Years' experience

The relationship between Q3 (*Years' experience in THRIP projects)* and Question 13.16 (*Intellectual Property Issues as a negative constraint)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a relatively medium, negative visible significance between the variables (r = -0.396; p = 0.041; n = 27), with high levels of *Years' experience*, with lower levels of *Intellectual Property Issues* as a negative constraint. The difference between the two groups is statistical significant. The ***longer the involvement in THRIP projects, the less Intellectual Property Issues is seen as a constraint that has a negative impact on the THRIP projects.***

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3.4.3.1.5. Last involved

The relationship between Q4 (*last involved in THRIP)* and Q5 (*Interface with Organisations)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a relatively medium, negative visible significance between the variables (r = -0.312, p = 0.005, n = 78), with high levels of *last involved* in THRIP, with lower levels of *Interface with Organisations*. The difference between the two groups is statistical significant. The ***respondents currently involved in THRIP projects, perceive higher involvement with other Organisations regularly.***

The relationship between Q4 (*last involved in THRIP)* and Q10.12 (*University Staff gain the most from THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a medium, negative visible significance between the variables (r = -0.310, p = 0.019, n = 15), with high levels of *last involved in THRIP*, with lower levels of *University Staff gains the most from THRIP*. The difference between the two groups is statistical significant. The respondents perceive the ***longer ago involved in THRIP, the less University Staff gain from the THRIP projects.***

The relationship between Q4 (*Last involved in THRIP)* and Q10.13 (*University Students gain the most from THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been sperformed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a medium, negative visible significance between the variables (r = -0.310, p = 0.021, n = 55), with high levels of *last involved with THRIP*, with lower levels of *University Students gains the most from THRIP*. The difference between the two groups is statistical significant. The responses indicate that the ***respondents perceive the greater the time period last involved in THRIP, the less University students gain from the THRIP projects.***

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3.4.3.1.6. Interface with organisations

The relationship between Q5 (I*nterface with Organisations)* and Q10.10 (*South Africa gains the most from THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a medium, negative visible significance between the variables (r = -0.358, p = 0.029, n = 37), with high levels of interface with *Organisations*, with lower levels of *South Africa gains the most from THRIP*. The difference between the two groups is statistical significant. When the ***interface with organisations on THRIP is low, the gain for South Africa will be low.***

The relationship between Q5 (*Interface with Organisations on THRIP)* and Q10.11 (*Universities gain the most from THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a medium, negative visible significance between the variables (r = -0.340, p = 0.008, n = 60), with high levels of *Interface with Organisationson THRIP*, with lower levels of *Universities gain the most from THRIP*. The difference between the two groups is statistically significant. The responses indicate that when the ***interface with organisations on THRIP is low, the gain for universities will be low.***

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3.4.3.1.7. Gaining the most from THRIP projects

The relationship between Q10.1 (*Businesses gain the most from THRIP)* and Q10.10 (*South Africa gains the most from THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a large, negative practical significance between the variables (r = -0.653, p = 0.002, n = 20), with high levels of *Business gain the most from THRIP*, with lower levels of *South Africa gain the most from THRIP*. The response indicates that when ***the gain for Businesses is, low the gain for South Africa will be low.***

The relationship between Q10.1 (*Businesses gain the most from THRIP)* and Q13.7 (*Objectives and Expectations as a negative impact on the success of THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a large, negative practical significance between the variables (r = -0.535, p = 0.074, n = 12), with high levels of *Business gain the most from THRIP*, with lower levels of *Objectives and Expectations as a negative impact on the success of THRIP*. The difference between the two groups is statistical significant. The responses indicate that when ***the respondents select Businesses as gaining the most from THRIP projects, Objects and Expectations are having the most negative impact on THRIP projects.***

The relationship between Q10.2 (*Communities gain the most from THRIP)* and Q10.11 (*Universities gain the most from THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a large, negative practical significance between the variables (r = -0.687, p = 0.002, n = 18), with high levels of *Communities gain the most from THRIP*, with lower levels of *Universities gain the most from THRIP*. The difference between the two groups is statistically significant. The responses indicate that when the respondents select ***Communities as gaining the most from THRIP, the perceived feeling is that universities will gain less from THRIP.***

The relationship between Q10.4 (*Government Bodies gain the most from THRIP)* and Q13.14 (*Co-operation and Support as the most negative impact on the success of*

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THRIP) has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a large, negative practical significance between the variables (r = -0.902, p = 0.014, n = 6), with high levels of *Government Bodies gain the most from THRIP*, with lower levels of *Co-operation and Support as the most negative impact on the success of THRIP*. The difference between the two groups is statistically significant. The responses indicate that the ***respondents selecting Government Bodies perceive that Co-operation and Support are having the most negative impact on the success of THRIP projects.***

The relationship between Q10.5 (*Government Officials gain the most from THRIP)* and Q13.13 (*Resource Availability as the most negative impact on the success of THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a large, negative practical significance between the variables (r = -0.943, p = 0.057, n = 4), with high levels of *Government Officials gain the most from THRIP*, with lower levels of *Resources Availability as the most negative impact on the success of THRIP*. There is almost a linear negative practical significance that the respondents feel when ***Government Officials gain the most from THRIP resources availability is non-existent.***

The relationship between Q10.6 (*Industries gains the most from THRIP)* and Q10.9 (*Investors gain the most from THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a large, negative practical significance between the variables (r = -0.596, p = 0.041, n = 12), with high levels of *Industry gain the most from THRIP*, with lower levels of *Investors gain the most from THRIP*. The difference between the two groups is statistical significant. The responses indicate that when ***the respondents perceive that Industry gain the most from the THRIP programme, Investors gain less from the THRIP programme.***

The relationship between Q10.6 (*Industry gain the most from THRIP)* and Q13.3 (*Resources Availability as the factor having a negative impact on the success of THRIP)* has been investigated using Pearson product-moment correlation coefficient.

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Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a medium, positive visible significance between the variables (r = 0.394, p = 0.046, n = 26), with high levels of *Industry gain the most from THRIP*, with higher levels of *Resources Availability as a negative impact on the success of THRIP*. The difference between the two groups is statistical significant. The responses indicate that when ***the Industry gain the most from THRIP, the respondents perceive that resources' availability, have the most negative impact on the success on the THRIP programme.***

The relationship between Q10.8 (*Industry Staff gain the most from THRIP)* and Q10.11 (*Universities gain the most from THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a strong, negative practical significance between the variables (r = -0.812, p = 0.050, n = 6), with high levels of *Industry staff gain the most from THRIP*, with lower levels of *Universities gain the most from THRIP*. The difference between the two groups is statistical significant. The responses indicate that when ***Industry Staff gains the most from the THRIP programme, the universities gain less.***

The relationship between Q10.9 (*Investors gain the most from THRIP)* and Q13.3 (*Resource Availability negatively impact the success of THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a strong, negative practical significance between the variables (r = -0.744, p = 0.021, n = 9), with high levels of *Investors gain the most from THRIP*, with lower levels of *Resource Availability negatively impact the success of THRIP*. The difference between the two groups is statistical significant. The responses indicate that when the ***Investors gain the most from the THRIP programme, respondents perceive that resources' availability have the most negative impact on the success of THRIP.***

The relationship between Q10.10 (*South Africa gain the most from THRIP)* and Q10.11 (*Universities gain the most from THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity.

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There is an almost large, negative practical significance between the variables (r = -0.489, p = 0.004, n = 32), with high levels of *South Africa gain the most from THRIP*, with lower levels of *Universities gain the most from THRIP*. The difference between the two groups is statistically significant. The responses indicate that when ***South Africa gains the most from THRIP, the respondent perceives that universities will gain less.***

The relationship between Q10.10 (*South Africa gain the most from THRIP)* and Q10.13 (*University Students gain the most from THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a large, negative practical significance between the variables (r = -0.505, p = 0.006, n = 28), with high levels of *South Africa gain the most from THRIP*, with lower levels of *Universities Students gain the most from THRIP*. The difference between the two groups is statistical significant. The responses indicate that when ***South Africa gains the most from THRIP, the respondent perceive that University Students will gain less.***

The relationship between Q10.12 (*University Staff gain the most from THRIP)* and Q13.3 (*Resource Availability negatively impact the success of THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a large, negative practical significance between the variables (r = -0.642, p = 0.013, n = 14), with high levels of *University Staff gain the most from THRIP*, with lower levels of *Resource Availability negatively impact on the success of THRIP*. The difference between the two groups is statistical significant. The responses indicate that when ***University Staff gains the most from THRIP projects, the respondent perceive that Resource Availability will have the most negative impact on the success of THRIP.***

The relationship between Q10.12 (*University Staff gain the most from THRIP)* and Q13.11 (*Leadership and Mentorship negatively impact the success of THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a strong, negative practical significance

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between the variables (r = -0.872, p = 0.010, n = 7), with high levels of *University Staff gain the most from THRIP*, with lower levels of *Leadership and Mentorship* n*egatively impact on the success of THRIP*. The difference between the two groups is statistical significant. The responses indicate that when ***University Staff gains the most from THRIP projects, Leadership and Mentorship have a negative impact on the success of THRIP.***

The relationship between Q10.12 (*University Staff gain the most from THRIP project)s* and Q13.17 (*Policies and Programmes negatively impact the success of THRIP*) has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a large, negative practical significance between the variables (r = -0.664, p = 0.005, n = 16), with high levels of *University Staff gain the most from THRIP*, with lower levels of *Policies and Programmes negatively impact on the success of THRIP*. The difference between the two groups is statistical significant. The respondents perceive that when ***University Staff gains the most from THRIP projects, Policies and Programmes have a negative impact on the success of THRIP.***

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3.4.3.1.8. Factors that have the most negative impact on THRIP projects

The relationship between Q13.1 (*Information Systems as a negative factor influence the success of THRIP)* and Q13.15 (*Funding and Budgets negatively impact the success of THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a strong, negative practical significance between the variables (r = -0.826, p = 0.022, n = 7), with high levels of *Information Systems as a negative factor influence the success of THRIP*, with lower levels of *Funding and Budgets negatively impact on the success of THRIP*. The difference between the two groups is statistical significant. The responses indicate that when ***Information Systems have a negative impact on the success of THRIP, funding and budgeting will impact on the success of THRIP negatively.***

The relationship between Q13.4 (*Knowledge and Know-how as a negative factor influence the success of THRIP)* and Q13.3 (*Resource Availability negatively impact the success of THRIP)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a strong, negative practical significance between the variables (r = -0.726, p = 0.065, n = 7), with high levels of *Knowledge and Know-how as a negative factor influence the success of THRIP*, with lower levels of *Resource Availability negatively impact on the success of THRIP.* The difference between the two groups is statistical significant. The responses indicate that when ***Knowledge and Know-how have a negative impact on the success of THRIP, Resource Availability will also negatively influence the success of THRIP.***

The relationship between Q13.6 (*Awareness and Understanding as a negative factor influence the success of THRIP)* and Q13.17 (*Policies and Programmes impact the success of THRIP negative)* has been investigated using Pearson product-moment correlation coefficient. Preliminary analyses have been performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is a strong almost linear, negative practical significance between the variables (r = -0.903, p = 0.036, n = 5), with high levels of *Awareness and Understanding as a negative factor influence the success of THRIP*, with higher levels of *Policies and Programmes*

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negatively impact on the success of THRIP. The difference between the two groups is statistically significant. The responses indicate that when ***Awareness and Understanding have a negative impact on the success of THRIP, Policies and Programmes will influence the success of THRIP negatively.***

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3.4.3.2. Spearman's rho – Non parametric

Spearman's rho measures statistical dependence between two variables. Spearman's correlation applies to ranks, and thus provides a measure of a monotonic relationship between two continuous random variables. It is useful with ordinal data and is robust to outliers, unlike Pearson's correlation.

According to Kendall and Gibbons (1990:47) the confidence intervals for Spearman's rho are less reliable and less interpretable, but the calculation is much easier.

The correlations obtained by Pearson Parametric are similar to those obtained by Spearman Nonparametric, detailed in Appendix D.

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3.4.4. Compare the means of two groups

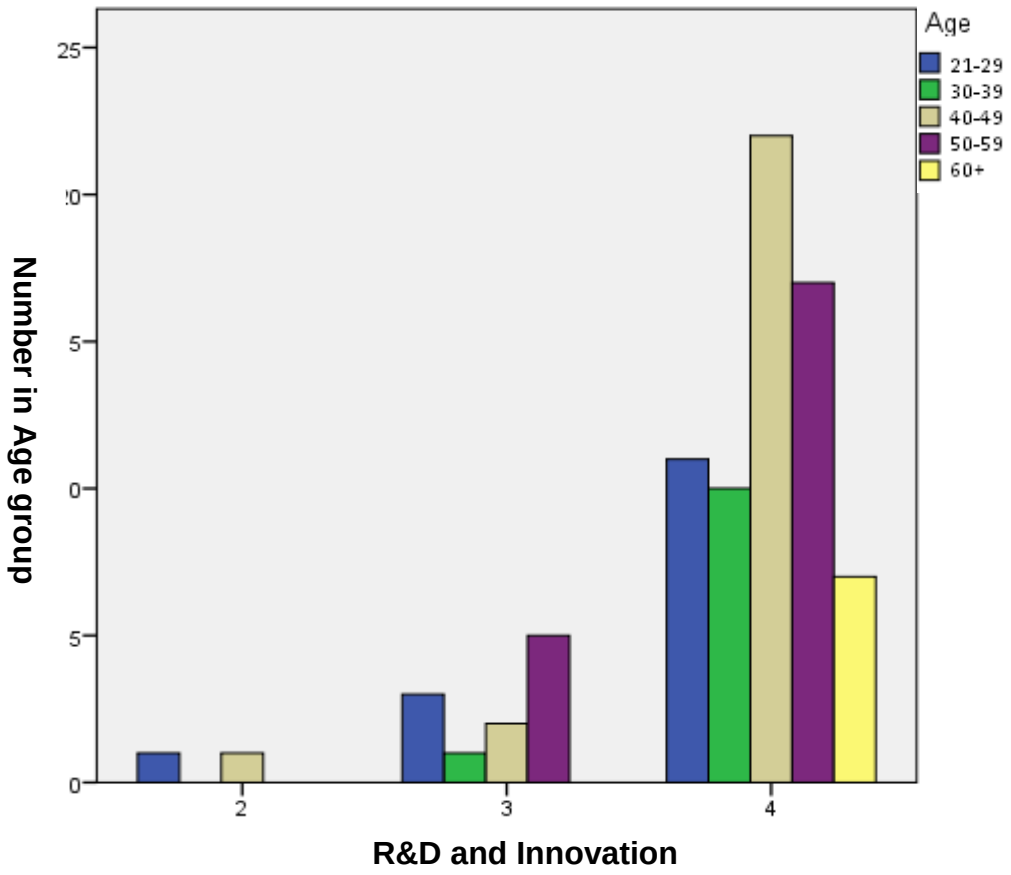
3.4.4.1 Cross Tabs

Cross-tabulation is one of the most useful analytical tools. Cross-tabulation analysis is most often used to analyse categorical data. A cross-tabulation is a two or more dimensional table that records the number of (frequency) of respondents that have the characteristics described in the cells of the table. Cross tabulation provides a wealth of information about the relationship between variables (Levine, Stephan, Krehbiel & Berenson, 2008:54).

The following graphs essentially are histograms where responses for one question are

Number in Age versus Importance of R&D and Innovation to you

Graph 3.8: Age group versus R&D and innovation to you



Graph 3.8 shows that the majority of respondents from *Age* group 40-49 have generally rated the *importance of R&D and innovation* to them as very important (4). They are closely followed by age group 50-59. Nobody has rated this factor as not important and only 2 people as unimportant.

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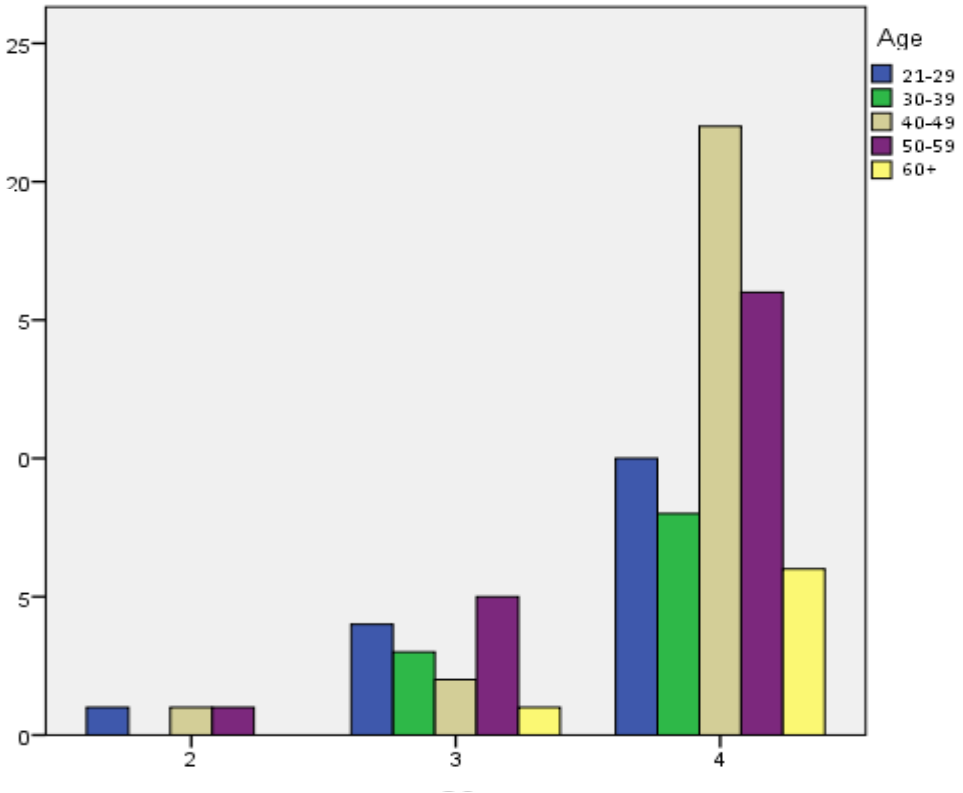
Number in Age versus Importance of R&D and Innovation to your organisation

Graph 3.9: Age group versus how important is R&D and innovation to your organisation



Graph 3.9 shows that the majority of respondents from *Age* group 40-49 have generally rated the *importance of R&D and innovation to their organisation* as very important (4). They are closely followed by the *age* group 50-59.

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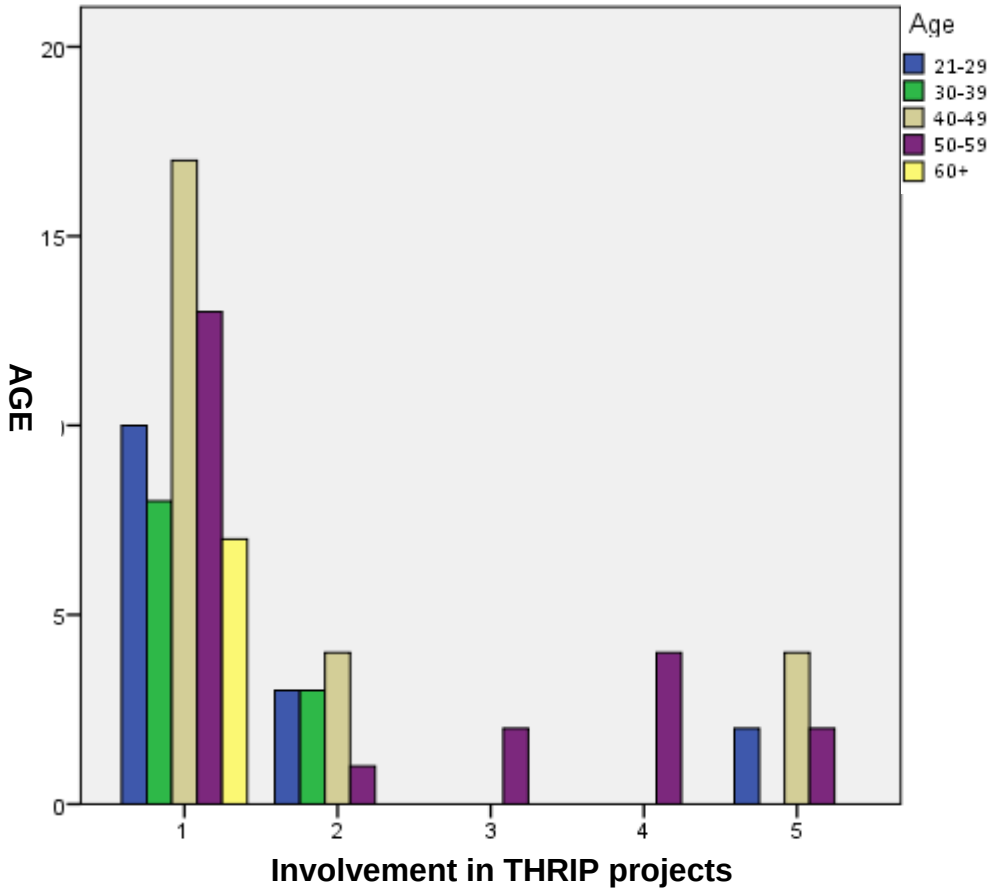
Number in Age versus last involvement in THRIP projects

Graph 3.10: Age group versus last involvement in THRIP projects



Graph 3.10 shows that the majority of respondents from the *Age* group 40-49 are *currently involved with THRIP projects* (1). They are closely followed by the *Age* group 50-59.

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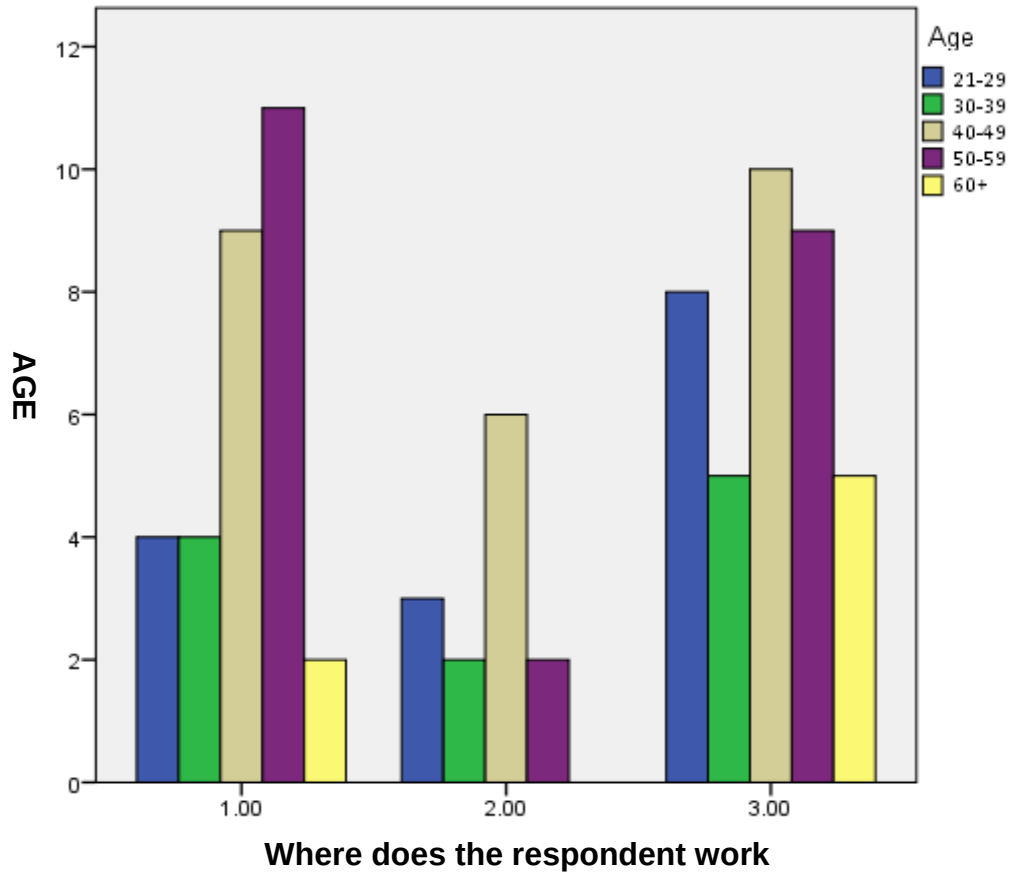
Age versus where does the respondent

Graph 3.11: Age group versus where you work



Industry

Graph 3.11 shows that the majority of respondents from the *Age* group 50-59 years are working in the *Industry* (1). They are closely followed by the *Age* group 40-49.

Universities

Closely following are the *University* with the majority respondents from the *Age* group 40.49, followed by the *Age* group 50-59.

Government and Other

The *Age* group 40-49 has selected the most and second is the age group 21-29. *Age* group 50-59 and 30-39 have ranked the same.

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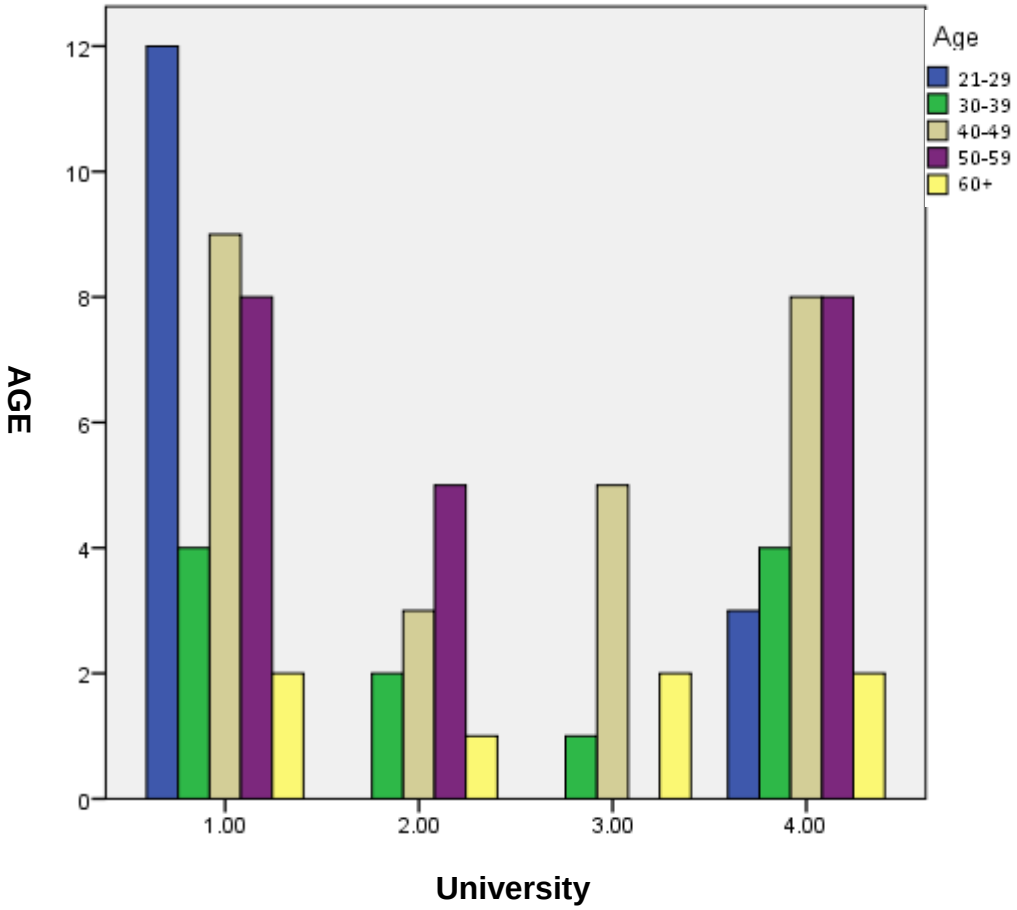
University respondent interface with or belong to

Graph 3.12: Age group versus which University you belong to



North-West University

Graph 3.12 shows that the majority of respondents in the *Age* group 21-29 interface with the *North-West University (1).*They are closely followed by *Age* 40-49.

University of Pretoria

Closely following are *University of Pretoria (2)* with the majority of the respondents in the *Age* group 40-49 and 50-59.

University of Stellenbosch

The *University of Stellenbosch (3)* are third with the majority of respondents in the *Age* group 40-49.

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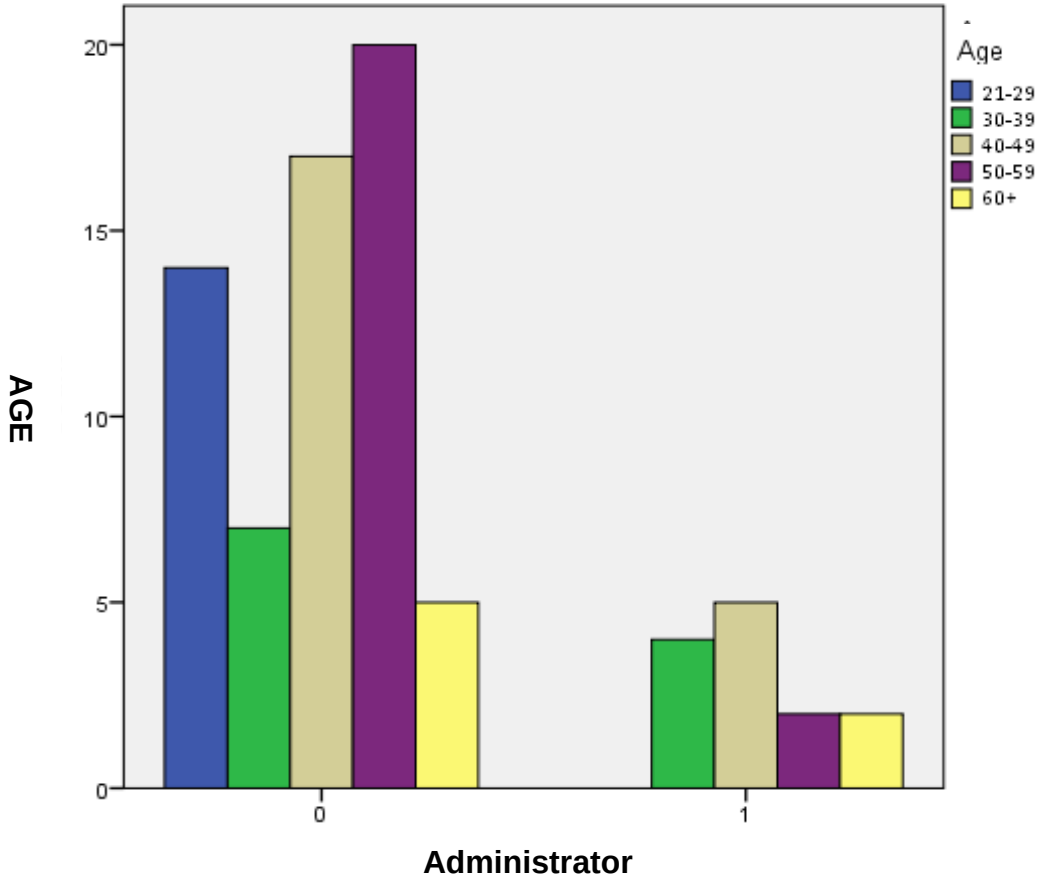
Number in Age group versus Administrator role within the THRIP project

Graph 3.13: Age group versus Administrators role within the THRIP projects



Graph 3.13 shows that the majority of respondents from *Age* group 50-59 are *Administrators* (1). They are closely followed by *Age* group 40-49.

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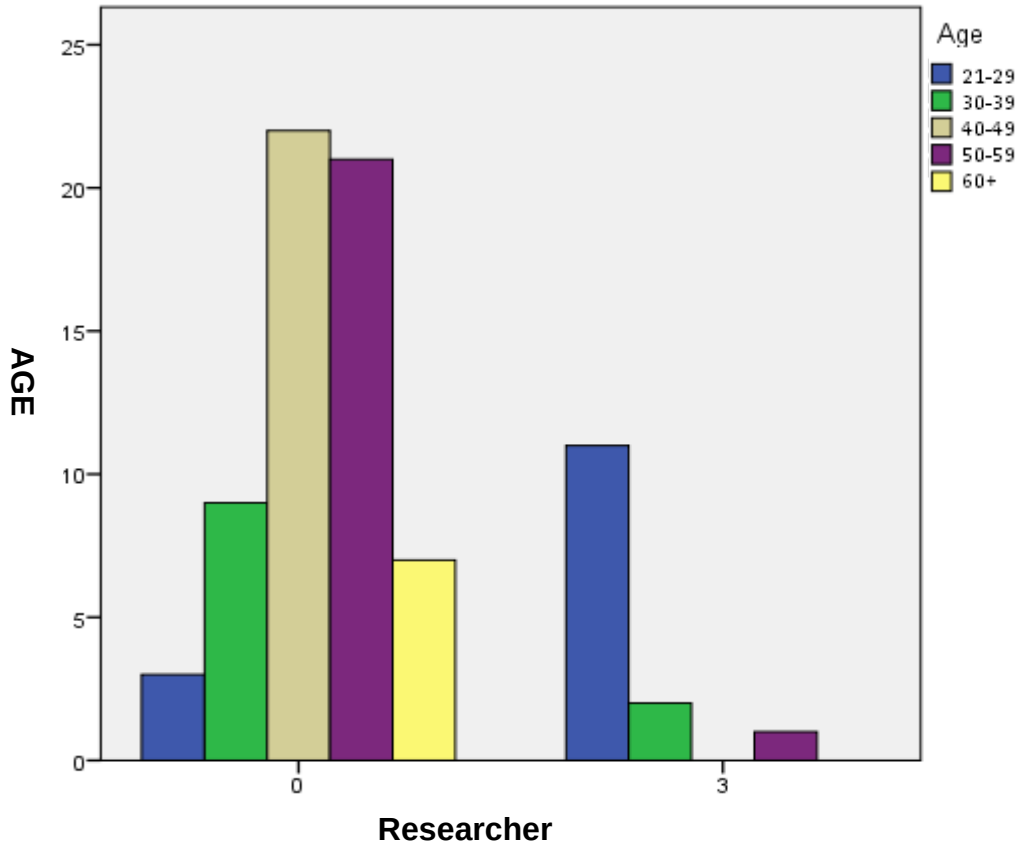
Number in Age versus Researcher role with THRIP projects

Graph 3.14: Age group versus Researcher role with the THRIP projects



Graph 3.14 shows that the majority of respondents from *Age* group 40-49 are *Researchers (3)*. They are closely followed by *Age* group 50-59.

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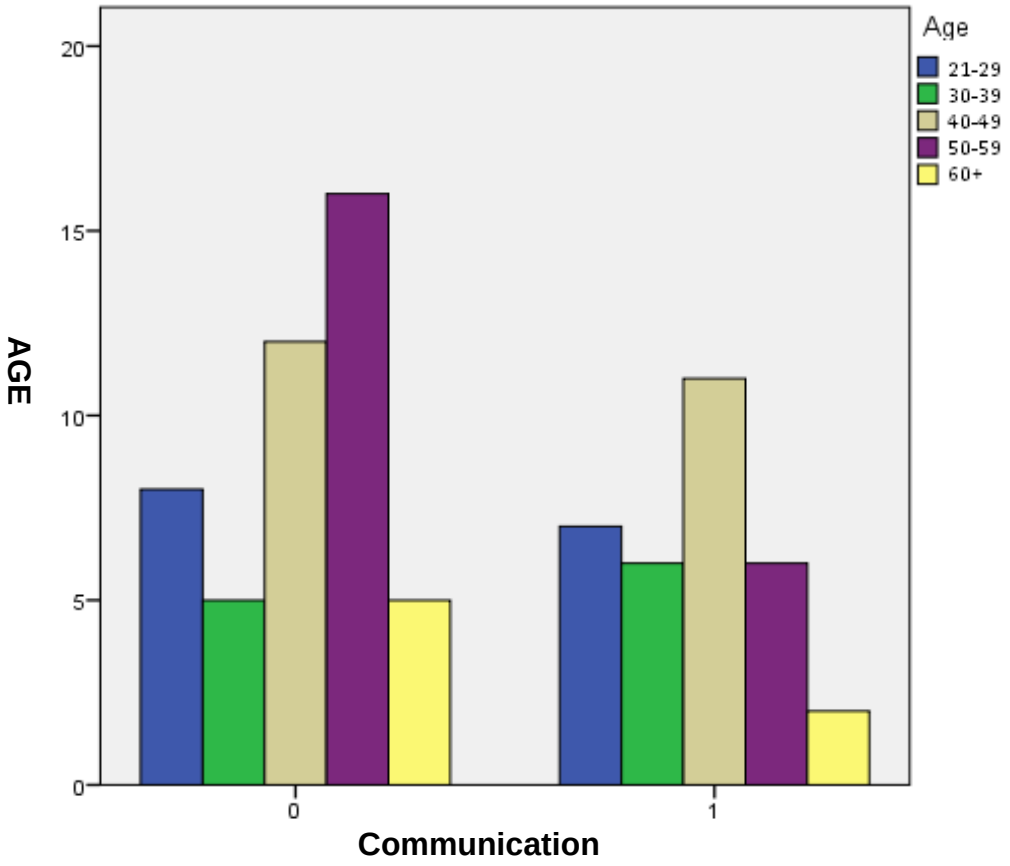
Number in Age versus improved or fixed Communication

Graph 3.15: Age group versus Communication as a constraint that can be improved or fixed



Graph 3.15 shows that *Age* group 40-49 believes that *Communication (2)* as a constraint can be improved or fixed, closely followed by *Age* group 21-29.

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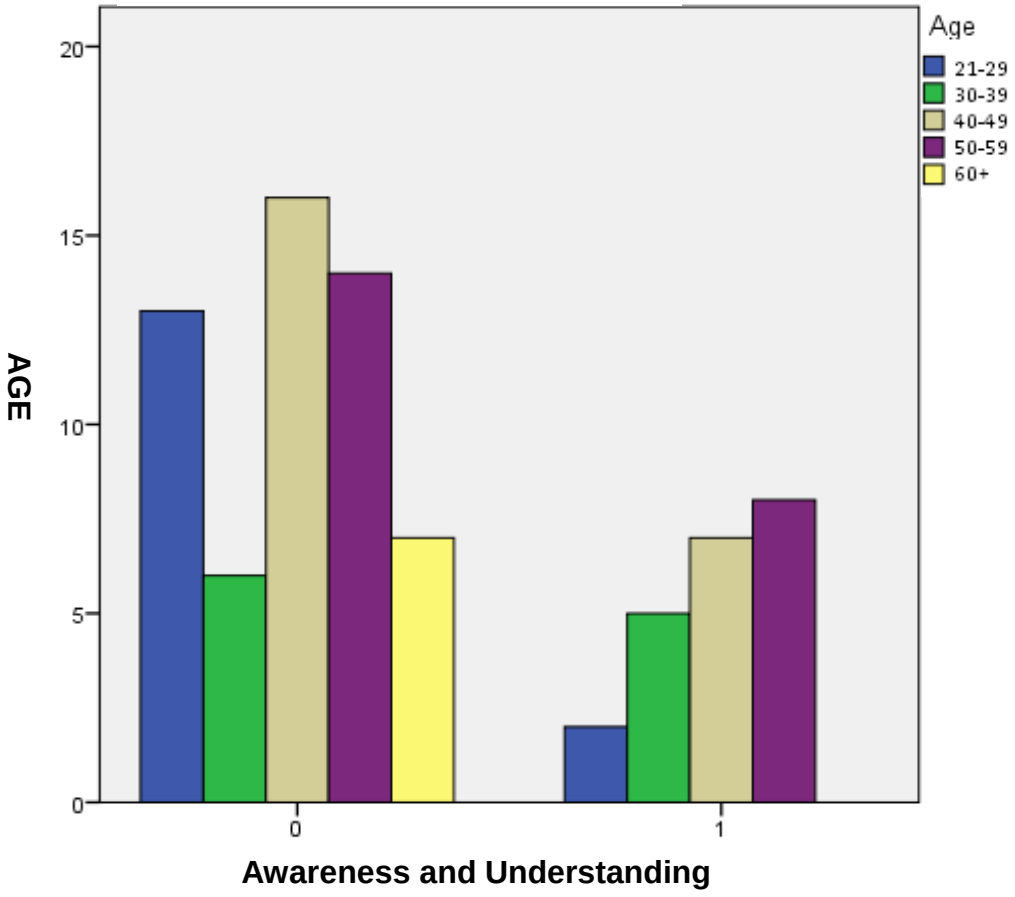
Number in Age versus improved or fixed Awareness and Understanding

Graph 3.16: Age group versus Awareness and Understanding as a constraint that can be improved or fixed



Graph 3.16 shows the *Age* group 50-59 believes that the constraint *Awareness and Understanding* can be improved, followed by *Age* group 40-49.

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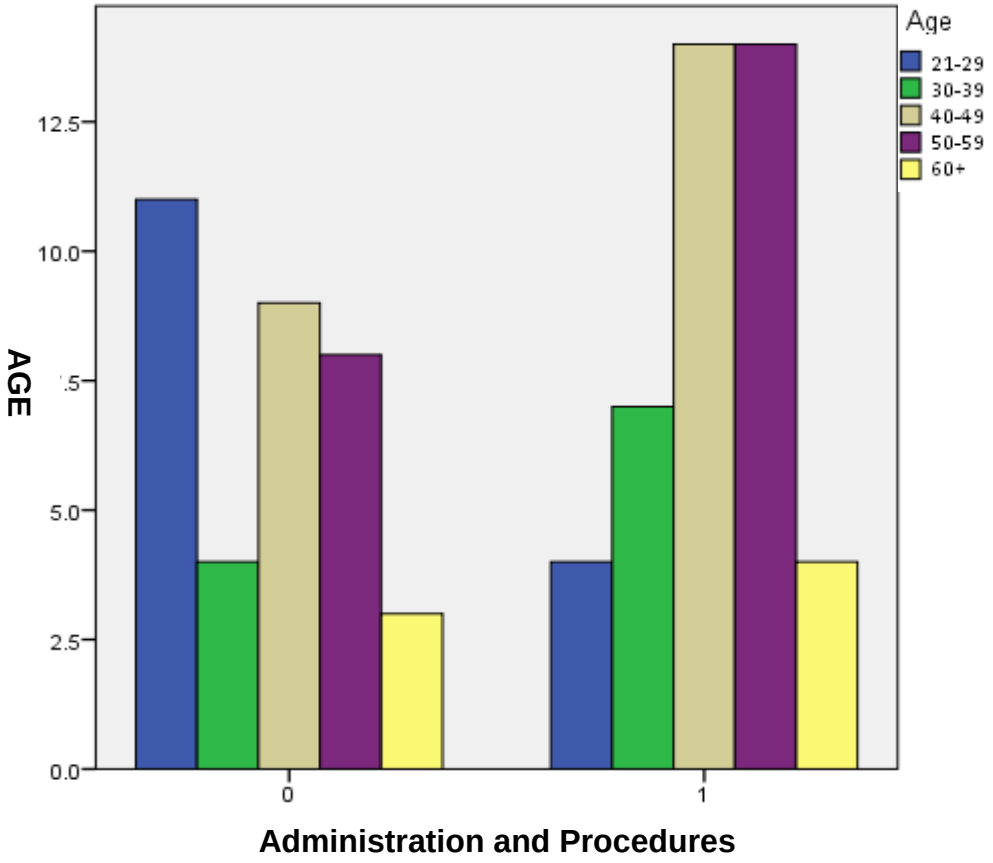
Number in Age versus improved or fixed Administration and Procedures

Graph 3.17: Age versus Administration procedures as a constraint that can be improved or fixed



Graph 3.17 shows that the majority of respondents in *Age* group 40-49 and 50-59 believe that *Administration and Procedure can be improved or fixed*.

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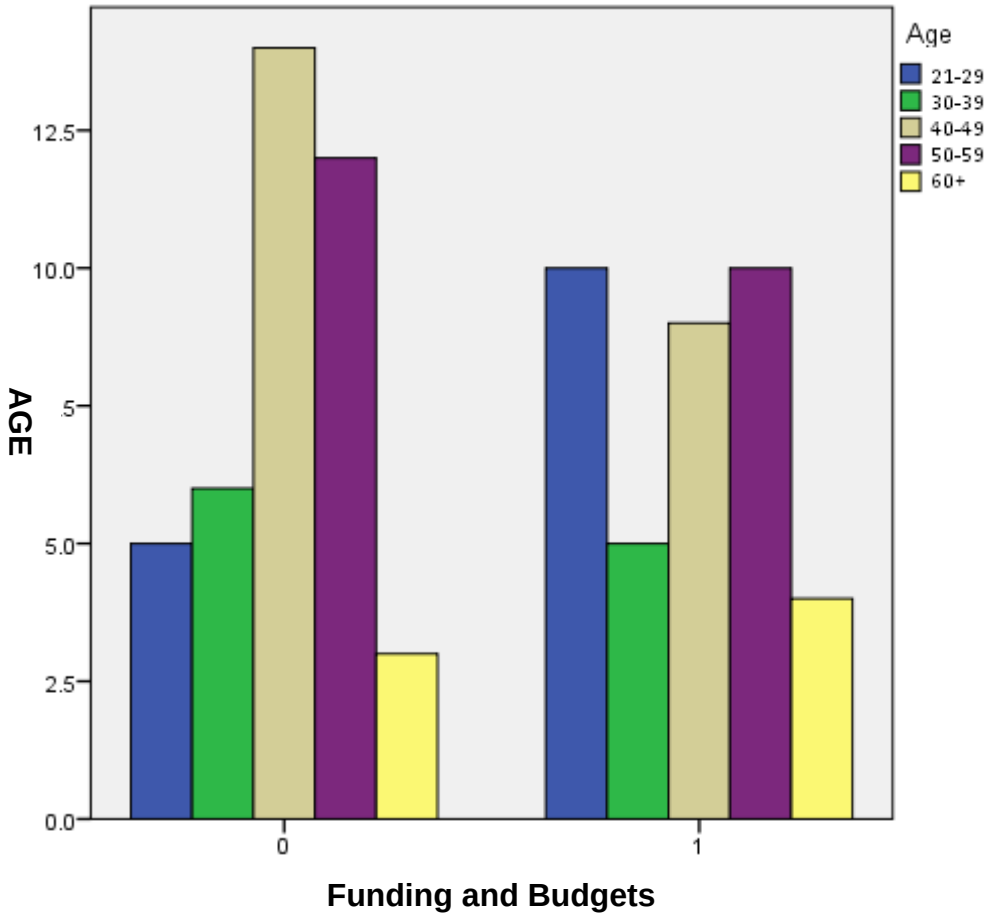
Number in age group versus improved or fixed Funding and Budgets

Graph 3:18: Age versus Funding and Budgets as constraints that can be improved or fixed



Graph 3.18 shows that the majority of respondents *Age* 50-59 and 21-29 believe that *Funding and Budgets* which have a negative impact on the success of THRIP projects will be improved or fixed. They are closely followed by *Age* group 40-49.

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3.4.4.2 T-test

Independent-samples T-test is used when researchers want to compare the mean score on some continuous variable, for two different groups of subjects (SPPS: 2011).

Effect size statistics provide an indication of the magnitude of the differences between the groups (not just whether the difference could have occurred by chance). There are a number of different effect size statistics, the most commonly used being eta squared. Eta squared can range from 0 to 1 and represents the proportion of variance in the dependent variable that can be explained by the independent (group) variable (SPPS: 2011).

The reader should take note of the following regarding the comparison of groups in order for the calculation of the mean value:

- "Not Applicable" option for question 17, 18, 19 and 20 has been dropped,
- Only the top five results of question 10 and 13 have been used for the analysis,
- Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis,
- Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.

Interpreting the p-value in the T-test, if the significance level of Levene's test is $p>0.05$, this means that the variance for the two groups are not the same, indicating that the data violate the assumption of equal variance, and the t-value compensates for the fact that your variances are not the same. Only correlations where $p<0.05$ are included in the list, but reporting will be on the d-value (medium 0.5 to large 0.8), for cross tabs outside the list, see Appendix E.

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T-test *Administrators* versus Non-*Administrators*

Administrators versus importance of R&D and innovation to respondent

Table 3.13: Administrators versus Innovation importance to respondent

Q8.1	Administrators	N	Mean	Std Dev	Independent T-test	
Question 1	Grouping				p-value	d-value
	Administrators	15	4.000	0.000	0.000	0.481
	Non-Administrators	76	3.750	0.520		

An independent-sample T-test has been conducted to compare Table 3.13 - the importance of R&D and innovation scores for *Administrators* and non-*Administrators*. There is no significant difference in mean scores for *Administrators* (M = 4.00, SD = 0.00) and non-*Administrators* (M = 3.750, SD = 0.521; d = 0.481, p = 0.000). The magnitude of the differences in the means is small (eta squared = 0.008). ***There is a medium visible significance between the mean score of the Administrators and non-Administrators, perceiving that R&D and innovation are important to them.***

$$\eta^2 = \frac{0.481^2}{0.481^2 + (15+17-2)} = 0.008$$

This indicates 0.8% difference between the mean scores, where *Administrators* rank the importance of R&D to them higher than the non-*Administrators*.

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Administrators versus Years' experience

Table 3.14: Administrators versus years' experience

Q8.1	Administrators	N	Mean	Std Dev	Independent T-test	
Question 3	Grouping				p-value	d-value
	Administrators	15	7.600	3.661	0.026	0.678
	Non-Administrators	76	5.120	3.510		

There is a medium visible significance between the mean score of the *Administrators* and non-*Administrators* with a p-value of 0.026 and a d-value of 0.678.

Administrators versus Resource Availability as the most negative impact on the success of THRIP projects

Table 3.15: Administrators versus Resource Availability as the most negative impact on the success of THRIP projects

Q8.1	Administrators	N	Mean	Std Dev	Independent T-test	
Question 13.3	Grouping				p-value	d-value
	Administrators	7	3.429	0.787	0.020	0.748
	Non-Administrators	27	2.407	1.366		

There is a significant difference in the mean scores for *Administrators* and non-*Administrators* with a p-value of 0.020 and d-value of 0.748.

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Administrators versus Awareness and Understanding as the most negative impact on the success of THRIP projects

Table 3.16: Administrators versus Awareness and Understanding as the most negative impact on the success of THRIP projects

Q8.1	Administrators	N	Mean	Std Dev	Independent T-test	
Question 13.6	Grouping				p-value	d-value
	Administrators	3	1.333	0.577	0.019	1.063
	Non-Administrators	20	2.750	1.332		

There is a significant difference in mean scores for *Administrators* and non-*Administrators* with a p-value of 0.019 and a d-value of 1.063.

For T-test outside the range see Appendix E

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T-test Researcher versus Non-Researcher

Researchers versus Years' experience

Table 3.17: Researcher versus Non-Researchers Years' experience

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 3	Grouping				p-value	d-value
	Researcher	17	3.060	2.410	0.000	0.834
	Non Researcher	74	6.090	3.642		

There is no significant difference in mean scores for *Researchers* and non-*Researchers* with a p-value of 0.000 and d-value of 0.834.

Researcher versus Entrepreneurs gain the most from THRIP projects

Table 3.18: Researcher versus Entrepreneurs gain the most from THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 10.3	Grouping				p-value	d-value
	Researcher	5	1.800	0.837	0.004	1.466
	Non Researcher	24	3.630	1.245		

There is no significant difference in the mean scores for *Researchers* and non-*Researchers* with a p-value of 0.004 and a d-value of 1.466.

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Researcher versus Industry gain the most from THRIP projects

Table 3.19: Researcher versus Industry gain the most from THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 10.6	Grouping				p-value	d-value
	Researcher	10	3.600	1.506	0.047	0.750
	Non Researcher	51	2.471	1.250		

There is no significant difference in the mean scores for *Researchers* and non-*Researchers* with a p-value of 0.047 and d-value of 0.750.

Researcher versus South Africa gains the most from THRIP projects

Table 3.20: Researcher versus South Africa gains the most from THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 10.10	Grouping				p-value	d-value
	Researcher	7	4.000	1.528	0.064	0.856
	Non Researcher	31	2.650	1.582		

There is no significant difference in mean scores for *Researchers* and non-*Researchers* with a p-value of 0.064 and d-value of 0.856.

`

Researcher versus University Staff gains the most from THRIP projects

Table 3.21: Researcher versus University Staff gains the most from THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 10.12	Grouping				p-value	d-value
	Researcher	7	2.286	1.113	0.030	0.903
	Non Researcher	32	3.500	1.344		

There is no significant difference in the mean scores for *Researchers* and non-*Researchers* with a p-value of 0.0.30 and a d-value of 0.903.

Researcher versus Age category

Table 3.22: Researcher versus Age category

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 20	Grouping				p-value	d-value
	Researcher	14	4.357	0.842	0.000	1.926
	Non Researcher	62	6.323	1.021		

There is no significant difference in scores for *Researchers* with a p-value of 0.000 and a d-value of 1.926.

For T-test outside this range see Appendix F

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T-test Communication versus Non-Communication

Communication improved or fixed versus Non-Communication as negative impact on the success of THRIP projects

Table 3.23: Communication improved or fixed versus Communication negative impact on success of THIRP projects

Q14.2	Communication	N	Mean	Std Dev	Independent T-test	
Question 13.2	Grouping				p-value	d-value
	Communication	33	2.000	1.871	0.001	0.717
	Non-Communication	47	0.660	1.536		

There is no significant difference in the mean scores of *Communication* that can be improved and non-*Communication* that can be improved or fixed with a p-value of 0.001 and a d-value of 0.717

Communication improved or fixed versus Culture and Behaviour negative impact on the success of THRIP projects

Table 3.24: Communication improved or fixed versus Culture and Behaviour negative impact on the success of THRIP projects

Q14.2	Communication	N	Mean	Std Dev	Independent T-test	
Question 13.5	Grouping				p-value	d-value
	Communication	33	0.520	1.349	0.025	0.429
	Non Communication	47	1.360	1.972		

There is no significant difference in the mean scores of *Communication* and non-*Communication* with a p-value of 0.025 and a d-value of 0.429.

`

T-test Resource Availability versus Non-Resource Availability

Resource Availability improved or fixed versus Awareness and Understanding negative impact on the success of THRIP projects

Table 3.25: Communication improved or fixed versus Awareness and Understanding negative impact on the success of THRIP projects

Q14.3	Resource Availability	N	Mean	Std Dev	Independent T-test	
Question Q13.6	Grouping				p-value	d-value
	Resource Availability	19	0.160	0.501	0.001	0.500
	Non Resource Availability	62	0.900	1.490		

There is no significant difference in the mean scores for *Resources Availability* that can be improved or fixed and non-*Resource Availability* that can be improved or fixed with a p-value of 0.001 and a d-value of 0.500.

Resource Availability improved or fixed versus Organisational Structure negative impact on the success of THRIP projects

Table 3.26: Resource Availability improved or fixed versus Organisational Structure most negative impact on the success of THRIP projects

Q14.3	Resource Availability	N	Mean	Std Dev	Independent T-test	
Question Q13.13	Grouping				p-value	d-value
	Resource Availability	19	0.160	0.688	0.021	0.388
	Non Resource Availability	62	0.740	1.503		

There is no significant difference in the mean scores for *Resource Availability* that can be improved or fixed and non-*Resource Availability* that can be improved or fixed with a p-value of 0.021 and a d-value of 0.388.

`

T-test Knowledge and Know-how versus Non-Knowledge and Know-how

Knowledge and Know-how improved or fixed versus Information Systems negative impact on the success of THRIP projects

Table 3.27: Knowledge and Know-how improved or fixed versus Information Systems as the most negative impact on the success of THRIP projects

Q14.4	Knowledge and know-how	N	Mean	Std Dev	Independent T-test	
Question Q13.1	Grouping				p-value	d-value
	Knowledge and know-how	16	0.000	0.000	0.001	0.433
	Non-Knowledge and know-how	65	0.690	1.600		

There is no significant difference in the mean scores for *Knowledge and Know-how* that can be improved or fixed and non-*Knowledge and Know-how* that can be improved or fixed with a p-value of 0.001 and a d-value of 0.433, p = 0.001).

Knowledge and Know-how improved or fixed versus Non-Knowledge and Know-how negative impact on the success of THRIP projects

Table 3.28: Knowledge and Know-how improved or fixed versus Knowledge and Know-how negative impact on the success of THRIP projects

Q14.4	Knowledge and Know-how	N	Mean	Std Dev	Independent T-test	
Question Q13.4	Grouping				p-value	d-value
	Knowledge and know-how	16	2.440	2.032	0.003	0.904
	Non-Knowledge and know-how	65	0.600	1.477		

`

There is no significant difference in the mean scores for *Knowledge and Know-how* that can be improved or fixed and non-*Knowledge and Know-how* that can be improved or fixed with a p-value of 0.003 and a d-value of 0.904.

Knowledge and Know-how improved or fixed versus Funding and Budgets negative impact on the success of THRIP projects

Table 3.29: Knowledge and Know-how improved or fixed versus Funding and Budgets negative impact on the success of THRIP projects

Q14.4	Knowledge and Know-how	N	Mean	Std Dev	Independent T-test	
	Grouping				p-value	d-value
Question 13.15	Knowledge and Know-how	16	0.500	1.155	0.002	0.735
	Non-Knowledge and Know-how	65	1.680	1.602		

There is no significant difference in the mean scores for *Knowledge and Know-how* that can be improved or fixed and non-*Knowledge and Know-how* that can be improved or fixed with a p-value of 0.000 and a d-value of 0.735.

`

T-test Culture and Behaviour versus Non-Culture and Behaviour

Culture and Behaviour improved or fixed versus Information Systems negative impact on the success of THRIP projects

Table 3.30: Culture and Behaviour improved or fixed versus Information Systems negative impact on the success of THRIP projects

Q14.5	Culture and Behaviour	N	Mean	Std Dev	Independent T-test	
Question Q13.1	Grouping				p-value	d-value
	Culture and Behaviour	12	0.000	0.000	0.001	0.418
	Non-Culture and Behaviour	69	0.650	1.561		

There is no significant difference in the mean scores for *Culture and Behaviour* that can be improved or fixed and non-*Culture and Behaviour* that can be improved or fixed with a p-value of 0.001 and a d-value of 0.418.

Culture and Behaviour constraints that can be improved or fixed versus Communication negative impact on the success of THRIP projects

Table 3.31: Culture and Behaviour improved or fixed versus Communication negative impact on the success of THRIP projects

Q14.5	Culture and Behaviour	N	Mean	Std Dev	Independent T-test	
Question Q13.2	Grouping				p-value	d-value
	Culture and Behaviour	12	0.000	0.000	0.000	0.775
	Non-Culture and Behaviour	69	1.480	1.907		

There is no significant difference in the mean scores for *Culture and Behaviour* that can be improved or fixed and non-*Culture and Behaviour* that can be improved or fixed with a p-value of 0.000 and a d-value of 0.775.

`

T-test Objectives and Expectations versus Non-Objectives and Expectations

Objectives and Expectations improved or fixed versus Objectives and Expectations negative impact on the success of THRIP projects

Table 3.32: Objectives and Expectations improved or fixed versus Objectives and Expectations negative impact on the success of THRIP projects

Q14.7	Objectives and Expectations	N	Mean	Std Dev	Independent T-test	
Question Q13.7	Grouping				p-value	d-value
	Objectives and Expectations	21	1.240	1.513	0.037	0.532
	Non-Objectives and Expectations	60	0.430	1.254		

There is no significant difference in the mean scores for *Objectives and Expectations* that can be improved or fixed and non-*Objectives and Expectations* that can be improved or fixed with a p-value 0.037 and a d-value of 0.532.

`

Objectives and Expectations improved or fixed versus Organisational Structure negative impact on the success of THRIP projects

Table 3.33: Objectives and Expectations improved or fixed versus Organisational Structure negative impact on the success of THRIP projects

Q14.7	Objectives and Expectations	N	Mean	Std Dev	Independent T-test	
Question Q13.13	Grouping				p-value	d-value
	Objectives and Expectations	21	0.240	0.768	0.059	0.327
	Non Objectives and Expectations	60	0.730	1.517		

There is no significant difference in the mean scores for *Objectives and Expectations* that can be improved or fixed and non-*Objectives and Expectations* that can be improved or fixed with a p-value of 0.059 and a d-value of 0.327.

`

T-test Management and Coordination versus Non-Management and Coordination

Management and Coordination improved or fixed versus Awareness and Understanding negative impact on the success of THRIP projects

Table 3.34: Management and Coordination improved or fixed versus Awareness and Understanding negative impact on the success of THRIP projects

Q14.8	Management and Coordination	N	Mean	Std Dev	Independent T-test	
Question Q13.6	Grouping				p-value	d-value
	Management and Coordination	17	0.180	0.728	0.008	0.481
	Non-Management and Coordination	64	0.880	1.453		

There is no significant difference in the mean scores for *Management and Coordination* that can be improved or fixed and non-*Management and Coordination* that can be improved or fixed with a p-value of 0.008 and a d-value of 0.481.

`

Management and Coordination improved or fixed versus Objectives and Expectations negative impact on the success of THRIP projects

Table 3.35: Management and Coordination improved or fixed versus Objectives and Expectations negative impact on the success of THRIP projects

Q14.8	Management and Coordination	N	Mean	Std Dev	Independent T-test	
Q13.7	Grouping				p-value	d-value
	Management and Coordination	17	0.240	0.752	0.052	0.350
	Non-Management and Coordination	64	0.750	1.469		

There is no significant difference in the mean scores for *Management and Coordination* that can be improved or fixed and non-*Management and Coordination* that can be improved or fixed with a p-value of 0.052 and a d-value of 0.350.

`

T-test *Administration and Procedures* versus Non-*Administration and Procedures*

Administration and Procedures improved or fixed versus Location and Facilities negative impact on the success of THRIP projects

Table 3.36: Administration and Procedures improved or fixed versus Location and Facilities negative impact on the success of THRIP projects

Q14.10	Administration and Procedures	N	Mean	Std Dev	Independent T-test	
Question 13.9	Grouping				p-value	d-value
	Administration and Procedures	45	0.090	0.468	0.021	0.415
	Non Administration and Procedures	36	0.750	1.592		

There is no significant difference in the mean scores *Administration and Procedures* that can be improved or fixed and non-*Administration and Procedures* that can be improved or fixed with a p-value of 0.021 and a d-value of 0.415.

`

Administration and Procedures improved or fixed versus Administration and Procedures negative impact on the success of THRIP projects

Table 3.37: Administration and Procedure improved or fixed versus Administration and Procedures negative impact on the success of THRIP projects

Q14.10	Administration and Procedures	N	Mean	Std Dev	Independent T-test	
Question 13.10	Grouping				p-value	d-value
	Administration and Procedures	45	1.800	1.471	0.000	0.865
	Non-Administration and Procedures	36	0.530	1.158		

There is no significant difference in the mean scores for *Administration and Procedures* that can be improved or fixed and non-*Administration and Procedures* that can be improved or fixed with a p-value of 0.000 and a d-value of 0.865.

`

Administration and Procedures improved or fixed or fixed versus Intellectual properties issues negative impact on the success of THRIP projects

Table 3.38: Administration and Procedures improved or fixed versus Intellectual Property Issues as a negative impact on the success of THRIP projects

Q14.10	Administration and Procedures	N	Mean	Std Dev	Independent T-test	
Question 13.16	Grouping				p-value	d-value
	Administration and Procedures	45	0.560	1.423	0.015	0.495
	Non Administration and Procedures	36	1.560	2.021		

There is no significant difference in the mean scores for *Administration and Procedures* that can be improved or fixed and non-*Administration and Procedures* that can be improved or fixed with a p-value of 0.015 and a d-value of 0.495.

`

T-test Co-operation and Support versus Non-Co-operation and Support

Co-operation and Support improved or fixed versus Location and Facilities negative impact on the success of THRIP projects

Table 3.39: Co-operation and Support improved or fixed versus Location and Facilities negative impact on the success of THRIP projects

Q14.14	Co-operation and Support	N	Mean	Std Dev	Independent T-test	
Question Q13.9	Grouping				p-value	d-value
	Co-operation and Support	17	0.000	0.000	0.004	0.377
	Non Co-operation and Support	64	0.480	1.285		

There is no significant difference in the mean scores for *Co-operation and Support* that can be improved or fixed and non-*Co-operation and Support* that can be improved or fixed with a p-value of 0.004 and a d-value of 0.377.

`

Co-operation and Support improved or fixed versus Administration and Procedures negative impact on the success of THRIP projects

Table 3.40: Co-operation and Support improved or fixed versus Administration and Procedures negative impact on the success of THRIP projects

Q14.14	Co-operation and Support	N	Mean	Std Dev	Independent T-test	
Question Q13.10	Grouping				p-value	d-value
	Co-operation and Support	17	2.290	1.532	0.003	0.876
	Non Co-operation and Support	64	0.950	1.338		

There is no significant difference in scores for *Co-operation and Support* that can be improved or fixed and non-*Management and Coordination* that can be improved or fixed with a p-value of 0.003 and a d-value of 0.876.

Co-operation and Support improved or fixed versus Organisational Structures negative impact on the success of THRIP projects

Table 3.41: Co-operation and Support improved or fixed versus Organisational Structures negative impact on the success of THRIP projects

Q14.14	Co-operation and Support	N	Mean	Std Dev	Independent T-test	
Question Q13.13	Grouping				p-value	d-value
	Co-operation and Support	17	0.060	0.243	0.001	0.457
	Non Co-operation and Support	64	0.750	1.512		

There is no significant difference in the mean scores for *Co-operation and Support* that can be improved or fixed and non-*Co-operation and Support* that can be improved or fixed with a p-value of 0.001 and d-value of 0.457.

Co-operation and Support improved or fixed versus Co-operation and Support negative impact on the success of THRIP projects

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Table 3.42: Co-operation and Support improved or fixed versus Co-operation and Support negative impact on the success of THRIP projects

Q14.14	Co-operation and Support	N	Mean	Std Dev	Independent T-test	
Question Q13.14	Grouping				p-value	d-value
	Co-operation and Support	17	1.350	1.801	0.050	0.534
	Non Co-operation and Support	64	0.390	1.163		

There is no significant difference in the mean scores for *Co-operation and Support* that can be improved or fixed and non-*Co-operation and Support* that can be improved or fixed with a p-value of 0.050 and d-value of 0.534.

`

T-test Funding and Budgets versus Non-Funding and Budgets

Funding and Budgets improved or fixed versus Communication negative impact on the success of THRIP projects

Table 3.43: Funding and Budgets improved or fixed versus Communication negative impact on the success of THRIP projects

Q14.15	Funding and Budgets	N	Mean	Std Dev	Independent T-test	
Question Q13.2	Grouping				p-value	d-value
	Funding and Budgets	41	1.660	2.128	0.046	0.380
	Non Funding and Budgets	40	0.850	1.388		

There is no significant difference in the mean scores for *Funding and Budgets* that can be improved or fixed and non-*Management and Coordination* that can be improved or fixed with a p-value of 0.046 and d-value of 0.380.

`

T-test Intellectual Property Issues versus Non-Intellectual Property Issues

Intellectual Property Issues improved or fixed versus Leadership and Mentorship negative impact on the success of THRIP projects

Table 3.44: Intellectual Property Issues improved or fixed versus Leadership and Mentorship negative impact on the success of THRIP projects

Q14.16	Intellectual Property Issues	N	Mean	Std Dev	Independent T-test	
Question 13.11	Grouping				p-value	d-value
	Intellectual Property Issues	15	0.130	0.516	0.017	0.369
	Non Intellectual Property Issues	66	0.700	1.529		

There is no significant difference in the mean scores for *Intellectual Property Issues* that can be improved or fixed and non-*Intellectual Property Issues* that can be improved or fixed with a p-value of 0.017 and d-value of 0.369.

`

Intellectual Property Issues improved or fixed versus Intellectual Property Issues negative impact on the success of THRIP projects

Table 3.45: Intellectual Property Issues improved or fixed versus Intellectual Property Issues negative impact on the success of THRIP projects

Q14.16	Intellectual Property Issues	N	Mean	Std Dev	Independent T-test	
Question 13.16	Grouping				p-value	d-value
	Intellectual Property Issues	15	2.270	1.831	0.007	0.849
	Non Intellectual Property Issues	66	0.710	1.643		

There is no significant difference in the mean scores for *Intellectual Property Issues* that can be improved or fixed and non-*Intellectual Property Issues* that can be improved or fixed with a p-value of 0.007 and a d-value of 0.849.

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T-test Policies and Programmes versus Non-Policies and Programmes

Policies and Programmes improved or fixed versus Co-operation and Support negative impact on the success of THRIP projects

Table 3.46: Policies and Programmes improved or fixed versus Co-operation and Support negative impact on the success of THRIP projects

Q14.17	Policies and Programmes	N	Mean	Std Dev	Independent T-test	
Question Q13.14	Grouping				p-value	d-value
	Policies and Programmes	13	0.000	0.000	0.000	0.481
	Non Policies and Programmes	68	0.710	1.467		

There is no significant difference in the mean scores for *Management and Coordination* that can be improved or fixed and non-*Policies and Programmes* that can be improved or fixed with a p-value of 0.000 and a d-value of 0.481.

Policies and Programmes improved or fixed versus Policies and Programmes and support negative impact on the success of THRIP projects

Table 3.47: Policies and Programmes improved or fixed versus Policies and Programmes negative impact on the success of THRIP projects

Q14.17	Policies and Programmes	N	Mean	Std Dev	Independent T-test	
Question Q13.17	Grouping				p-value	d-value
	Policies and Programmes	13	2.000	1.871	0.009	0.865
	Non Policies and Programmes	68	0.380	0.993		

There is no significant difference in the mean scores for *Policies and Programmes* that can be improved or fixed and non-*Policies and Programmes* on that can be improved or fixed with a p-value 0.009 and a d-value of 0.865.

`

T-test Project Applications versus Non-Project Applications

Project Applications improved or fixed versus Communication negative impact on the success of THRIP projects

Table 3.48: Project Applications improved or fixed versus Communication negative impact on the success of THRIP projects

Q14.18	Project Applications	N	Mean	Std Dev	Independent T-test	
Question Q13.2	Grouping				p-value	d-value
	Project Applications	20	0.650	1.424	0.051	0.421
	Non Project Applications	61	1.460	1.920		

There is no significant difference in scores for *Project Application*s that can be improved or fixed and non-*Project Application*s that can be improved or fixed with a p-value 0.051 and a d-value 0.421.

Project Applications improved or fixed versus Knowledge and Know-how negative impact on the success of THRIP projects

Table 3.49: Project Applications improved or fixed versus Knowledge and Know-how negative impact on the success of THRIP projects

Q14.18	Project Applications	N	Mean	Std Dev	Independent T-test	
Question Q13.4	Grouping				p-value	d-value
	Project Applications	20	0.200	0.616	0.001	0.526
	Non Project Applications	61	1.210	1.925		

There is no significant difference in scores for the project and application that can be improved or fixed and non-project and application that can be improved or fixed with a p-value of 0.001 and a d-value of 0.526.

`

Project Applications improved or fixed versus Project Applications negative impact on the success of THRIP projects

Table 3.50: Project Applications improved or fixed versus Project Applications negative impact on the success of THRIP projects

Q14.18	Project Applications	N	Mean	Std Dev	Independent T-test	
Question Q13.18	Grouping				p-value	d-value
	Project Applications	20	2.050	1.638	0.001	0.932
	Non Project Applications	61	0.520	1.398		

There is no significant difference in scores for the *Project Application* that can be improved or fixed and non-*Project Application* that can be improved or fixed with a p-value of 0.001 and a d-value of 0.932.

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3.4.5. ANOVA

When comparing the mean scores of more than two groups, we have used analysis of variance (ANOVA). One-way analysis of variance involves one independent variable (referred to as a factor), which has a number of different levels. These levels correspond to the different groups or conditions.

Only correlations where $p<0.05$ have been reported here, see Appendix G for ANOVA outside this range.

Statistical Significance

Table 3.51: Years' Experience vs. which University do you interface with?

					p-values		
	Compared to …		Mean	Std Dev	ANOVA	Welch	Brown-Forsythe
Q3	Q7	NWU	3.951	3.324	0.001	0.003	0.001
		UP	6.357	3.543			
		Stellenbosch	8.545	3.387			
		Other	5.700	3.385			

	Compared to …		Games Howel p-value	Cohen's d-value
Q3	Q7	NWU vs. Stellenbosch	0.005	1.357

The p-value is small, and therefore there is a statistically significant difference between the different universities, with NWU and Stellenbosch having the biggest difference.

Further investigation shows that the biggest difference in experience is between Stellenbosch and NWU - the difference is statistical significant with a p-value of 0.005 and practical significant with a d-value of 1.357. The multi comparison table is confirming by the Turkish B.

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Table 3.52: Business vs. which University do you interface with?

					p-values		
Compared to …			**Mean**	**Std Dev**	**ANOVA**	**Welch**	**Brown-Forsythe**
Q10.1	**Q 7**	NWU	3.136	1.490	0.012	0.013	0.004
		UP	4.125	0.991			
		Stellenbosch	4.250	0.957			
		Other	2.400	1.465			

	Compared to …		**Games Howel p-value**	**Cohen's d-value**
Q10.1	**Q 7**	Stellenbosch vs. Other	0.066	1.262
		Other vs. UP	0.009	1.177

The p-value is small, and therefore there is a statistically significant difference between the responses of Stellenbosch and "*Other*" universities, with Stellenbosch having the biggest difference.

Further investigation indicates that there is a statistically significant and practical significant difference between the responses of Stellenbosch vs. "*Other*" (p-value 0.066, d-value 1.262), and *Other* vs. UP (p-value 0.009, d-value 1.177). The multi comparison table is confirming by the Turkish B.

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Table 3.53: Communication as a negative impact on THRIP vs. which University do you interface with?

					p-values		
Compared to …			**Mean**	**Std Dev**	**ANOVA**	**Welch**	**Brown-Forsythe**
Q13.2	**Q 7**	NWU	2.706	1.448	0.037	0.027	0.022
		UP	3.500	1.291			
		Stellenbosch	4.500	0.577			
		Other	4.143	1.215			

	Compared to …		**Games Howel p-value**	**Cohen's d-value**
Q13.2	**Q 7**	NWU vs. Stellenbosch	0.008	1.239

The p-value is small, and therefore there is a statistically significant difference between the different universities, with North-West University and Stellenbosch having the biggest difference.

Further investigation indicates that there is a statistically significant and practical significant difference between the responses of NWU vs. Stellenbosch (p-value 0.008, d-value 1.239). The NWU experiences *Communication* as a constraint a higher risk than Stellenbosch - it might be that Stellenbosch has an effective *Communication* plan, which is worth investigating. The multi comparison table is confirming by the Turkish B.

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Table 3.54: Age versus Age

					p-values		
Compared to …			**Mean**	**Std Dev**	**ANOVA**	**Welch**	**Brown-Forsythe**
Q20		NWU	5.543	1.336	0.076	0.086	0.047
		UP	6.455	0.934			
		Stellenbosch	6.375	1.061			
		Other	6.080	1.152			
	Compared to …				**Games Howel p-value**		**Cohen's d-value**
Q20	**Q 7**	NWU vs. UP			0.081		0.682

The p-value is small, and therefore there is a statistically significant difference between the different universities, with North-West University and University of Pretoria having the biggest difference.

Further investigation indicates that there is a statistically significant and practical significant difference between the responses of NWU vs. UP (p-value 0.081, d-value 0.682). The respondents of UP is older than the respondents of the NWU. The multi comparison table is confirming by the Turkish B.

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3.5. CHAPTER CONCLUSION

This study is intended to show whether the constraint when managing THRIP in *South Africa* exists. This has an effect on the effective management and successful completion of THRIP projects. Therefore it is very important to know if these constraints exist within the managing of collaborative projects.

This chapter has shown that some of the constraints does exist, but cannot be generalised due to the limited responses. Between the literature study and the empirical study, not all factors that have been mentioned within the literature study could be proven in this chapter.

The major factors that have been covered within this chapter are who gain the most from THRIP projects, the factors having the most negative impact on the success of THRIP and which areas of constraints could be improved or fixed. With this chapter the researcher has intended to measure the impact of these aspects on the success of THRIP projects.

The next chapter will cover the interpretation and a framework proposal to streamline the process.

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CHAPTER 4: CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

4.1 INTRODUCTION

In chapter one the scene of the study was set with the problem statement. Throughout chapter two the focus was on the literature study about the constraints experienced in a collaborative environment. In chapter three the focus was on the statistical analysis of the data gathered via the questionnaire and the interpretation thereof. This chapter will discuss the differences between the literature study and the empirical study. Even though not all the factors have been focused on in the empirical study, the factors that have been focused on it will be highlighted and discuss in this chapter.

In this chapter the conclusion regarding the literature study and the results of the empirical research will be made. Shortcomings of the research will be discussed and recommendations for future research will be provided.

4.2 LIMITATIONS

In an empirical study, the researcher had to rely on the commitment from people who might not be involved with THRIP anymore, which may have an impact on the response rate and affect the accuracy of the respondents completing the questionnaire. The study is only applicable to South Africa and therefore cannot be inferred to represent constraints experienced in other countries. In the study a limited number of people have had experience with THRIP, which could reduce the population considerably. However, the database of people to whom the questionnaire has been sent is the most comprehensive list that exists containing people that are, or have been, involved with THRIP projects in South Africa.

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4.3. CONCLUSIONS

4.3.1. Constraints

4.3.1.1. Constraints identified in literature

The following constraints were identified from the literature:

- *Information Systems,*
- *Communication*
- *Resource Availability*
- *Knowledge and know-how*
- *Culture and Behaviour*
- *Awareness and understanding*
- *Objectives and Expectations*
- *Management and Coordination*
- *Location and Facilities*
- *Administration and procedure*
- *Leadership and Mentorship*
- *Education and training*
- *Organisational structure*
- *Co-operation and Support*
- *Funding and budgets*
- *Intellectual Property Issues*
- *Policies and Programmes*
- *Project Application*

The factors listed in the literature that have the most negative impact, are:

- *Policies and Programmes,*
- *Funding and Budgets,*
- *Awareness and Understanding.*

The following factors have been added through the experience gained during the research and from various interviews as reported in chapter 2:

- *Administration and Procedures*
- *Resource Availability.*

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It can be concluded, from literature, that the above factors are negatively impacting the effectiveness of THRIP projects. Hence these were tested in the empirical research.

4.3.1.2. Constraints ranked during the empirical research

During the empirical research the respondents have been asked to rank all the constraints mentioned above. The five factors that have been eminent in the literature have also been found to be the ones that respondents have felt to be important constraints in the management of THRIP projects. In order of decreasing importance as a constraint, the conclusions on each of these are:

- *Administration and Procedures* has been rated as the most important constraint (weighted rating = 5.00):
  - In terms of the variable *constraints that can be improved or fixed* this constraint has rated the highest. This implies that, although respondents are concerned about *Administration and Procedures* as a constraint, they felt that it can easily be removed as a constraint. Interestingly, from the t-tests there has been a strong difference in opinion about whether this constraint can be fixed between those that chose *Administration and Procedures* as a constraint and those that did not choose it (d = 0.865, p = 0.000).
  - The t-test between whether *Co-operation and Support* as a constraint can be fixed and *Administration and Procedures* as a constraint shows a high effect size (d = 0.876, p = 0.003). This implies that respondents who feel that *Co-operation and Support* as a constraint can be fixed, regarded *Administration and Support* as a much larger constraint than those that do not feel that *Co-operation and Support* can be fixed.
  - The above conclusions indicate that *Administration and Procedures* as a constraint snowballs into other constraints such as *Co-operation and Support.*
- *Resource Availability* has jointly been rated first as the most important constraint (weighted rating = 5.00):
  - The correlation between *Resource Availability* and *who gains most from THRIP projects* were mostly negative. *Resource Availability* vs. *Government Officials*: (r = -0.902, p = 0,057; *Resource Availability* vs.

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Investors: r = -0.744, p = 0,021; *Resource Availability* vs. *University Staff:* r = -0.642, p = 0,013). This implies that respondents that feel that these parties gain most are not too concerned about *Resource Availability* as a constraint.

- When a t-test has been carried out between those that feel that *Resource Availability can be fixed* and those that perceive that it cannot be fixed, against the constraint *Awareness and Understanding*, there is a medium effect (d = 0.500, p = 0.001), with those that say it cannot be fixed having a much higher mean than those that state that it can be fixed. This implies that those people that feel that *Resources Availability* cannot be fixed are concerned about the lack of *Awareness and Understanding*. This could indicate the need for focused training programmes as a resource.
- T-tests between *Administrators* and *non-Administrators* on the constraint *Resource Availability* show a medium to strong effect (d = 0.748, p = 0.020). *Administrators* are far more concerned about *Resource Availability* than their counterparts. These are also the people most intimately involved in THRIP projects, which probably explain why they are more concerned about lack of resources.

- *Funding and Budgets (*third with weighted ranking = 4.01):
  - There is a strong negative correlation (r = -0.826, p = 0.026) between *Funding and Budgets* and *Information Systems* as constraints. This implies that those that regard *Funding and Budgets as a constraint* do not regard the *Information Systems* as a constraint.
  - An independent T-test between respondents that selected *Knowledge and Knowhow can be improved* and those that feel that it cannot be improved regarding *Funding and Budgets* as a constraint, shows a medium to large effect (d = 0.735, p = 0.002). Interestingly, the respondents who feel that *knowledge and knowhow* cannot be improved, feel more strongly about *Funding and Budget* as a constraint. Increased funding will therefore lead to better knowledge.
- *Awareness and Understanding* (Weighted ranking = 2.00):

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- T-tests between *Administrators* and *non-Administrators* on the constraint *Awareness and Understanding* yields a strong effect (d = 1.063, p = 0.019), with *non-Administrators* rating it higher than *Administrators.* This could be due to the fact that they are less intimately involved with THRIP projects and are therefore less aware of details and information.

- *Policies and Programmes (Weighted ranking = 1.50)*
  - *Policies and Programmes* as a constraint have been found to be highly negatively correlated (r = -0.664, p = 0.005), with the perception that *university staff gains most from THRIP projects.* The implication is that those that feel that other parties than the *university staff gains most* from THRIP projects, also feel that *Policies and Programmes* is a constraint, and that the constraint arises from *Policies and Programmes* at the Government and/or Industry.
  - There is a high negative correlation (r = -0.903, p = 0.036) between the constraints *Policies and Programmes* and *Awareness and Understanding.* This implies that respondents that enter the THRIP process are keen to understand and be aware of what the process is about. The more they know what is involved in THRIP, the less they would perceive *Awareness and Understanding* as a constraint and the more *Policies and Programmes* would start to matter to them.
  - A T-test between those that selected *Policies and Programmes* as a constraint and those that did not select it regarding the variable *Policies and Programmes can be fixed,* indicates a strong effect *(d = 0.865, p = 0.009).* The respondents that select *Policies and Programmes* as a constraint also believe the constraint can be removed.
  - A T-test between those that select *Policies and Programmes* as a constraint and those that have not selected it regarding the variable *O (can be fixed),* indicates a strong effect *(d = 0.865, p = 0.009).* The respondents that selected *Policies and Programmes* as a constraint also believe the constraint can be removed.

- The constraints that were elucidated in the research are interrelated and each constraint influences the others. Making amends to one constraint is bound to have an effect on one or more of the others too.

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- Although the measuring instrument have not per se measured the influence of these constraints on scheduling and the time lag between steps in the THRIP management process, it is clear from the literature study that this influence does exist. An important conclusion is therefore that removing these constraints will have a beneficial effect on the schedule of THRIP projects due to the influence of the constraints on the time lag between steps.

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4.3.2. Demographic variables

The research done in chapter three has determined that the population is represented by a majority of males, making up 73% of the sample size used in this study. The majority of the study population fall within three age categories, ranging from 40-49 years, 30.9% of the population. An interesting factor is the upswing in the age group 21-29 year, 18.5% this is a positive sign, indicating THRIP involvement is starting at a younger age, even though this upswing may be due to the involvement of students working as assistants on the THRIP projects. The students of today are the entrepreneurs of tomorrow and if they are experiencing THRIP as positive, there may be a growth in THRIP involvement.

The universities represented the majority of the sample, with industries second and the smallest was Government. The reader need to bear in mind that the number of responses from the Government sector has been very small.

When dividing the sample into more detail, the North-West University has represented the majority of the sample, 42.7%, with the University of Pretoria second with 14.6%, and Stellenbosch University third with 11.5%. The correlations and comparisons made in the empirical study are discussed in the sections to follow.

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4.3.3. Age correlations

In chapter 3 a correlation of *Age* against various variables, to describe the strength and direction of the linear relationship between the two variables, have been examined. There is considerable evidence that *Age* plays an important role in THRIP projects - the higher the *Age* the longer the respondents *experience with THRIP projects*. In many ways the *Age* of the person involved with THRIP create a different view-points on many aspects asked in the questionnaire.

Comparing the *Age* of the people working in the THRIP environment against the *years of experience*, there has been a **strong positive correlation**, the higher the age in the sample, the more experience they gain with THRIP.

Different *Age* groups have different view-points regarding *who gain the most from THRIP*. There has been a **positive correlation** in the response rate between *Age* and *Government Officials*, *Industry Staff*, and *Communication*. It can be concluded that *Communication* becomes less of a problem the older you are.

It has been interesting that the higher *Age* group rate *Communication as a constraint having a negative impact on THRIP projects*.

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4.3.4. Role in THRIP projects

The representation of the role in THRIP projects have mainly been between the *Researchers* 18.7% and *Administrators* 16.5%. Both of them play an important role in managing THRIP projects: *Researchers* in the *University* environment, in their capacity as grant holders and supervising students, and in the *Industry* as *Industry partners; Administrators* help managing the projects both in the *University* and *Industry* environment. In Table 3.7 **there is a view that *Universities* and *Industry* gain the most from the THRIP projects**.

In order to have a stable foundation, management will play an important role in the success or failure of THRIP projects. Management of THRIP projects includes various aspects which starts with the writing of a THRIP or collaboration proposal and ends with the delivering of a successful project after three years. The gap in-between is crucial, and will be discussed in more detail later in chapter 4.

The management team combination is crucial, if this foundation is not stable, even the best idea will not meet the success criteria. The focus in the questionnaire has been on the constraints experienced - the reason being that you can only minimise something if you have identified it (Hattingh, 2012).

4.3.5. Importance of R&D and Innovation

Innovation can be seen as the heartbeat of a country. It is not only significant at the level of individual enterprises, but also increasingly for national economic growth. It has been shown in chapter 2 that there is a strong correlation between market performance and new products, since the marketing of new products captures and retains market share and increases owner's equity. Furthermore, there is strong evidence to suggest that innovating companies consistently outperform non-innovating firms in terms of growth and profits. In theory, innovation offers the opportunity to share cost and risks associated with technological development and to reduce development time (Tidd & Bessant, 2009:19).

In the empirical study it has been shown that the correlation between the variables' *importance of R&D and innovation to the individual respondent* versus *the importance of R&D and innovation to their organisation* is positive and visible. There has been an indication that respondents rate the importance of R&D and innovation higher if they

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are personally involved, than when rating it for their organisation. This may be an indication that all the employees may not be aware of innovative projects that their organisation is involved in. Some employees are unaware of the culture of the organisation regarding innovation, which may be included in the mission and vision statement. *Years' experience* do not determine the *importance of innovation to the respondent*. The implication of this finding is that it is more likely that investors will be interested in THRIP if the organisation's employees understand the value of innovation. Investors know that innovation is important and therefore will be willing to invest money if the individual in the organisation are innovative by nature, knowing with the right stimulation shareholder's value will increase.

Students who understand the importance of R&D and innovation will be more creative and will gain from THRIP projects, in terms of experience and exposure to the industry. These students will add more value after graduation, because they already understand the environment and are more likely to start their own businesses.

Evaluating Intellectual Property as a constraint has become an issue the moment innovation is important to the individual - the reason being that the innovative person wants to know that his/her idea will be protected especially in a collaboration environment. There is the risk that somebody may steal the idea, and there is monetary value in an innovative idea. Mutual trust may become a crucial characteristic requirement when working in a collaboration environment. There is evidence in the results that the longer the respondents are involved with THRIP projects the less IP become an issue - the reason may be that they already know how it should be handled.

There is a different culture and behaviour in organisations where innovation is important to the organisation. When innovation is not understood by everybody in the collaboration team, it becomes a constraint which will negatively impact on the success of THRIP projects.

4.3.6. Interface with organisations

The respondents perceive that the fewer organisations are *involved with THRIP* the less *South Africa will gain*. It is important to bear in mind that THRIP is challenged by the concurrent needs of South Africa, to be sustainable in a rapid changing

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knowledge-based economy in a globally competitive environment. In order to achieve this, enabling SMME and BEE enterprises access to R&D, will drive knowledge development through skills and R&D training.

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4.3.7 Gaining the most from THRIP projects and the constraints generated

From the correlations between the different variables, it is evident that the moment an individual gain from the THRIP project, various deviations from the NRF strategic plan occurs. The reason is that conflict of interest arises and constraints such as *Resource Availability, policies & programs* and *awareness & understanding* occur. This indication is clearly visible in the correlation section from chapter 3 (3.4.3.1 Pearson correlation).

If *Information Systems* are a constraint, it will generate other constraints such as *funding & budgets*. This is one of the frustrations currently experienced with the THRIP programme regarding the release of funding.

The interactions between the different constraints that have been tested are found in the correlations between the constraints. The effect is complex: When there is a *lack of knowledge & know-how*, *Resource Availability* becomes a constraint, and a *lack of awareness & understanding* generates a problem with *policies & programmes*. Therefore most of the constraints currently experienced will be minimised by proper training and understanding.

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4.4. RECOMMENDATIONS

With the study done, it has been shown that the constraints experienced do exist in THRIP projects. The section above shows all the different aspects that have either been proved or needs further investigation.

The recommendations made in this study are not meant to generalise, and are based on the observations made throughout the literature and empirical study.

In recent years collaboration programmes between University and Industry have become a strategic challenge for any developed and developing country. The reason is to be a competitive participant in the global knowledge economy, while concurrently contributing to social upliftment, equity and sustainability.

One of the main concerns of the NRF as stated in the strategic plan, is the decline in THRIP participation by successfully engaging with SMMEs and BEE companies. The belief of the researcher is that when the constraints as stated in chapter 3 reduce, the participation will raise.

Below follows a framework of best practice, for the simple reason that despite the potential values of collaboration, many ventures fail to realise their full potential. The reason for this is that collaboration is by nature difficult to manage. The suggestion is that the framework should start with training programmes for participants interested in the collaboration programme. With a proper training programme possible, participants may have the opportunity to enter or withdraw from the programme.

Once the participant has decided to enter into a relationship with THRIP or any collaboration programme, the focus is to select the best management team to manage the selected project, taking into consideration the background and abilities of each person.

4.4.1. Practical recommendations from the research

- Since there is a strong perception that *Administration and Procedures* can be improved, attention should be given to a transparent process to improve administration of THRIP projects by all role players.

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- It is critical that all parties are properly briefed about the THRIP programmes to ensure that the constraint *Awareness and Understanding* is addressed. This especially applies to new people involved in THRIP projects.
- Resources need to be redirected towards communication (and/or training) so that the constraint *Awareness and Understanding* can be reduced.
- Ensure that those people who are involved in managing THRIP projects at universities and the NRF are carefully selected with regard to qualifications, insight and action orientation.
- Since the Triple Helix Model is per definition a multi-party model, THRIP projects should be managed by teams that are made up by diversified members.
- Industry partners should be carefully selected and reflect the values of THRIP.

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4.5. SUGGESTIONS FOR FURTHER RESEARCH

- Throughout the study it has been shown that there are constraints having a negative impact on THRIP projects. Reconciling these differences and resolving many other management issues associated with collaboration is no simple task, therefore it is recommended that further research is done specifically on the success factors present in collaboration programmes, in order to develop a proper framework which will be the guidance of collaborative projects.
- Furthermore, the management team plays an important role in THRIP projects, and further research on the structure and capabilities of the team members should be useful.
- The specific effect of the constraints mentioned in this study on the time lag in the THRIP process (between partners), need to be quantified.
- A longitudinal study, where the constraints are actively addressed and the effect of the intervention is measured over time, would add great value.
- Since the ANOVA between different *universities* regarding *Communication* yield an interesting difference in whether *Communication* is perceived as a constraint ($d = 1.239$, $p = 0.008$), it is recommended that different universities interact more closely with each other to achieve greater synergy and to learn from each other.

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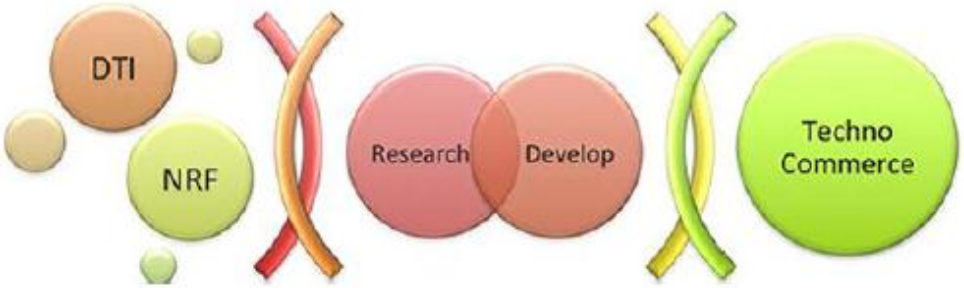
APPENDIX A: Questionnaire

- Please take note that the questionnaire is blurred due to it being web-based.

The Technology and Human Resources for Industry Programme (THRIP) aims to promote collaboration between industry, universities and governr and innovate new technology.



Your views, opinion and input are most important to improve the impact and success of the THRIP programme.
You can request your own copy of a summary on this research using the form at the end of the survey.

***1. How important is research, development and innovation to you?**

Not Important | Interesting | Important | Very Important

***2. How important is research, development and innovation to your organisation?**

Not Important | Interesting | Important | Very Important

***3. How many years of experience do you have in working on THRIP projects?**

<1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10-

***4. When last were you involved in a THRIP project?**

Currently involved | more than 1 year ago | more than 3 years ago | more than 5 years ago | Ne

***5. How often to you interface with other organisations on THRIP?**

N/A | Seldom | Monthly | Weekly | Daily

`

***6. Where do you work?**

- ◯ Industry
- ◯ Government
- ◯ University
- ◯ Other
- ◯ Other (please specify)

***7. Which university do you interface with or belong to?**

- ◯ ARC
- ◯ TUT
- ◯ UKZN
- ◯ NWU
- ◯ UCT
- ◯ UP
- ◯ RU
- ◯ UFH
- ◯ WITS
- ◯ Stellenbosch
- ◯ UJ
- ◯ Other university

***8. What role(s) do you play in THRIP projects? (please tick all applicable)**

- ☐ Administrator
- ☐ Manager
- ☐ Researcher
- ☐ Custodian
- ☐ Mentor
- ☐ Sponsor
- ☐ Decision-maker
- ☐ Policy-maker
- ☐ Supporter
- ☐ Developer
- ☐ Project Manager
- ☐ Team Leader
- ☐ Expert Advisor
- ☐ Promotor
- ☐ Thought Leader
- ☐ Other (please add)

9. If your are not currently directly involved in a THRIP project, please share the reason.

`

Drag and drop to rank your top 5 choices from top to bottom where top=1=most and 5=less.
To save time, you do not need to order factors ranking 6 and onwards.

***10. Who do you think gain most from THRIP projects?**

☐	Businesses
☐	Communities
☐	Entrepreneurs
☐	Government Bodies
☐	Government Officials
☐	Industry
☐	Industry Managers
☐	Industry Staff
☐	Investors
☐	South Africa
☐	Universities
☐	University Staff
☐	University Students

`

***11. Select the topics of personal interest to you.**

- [ ] Aerospace & Defence
- [ ] Agriculture & Agro-processing
- [ ] Aquaculture & Mariculture
- [ ] Automotive
- [ ] Banking, Finance & Insurance
- [ ] Biotechnology
- [ ] Boat Building
- [ ] Business Process & Practices
- [ ] Chemicals
- [ ] Clothing & Textiles
- [ ] Collaboration Systems
- [ ] Community & Cultural Advancement
- [ ] Construction & Engineering
- [ ] Containers & Packaging
- [ ] Creativity & Design
- [ ] Economic Development & Jobs
- [ ] Education & Training
- [ ] Energy
- [ ] Enterprise Developemnt
- [ ] Environment & Waste
- [ ] Fisheries, Forestry & Timber
- [ ] Forestry & Paper
- [ ] Healthcare & Pharmaceuticals
- [ ] ICT & Electronics
- [ ] Import Export
- [ ] Infrastructure & Facilities
- [ ] Life Skills & People Development
- [ ] Manufacturing & Industrialisation
- [ ] Media & Visual Commun
- [ ] Mining, Metals, Minerals
- [ ] Oil & Gas
- [ ] Paper & Pulp
- [ ] Personal & Household Go
- [ ] Public Sector
- [ ] Retail & Wholesale
- [ ] Sport & Recreation
- [ ] Telecommunications
- [ ] Tourism & Leisure
- [ ] Transportation
- [ ] Utilities
- [ ] Waste
- [ ] Water
- [ ] Please add

***12. What area applies most to your research, development, projects or business?**

- ◯ Aerospace & Defence
- ◯ Agriculture & Agro-processing
- ◯ Aquaculture & Mariculture
- ◯ Automotive
- ◯ Banking, Finance & Insurance
- ◯ Biotechnology
- ◯ Boat Building
- ◯ Business Process & Practices
- ◯ Chemicals
- ◯ Clothing & Textiles
- ◯ Collaboration Systems
- ◯ Community & Cultural Advancement
- ◯ Construction & Engineering
- ◯ Containers & Packaging
- ◯ Creativity & Design
- ◯ Economic Development & Jobs
- ◯ Education & Training
- ◯ Energy
- ◯ Enterprise Developemnt
- ◯ Environment & Waste
- ◯ Fisheries, Forestry & Timber
- ◯ Forestry & Paper
- ◯ Healthcare & Pharmaceuticals
- ◯ ICT & Electronics
- ◯ Import Export
- ◯ Infrastructure & Facilities
- ◯ Life Skills & People Development
- ◯ Manufacturing & Industrialisation
- ◯ Media & Visual Commun
- ◯ Mining, Metals, Minerals
- ◯ Oil & Gas
- ◯ Paper & Pulp
- ◯ Personal & Household Go
- ◯ Public Sector
- ◯ Retail & Wholesale
- ◯ Sport & Recreation
- ◯ Telecommunications
- ◯ Tourism & Leisure
- ◯ Transportation
- ◯ Utilities
- ◯ Waste
- ◯ Water
- ◯ Other (only add if not contained in above)

`

Drag and drop to rank your top 5 choices from top to bottom where top=1=most and 5=less.
To save time, you do not need to order factors ranking 6 and onwards.

***13. Which 5 factors have the most negative impact on the success of THRIP?**

- ☐ Culture & Behaviour
- ☐ Resource Availability
- ☐ Information Systems
- ☐ Policies & Programmes
- ☐ Awareness & Understanding
- ☐ Intellectual Property Issues
- ☐ Knowledge & Know-how
- ☐ Objectives & Expectations
- ☐ Communication
- ☐ Leadership & Mentorship
- ☐ Organisational Structure
- ☐ Location & Facilities
- ☐ Project Application
- ☐ Funding & Budgets
- ☐ Management & Coordination
- ☐ Education & Training
- ☐ Administration & Procedures
- ☐ Co-operation & Support

`

14. Which areas of constraint do you believe can improve or be fixed. Tick maximum of 5.

☐ Administration & Procedures	☐ Funding & Budgets	☐ Management & Coordina
☐ Awareness & Understanding	☐ Information Systems	☐ Objectives & Expectation
☐ Communications	☐ Intellectual Property Issues	☐ Organisational Structure
☐ Co-operation & Support	☐ Knowledge & Know-how	☐ Policies & Programmes
☐ Culture & Behaviour	☐ Leadership & Mentorship	☐ Project Application
☐ Education & Training	☐ Location & Facilities	☐ Resource Availability

15. Which areas do you believe to be totally flawed and CANNOT be fixed? Only answer if strong about it.

☐ Administration & Procedures	☐ Funding & Budgets	☐ Management & Coordina
☐ Awareness & Understanding	☐ Information Systems	☐ Objectives & Expectation
☐ Communications	☐ Intellectual Property Issues	☐ Organisational Structure
☐ Co-operation & Support	☐ Knowledge & Know-how	☐ Policies & Programmes
☐ Culture & Behaviour	☐ Leadership & Mentorship	☐ Project Application
☐ Education & Training	☐ Location & Facilities	☐ Resource Availability

☐ Other (please specify)

16. If you had to tackle the problem, where would you start?

`

***17. What is you nationality?**

- ◯ Not Applicable
- ◯ South African Citizen
- ◯ Other (please specify)

***18. What is your gender?**

- ◯ Not Applicable
- ◯ Female
- ◯ Male

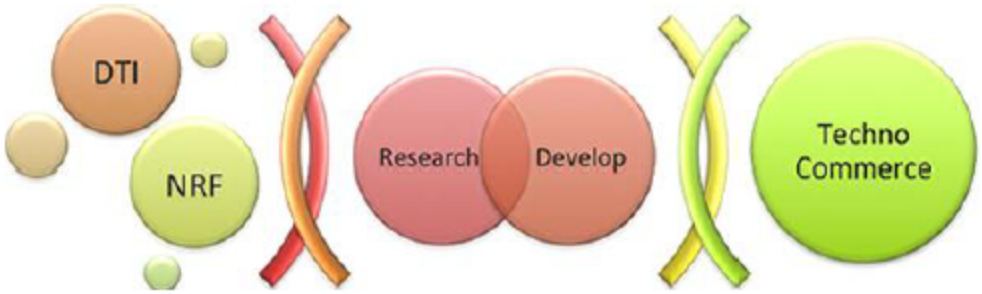
19. Are you?

- ◯ White
- ◯ Asian
- ◯ Indian
- ◯ Black
- ◯ Coloured
- ◯ Not Applicable

***20. Which category below includes your age?**

- ◯ Not Applicable
- ◯ 0-17
- ◯ 18-20
- ◯ 21-29
- ◯ 30-39
- ◯ 40-49
- ◯ 50-59

`



***21. Would you like to receive a summary copy of this research output?**

***22. Would you like to be kept up to date on trends and other information regarding rese innovation?**

***23. Are you interested to participate online to improve research, development and innov initiatives?**

Please update your contact details and communication preferences.

24. First Name and Surname

25. Your Organisation

26. At what email address would you like to be contacted?

27. If you would like to receive SMS notifications please enter your cell phone number below.

On then next page, please add you opinion and views in freeform format.

`

Please share your ideas and opinion on how the THRIP programme can be improved.

28. From your personal point of view... What do you get out of THRIP?

29. Please share any tips you may have with other people working on THRIP projects.

30. What can government do to improve participation and collaboration on THRIP?

31. What can industry partners do to improve participation and collaboration on THRIP?

32. What can universities do to improve participation and collaboration on THRIP?

33. Are there any other questions you think are important to ask? Please press enter between each.

`

APPENDIX B: Frequency Table

Question18: What is your gender?

		Frequency	Valid Percent
Valid	Not Applicable	1	1.2
	Female	21	25.9
	Male	59	72.8
	Total	81	100.0
Missing	System	16	
Total		97	

Question 20: Which category below includes your age?

		Frequency	Valid Percent
Valid	Not Applicable	1	1.2
	21-29	15	18.5
	30-39	11	13.6
	40-49	25	30.9
	50-59	22	27.2
	60+	7	8.6
	Total	81	100.0
Missing	System	16	
Total		97	

Question 1: How important is research, development and innovation to you?

		Frequency	Valid Percent
Valid	Interesting	3	3.1
	Important	14	14.4
	Very Important	80	82.5
	Total	97	100.0

`

Question 2: How important is research, development and innovation to your organisation?

		Frequency	Valid Percent
Valid	2	3	3.1
	3	17	17.5
	4	77	79.4
	Total	97	100.0

Question 3: How many years of experience do you have in working on THRIP projects?

		Frequency	Valid Percent
Valid	<1 year	21	21.6
	1 year	5	5.2
	2 year	9	9.3
	3 year	10	10.3
	4 year	11	11.3
	5 year	10	10.3
	6 year	6	6.2
	7 year	2	2.1
	8 year	1	1.0
	9 year	1	1.0
	10+ year	21	21.6
	Total	97	100.0

`

Question 4: When last were you involved in a THRIP project?

		Frequency	Valid Percent
Valid	Currently involved	64	66.0
	More than 1 year ago	13	13.4
	more than 3 years ago	3	3.1
	More than 5 years ago	5	5.2
	Never	12	12.4
	Total	97	100.0

Question 5: How often do you interface with other organisations on THRIP?

		Frequency	Valid Percent
Valid	Not Applicable	13	13.5
	Seldom	43	44.8
	Monthly	26	27.1
	Weekly	9	9.4
	Daily	5	5.2
	Total	96	100.0
Missing	System	1	
Total		97	

Question 6: Where do you work?

		Frequency	Valid Percent
Valid	Industry	36	37.1
	Government	5	5.2
	University	45	46.4
	Other	11	11.3
	Total	97	100.0

`

Question 7: Which university do you interface with or belong to?

		Frequency	Valid Percent
Valid	TUT	4	4.2
	UKZN	2	2.1
	NWU	41	42.7
	UCT	4	4.2
	UP	14	14.6
	RU	6	6.3
	UFH	3	3.1
	WITS	1	1.0
	Stellenbosch	11	11.5
	UJ	2	2.1
	Other university	8	8.3
	Total	96	100.0
Missing	System	1	
Total		97	

Q7.1:

		Frequency	Valid Percent
Valid	0	96	100.0
Missing	System	1	
Total		97	

Q7.2:

		Frequency	Valid Percent
Valid	0	92	95.8
	2	4	4.2
	Total	96	100.0
Missing	System	1	
Total		97	

`

Q7.3:

		Frequency	Valid Percent
Valid	0	94	97.9
	3	2	2.1
	Total	96	100.0
Missing	System	1	
Total		97	

Q7.4:

		Frequency	Valid Percent
Valid	0	55	57.3
	4	41	42.7
	Total	96	100.0
Missing	System	1	
Total		97	

Q7.5:

		Frequency	Valid Percent
Valid	0	92	95.8
	5	4	4.2
	Total	96	100.0
Missing	System	1	
Total		97	

`

Q7.6:

		Frequency	Valid Percent
Valid	0	82	85.4
	6	14	14.6
	Total	96	100.0
Missing	System	1	
Total		97	

Q7.7:

		Frequency	Valid Percent
Valid	0	90	93.8
	7	6	6.3
	Total	96	100.0
Missing	System	1	
Total		97	

Q7.8:

		Frequency	Valid Percent
Valid	0	93	96.9
	8	3	3.1
	Total	96	100.0
Missing	System	1	
Total		97	

`

Q7.9:

		Frequency	Valid Percent
Valid	0	95	99.0
	9	1	1.0
	Total	96	100.0
Missing	System	1	
Total		97	

Q7.10:

		Frequency	Valid Percent
Valid	0	85	88.5
	10	11	11.5
	Total	96	100.0
Missing	System	1	
Total		97	

Q7.11:

		Frequency	Valid Percent
Valid	0	94	97.9
	11	2	2.1
	Total	96	100.0
Missing	System	1	
Total		97	

`

Q7.12:

		Frequency	Valid Percent
Valid	0	88	91.7
	12	8	8.3
	Total	96	100.0
Missing	System	1	
Total		97	

Question 8: What role(s) do you play in THRIP projects? (please tick all applicable)

		Frequency	Valid Percent
Valid	Administrator	15	16.5
	Manager	5	5.5
	Researcher	17	18.7
	Custodian	4	4.4
	Mentor	2	2.2
	Sponsor	9	9.9
	Decision-maker	9	9.9
	Policy-maker	1	1.1
	Supporter	5	5.5
	Developer	2	2.2
	Project Manager	6	6.6
	Team Leader	1	1.1
	Expert Advisor	3	3.3
	Promotor	6	6.6
	Thought Leader	6	6.6
	Total	91	100.0
Missing	System	6	
Total		97	

`

Q8.1:

		Frequency	Valid Percent
Valid	0	76	83.5
	1	15	16.5
	Total	91	100.0
Missing	System	6	
Total		97	

Q8.2:

		Frequency	Valid Percent
Valid	0	86	94.5
	2	5	5.5
	Total	91	100.0
Missing	System	6	
Total		97	

Q8.3:

		Frequency	Valid Percent
Valid	0	74	81.3
	3	17	18.7
	Total	91	100.0
Missing	System	6	
Total		97	

`

Q8.4:

		Frequency	Valid Percent
Valid	0	87	95.6
	4	4	4.4
	Total	91	100.0
Missing	System	6	
Total		97	

Q8.5:

		Frequency	Valid Percent
Valid	0	89	97.8
	5	2	2.2
	Total	91	100.0
Missing	System	6	
Total		97	

Q8.6:

		Frequency	Valid Percent
Valid	0	82	90.1
	6	9	9.9
	Total	91	100.0
Missing	System	6	
Total		97	

`

Q8.7:

		Frequency	Valid Percent
Valid	0	82	90.1
	7	9	9.9
	Total	91	100.0
Missing	System	6	
Total		97	

Q8.8:

		Frequency	Valid Percent
Valid	0	90	98.9
	8	1	1.1
	Total	91	100.0
Missing	System	6	
Total		97	

Q8.9:

		Frequency	Valid Percent
Valid	0	86	94.5
	9	5	5.5
	Total	91	100.0
Missing	System	6	
Total		97	

`

Q8.10:

		Frequency	Valid Percent
Valid	0	89	97.8
	10	2	2.2
	Total	91	100.0
Missing	System	6	
Total		97	

Q8.11:

		Frequency	Valid Percent
Valid	0	85	93.4
	11	6	6.6
	Total	91	100.0
Missing	System	6	
Total		97	

Q8.12:

		Frequency	Valid Percent
Valid	0	90	98.9
	12	1	1.1
	Total	91	100.0
Missing	System	6	
Total		97	

`

Q8.13:

		Frequency	Valid Percent
Valid	0	88	96.7
	13	3	3.3
	Total	91	100.0
Missing	System	6	
Total		97	

Q8.14:

		Frequency	Valid Percent
Valid	0	85	93.4
	14	6	6.6
	Total	91	100.0
Missing	System	6	
Total		97	

Q8.15:

		Frequency	Valid Percent
Valid	0	91	100.0
Missing	System	6	
Total		97	

Q8.16

		Frequency	Valid Percent
Valid	0	85	93.4
	16	6	6.6
	Total	91	100.0
Missing	System	6	
Total		97	

`

Question 10: Who do you think gain the most from THRIP projects?

Q10.1

		Frequency	Valid Percent
Valid	0	36	39.6
	1= Most	13	14.3
	2	6	6.6
	3	14	15.4
	4	8	8.8
	5 = Less	14	15.4
	Total	91	100.0
Missing	System	6	
Total		97	

Q10.2

		Frequency	Valid Percent
Valid	0	60	65.9
	1= Most	4	4.4
	2	4	4.4
	3	8	8.8
	4	10	11.0
	5 = Less	5	5.5
	Total	91	100.0
Missing	System	6	
Total		97	

`

Q10.3

		Frequency	Valid Percent
Valid	0	58	63.7
	1= Most	5	5.5
	2	6	6.6
	3	7	7.7
	4	7	7.7
	5 = Less	8	8.8
	Total	91	100.0
Missing	System	6	
Total		97	

Q10.4

		Frequency	Valid Percent
Valid	0	68	74.7
	1= Most	1	1.1
	2	2	2.2
	3	6	6.6
	4	8	8.8
	5 = Less	6	6.6
	Total	91	100.0
Missing	System	6	
Total		97	

`

Q10.5

		Frequency	Valid Percent
Valid	0	82	90.1
	2	1	1.1
	4	3	3.3
	5 = Less	5	5.5
	Total	91	100.0
Missing	System	6	
Total		97	

Q10.6

		Frequency	Valid Percent
Valid	0	28	30.8
	1= Most	14	15.4
	2	19	20.9
	3	11	12.1
	4	10	11.0
	5 = Less	9	9.9
	Total	91	100.0
Missing	System	6	
Total		97	

`

Q10.7

		Frequency	Valid Percent
Valid	0	82	90.1
	1= Most	1	1.1
	2	1	1.1
	3	2	2.2
	4	3	3.3
	5 = Less	2	2.2
	Total	91	100.0
Missing	System	6	
Total		97	

Q10.8

		Frequency	Valid Percent
Valid	0	80	87.9
	1= Most	1	1.1
	2	1	1.1
	3	1	1.1
	4	5	5.5
	5 = Less	3	3.3
	Total	91	100.0
Missing	System	6	
Total		97	

`

Q10.9

		Frequency	Valid Percent
Valid	0	75	82.4
	1= Most	2	2.2
	2	2	2.2
	3	2	2.2
	4	5	5.5
	5 = Less	5	5.5
	Total	91	100.0
Missing	System	6	
Total		97	

Q10.10

		Frequency	Valid Percent
Valid	0	51	56.0
	1= Most	13	14.3
	2	6	6.6
	3	4	4.4
	4	7	7.7
	5 = Less	10	11.0
	Total	91	100.0
Missing	System	6	
Total		97	

`

Q10.11

		Frequency	Valid Percent
Valid	0	23	25.3
	1= Most	22	24.2
	2	16	17.6
	3	12	13.2
	4	6	6.6
	5 = Less	12	13.2
	Total	91	100.0
Missing	System	6	
Total		97	

Q10.12

		Frequency	Valid Percent
Valid	0	52	57.1
	1= Most	4	4.4
	2	10	11.0
	3	6	6.6
	4	9	9.9
	5 = Less	10	11.0
	Total	91	100.0
Missing	System	6	
Total		97	

`

Q10.13

		Frequency	Valid Percent
Valid	0	33	36.3
	1= Most	11	12.1
	2	17	18.7
	3	18	19.8
	4	9	9.9
	5 = Less	3	3.3
	Total	91	100.0
Missing	System	6	
Total		97	

Question 11: Select the topic of personal interest to you.

Q11.1:

		Frequency	Valid Percent
Valid	0	77	88.5
	1	10	11.5
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.2:

		Frequency	Valid Percent
Valid	0	62	71.3
	1	25	28.7
	Total	87	100.0
Missing	System	10	
Total		97	

`

Q11.3:

		Frequency	Valid Percent
Valid	0	82	94.3
	1	5	5.7
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.4:

		Frequency	Valid Percent
Valid	0	81	93.1
	1	6	6.9
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.5:

		Frequency	Valid Percent
Valid	0	82	94.3
	1	5	5.7
	Total	87	100.0
Missing	System	10	
Total		97	

`

Q11.6:

		Frequency	Valid Percent
Valid	0	68	78.2
	1	19	21.8
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.7:

		Frequency	Valid Percent
Valid	0	87	100.0
Missing	System	10	
Total		97	

Q11.8:

		Frequency	Valid Percent
Valid	0	78	89.7
	1	9	10.3
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.9:

		Frequency	Valid Percent
Valid	0	71	81.6
	1	16	18.4
	Total	87	100.0
Missing	System	10	
Total		97	

`

Q11.10:

		Frequency	Valid Percent
Valid	0	86	98.9
	1	1	1.1
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.11:

		Frequency	Valid Percent
Valid	0	79	90.8
	1	8	9.2
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.12:

		Frequency	Valid Percent
Valid	0	83	95.4
	1	4	4.6
	Total	87	100.0
Missing	System	10	
Total		97	

`

Q11.13:

		Frequency	Valid Percent
Valid	0	75	86.2
	1	12	13.8
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.14:

		Frequency	Valid Percent
Valid	0	87	100.0
Missing	System	10	
Total		97	

Q11.15:

		Frequency	Valid Percent
Valid	0	85	97.7
	1	2	2.3
	Total	87	100.0
Missing	System	10	
Total		97	

`

Q11.16:

		Frequency	Valid Percent
Valid	0	70	80.5
	1	17	19.5
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.17:

		Frequency	Valid Percent
Valid	0	80	92.0
	1	7	8.0
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.18:

		Frequency	Valid Percent
Valid	0	65	74.7
	1	22	25.3
	Total	87	100.0
Missing	System	10	
Total		97	

`

Q11.19:

		Frequency	Valid Percent
Valid	0	62	71.3
	1	25	28.7
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.20:

		Frequency	Valid Percent
Valid	0	77	88.5
	1	10	11.5
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.21:

		Frequency	Valid Percent
Valid	0	66	75.9
	1	21	24.1
	Total	87	100.0
Missing	System	10	
Total		97	

`

Q11.22:

		Frequency	Valid Percent
Valid	0	82	94.3
	1	5	5.7
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.23:

		Frequency	Valid Percent
Valid	0	85	97.7
	1	2	2.3
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.24:

		Frequency	Valid Percent
Valid	0	76	87.4
	1	11	12.6
	Total	87	100.0
Missing	System	10	
Total		97	

`

Q11.25:

		Frequency	Valid Percent
Valid	0	64	73.6
	1	23	26.4
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.26:

		Frequency	Valid Percent
Valid	0	87	100.0
Missing	System	10	
Total		97	

Q11.27:

		Frequency	Valid Percent
Valid	0	84	96.6
	1	3	3.4
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.28:

		Frequency	Valid Percent
Valid	0	75	86.2
	1	12	13.8
	Total	87	100.0
Missing	System	10	
Total		97	

`

Q11.29:

		Frequency	Valid Percent
Valid	0	72	82.8
	1	15	17.2
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.30:

		Frequency	Valid Percent
Valid	0	81	93.1
	1	6	6.9
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.31:

		Frequency	Valid Percent
Valid	0	73	83.9
	1	14	16.1
	Total	87	100.0
Missing	System	10	
Total		97	

`

Q11.32:

		Frequency	Valid Percent
Valid	0	80	92.0
	1	7	8.0
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.33:

		Frequency	Valid Percent
Valid	0	85	97.7
	1	2	2.3
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.34:

		Frequency	Valid Percent
Valid	0	85	97.7
	1	2	2.3
	Total	87	100.0
Missing	System	10	
Total		97	

`

Q11.35:

		Frequency	Valid Percent
Valid	0	85	97.7
	1	2	2.3
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.36:

		Frequency	Valid Percent
Valid	0	85	97.7
	1	2	2.3
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.37:

		Frequency	Valid Percent
Valid	0	79	90.8
	1	8	9.2
	Total	87	100.0
Missing	System	10	
Total		97	

`

Q11.38:

		Frequency	Valid Percent
Valid	0	73	83.9
	1	14	16.1
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.39:

		Frequency	Valid Percent
Valid	0	84	96.6
	1	3	3.4
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.40:

		Frequency	Valid Percent
Valid	0	83	95.4
	1	4	4.6
	Total	87	100.0
Missing	System	10	
Total		97	

`

Q11.41:

		Frequency	Valid Percent
Valid	0	82	94.3
	1	5	5.7
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.42:

		Frequency	Valid Percent
Valid	0	76	87.4
	1	11	12.6
	Total	87	100.0
Missing	System	10	
Total		97	

Q11.43:

		Frequency	Valid Percent
Valid	0	69	79.3
	1	18	20.7
	Total	87	100.0
Missing	System	10	
Total		97	

`

Question 12: What area applies most to your research, development, projects or business?

		Frequency	Valid Percent
Valid	Aerospace and Defence	3	3.4
	Agricultural and Agro-processing	4	4.5
	Aquaculture and Mariculture	2	2.2
	Automative	1	1.1
	Banking, Finance and Insurance	2	2.2
	Biotechnology	2	2.2
	Business Process and Practices	2	2.2
	Chemicals	2	2.2
	Community and Cultural Advancement	1	1.1
	Construction and Engineering	3	3.4
	Other	7	7.9
	Education and Training	7	7.9
	Energy	13	14.6
	Enterprise development	2	2.2
	Environment and Waste	5	5.6
	Healthcare and Pharmaceuticals	3	3.4
	ICT and Electronics	5	5.6
	Infrastructure and Facilities	1	1.1
	Life Skills and People Development	2	2.2
	Manufacturing and Industrialisation	2	2.2
	Mining, Metals, Minerals	6	6.7
	Oil and Gas	4	4.5
	Public Sector	2	2.2
	Telecommunications	5	5.6
	Waste	2	2.2
	Water	1	1.1
	Total	89	100.0
Missing	System	8	
Total		97	

`

Question 13: Which 5 factors have the most negative impact on the success of THIRP?

Q13.1:

		Frequency	Valid Percent
Valid	0	73	85.9
	2	1	1.2
	3	3	3.5
	4	3	3.5
	5	5	5.9
	Total	85	100.0
Missing	System	12	
Total		97	

Q13.2:

		Frequency	Valid Percent
Valid	0	53	62.4
	1	5	5.9
	2	5	5.9
	3	5	5.9
	4	8	9.4
	5	9	10.6
	Total	85	100.0
Missing	System	12	
Total		97	

`

Q13.3:

		Frequency	Valid Percent
Valid	0	49	57.6
	1	7	8.2
	2	13	15.3
	3	7	8.2
	4	4	4.7
	5	5	5.9
	Total	85	100.0
Missing	System	12	
Total		97	

Q13.4:

		Frequency	Valid Percent
Valid	0	63	74.1
	2	6	7.1
	3	1	1.2
	4	8	9.4
	5	7	8.2
	Total	85	100.0
Missing	System	12	
Total		97	

`

Q13.5:

		Frequency	Valid Percent
Valid	0	62	72.9
	1	4	4.7
	2	2	2.4
	3	2	2.4
	4	8	9.4
	5	7	8.2
	Total	85	100.0
Missing	System	12	
Total		97	

Q13.6:

		Frequency	Valid Percent
Valid	0	61	71.8
	1	6	7.1
	2	6	7.1
	3	7	8.2
	4	2	2.4
	5	3	3.5
	Total	85	100.0
Missing	System	12	
Total		97	

`

Q13.7:

		Frequency	Valid Percent
Valid	0	67	78.8
	1	2	2.4
	2	3	3.5
	3	6	7.1
	4	4	4.7
	5	3	3.5
	Total	85	100.0
Missing	System	12	
Total		97	

Q13.8:

		Frequency	Valid Percent
Valid	0	61	71.8
	1	4	4.7
	2	4	4.7
	3	6	7.1
	4	5	5.9
	5	5	5.9
	Total	85	100.0
Missing	System	12	
Total		97	

`

Q13.9:

		Frequency	Valid Percent
Valid	0	75	88.2
	1	3	3.5
	3	2	2.4
	4	3	3.5
	5	2	2.4
	Total	85	100.0
Missing	System	12	
Total		97	

Q13.10:

		Frequency	Valid Percent
Valid	0	39	45.9
	1	18	21.2
	2	7	8.2
	3	11	12.9
	4	8	9.4
	5	2	2.4
	Total	85	100.0
Missing	System	12	
Total		97	

`

Q13.11:

		Frequency	Valid Percent
Valid	0	70	82.4
	2	1	1.2
	3	5	5.9
	4	5	5.9
	5	4	4.7
	Total	85	100.0
Missing	System	12	
Total		97	

Q13.12:

		Frequency	Valid Percent
Valid	0	79	92.9
	1	1	1.2
	3	1	1.2
	5	4	4.7
	Total	85	100.0
Missing	System	12	
Total		97	

`

Q13.13:

		Frequency	Valid Percent
Valid	0	69	81.2
	1	2	2.4
	2	2	2.4
	3	2	2.4
	4	9	10.6
	5	1	1.2
	Total	85	100.0
Missing	System	12	
Total		97	

Q13.14:

		Frequency	Valid Percent
Valid	0	69	81.2
	2	4	4.7
	3	4	4.7
	4	5	5.9
	5	3	3.5
	Total	85	100.0
Missing	System	12	
Total		97	

`

Q13.15:

		Frequency	Valid Percent
Valid	0	35	41.2
	1	17	20.0
	2	12	14.1
	3	10	11.8
	4	6	7.1
	5	5	5.9
	Total	85	100.0
Missing	System	12	
Total		97	

Q13.16:

		Frequency	Valid Percent
Valid	0	58	68.2
	1	8	9.4
	2	5	5.9
	3	1	1.2
	4	3	3.5
	5	10	11.8
	Total	85	100.0
Missing	System	12	
Total		97	

`

Q13.17:

		Frequency	Valid Percent
Valid	0	63	74.1
	1	4	4.7
	2	9	10.6
	3	4	4.7
	4	2	2.4
	5	3	3.5
	Total	85	100.0
Missing	System	12	
Total		97	

Q13.18:

		Frequency	Valid Percent
Valid	0	61	71.8
	1	4	4.7
	2	5	5.9
	3	7	8.2
	4	2	2.4
	5	6	7.1
	Total	85	100.0
Missing	System	12	
Total		97	

`

Question 14 : Which areas of constraints do you believe can improve or be fixed.

Q14.1:

		Frequency	Valid Percent
Valid	0	73	90.1
	1	8	9.9
	Total	81	100.0
Missing	System	16	
Total		97	

Q14.2:

		Frequency	Valid Percent
Valid	0	47	58.0
	1	33	40.7
	2	1	1.2
	Total	81	100.0
Missing	System	16	
Total		97	

Q14.3:

		Frequency	Valid Percent
Valid	0	62	76.5
	1	19	23.5
	Total	81	100.0
Missing	System	16	
Total		97	

`

Q14.4:

		Frequency	Valid Percent
Valid	0	65	80.2
	1	16	19.8
	Total	81	100.0
Missing	System	16	
Total		97	

Q14.5:

		Frequency	Valid Percent
Valid	0	69	85.2
	1	12	14.8
	Total	81	100.0
Missing	System	16	
Total		97	

Q14.6:

		Frequency	Valid Percent
Valid	0	59	72.8
	1	22	27.2
	Total	81	100.0
Missing	System	16	
Total		97	

`

Q14.7:

		Frequency	Valid Percent
Valid	0	60	74.1
	1	21	25.9
	Total	81	100.0
Missing	System	16	
Total		97	

Q14.8:

		Frequency	Valid Percent
Valid	0	64	79.0
	1	17	21.0
	Total	81	100.0
Missing	System	16	
Total		97	

Q14.9:

		Frequency	Valid Percent
Valid	0	78	96.3
	1	3	3.7
	Total	81	100.0
Missing	System	16	
Total		97	

`

Q14.10:

		Frequency	Valid Percent
Valid	0	36	44.4
	1	45	55.6
	Total	81	100.0
Missing	System	16	
Total		97	

Q14.11:

		Frequency	Valid Percent
Valid	0	72	88.9
	1	9	11.1
	Total	81	100.0
Missing	System	16	
Total		97	

Q14.12:

		Frequency	Valid Percent
Valid	0	74	91.4
	1	7	8.6
	Total	81	100.0
Missing	System	16	
Total		97	

`

Q14.13:

		Frequency	Valid Percent
Valid	0	73	90.1
	1	8	9.9
	Total	81	100.0
Missing	System	16	
Total		97	

Q14.14:

		Frequency	Valid Percent
Valid	0	64	79.0
	1	17	21.0
	Total	81	100.0
Missing	System	16	
Total		97	

Q14.15:

		Frequency	Valid Percent
Valid	0	40	49.4
	1	41	50.6
	Total	81	100.0
Missing	System	16	
Total		97	

`

Q14.16:

		Frequency	Valid Percent
Valid	0	66	81.5
	1	15	18.5
	Total	81	100.0
Missing	System	16	
Total		97	

Q14.17:

		Frequency	Valid Percent
Valid	0	68	84.0
	1	13	16.0
	Total	81	100.0
Missing	System	16	
Total		97	

Q14.18:

		Frequency	Valid Percent
Valid	0	61	75.3
	1	20	24.7
	Total	81	100.0
Missing	System	16	
Total		97	

`

Question 15: Whih areas do you believe to be totally flawed and CANNOT be fixed?

Q15.1:

		Frequency	Valid Percent
Valid	0	96	99.0
	1	1	1.0
	Total	97	100.0

Q15.2:

		Frequency	Valid Percent
Valid	0	96	99.0
	1	1	1.0
	Total	97	100.0

Q15.3:

		Frequency	Valid Percent
Valid	0	97	100.0

Q15.4:

		Frequency	Valid Percent
Valid	0	97	100.0

Q15.5:

		Frequency	Valid Percent
Valid	0	90	92.8
	1	7	7.2
	Total	97	100.0

`

Q15.6:

		Frequency	Valid Percent
Valid	0	94	96.9
	1	3	3.1
	Total	97	100.0

Q15.7:

		Frequency	Valid Percent
Valid	0	96	99.0
	1	1	1.0
	Total	97	100.0

Q15.8:

		Frequency	Valid Percent
Valid	0	95	97.9
	1	2	2.1
	Total	97	100.0

Q15.9:

		Frequency	Valid Percent
Valid	0	97	100.0

Q15.10:

		Frequency	Valid Percent
Valid	0	92	94.8
	1	5	5.2
	Total	97	100.0

`

Q15.11:

		Frequency	Valid Percent
Valid	0	97	100.0

Q15.12:

		Frequency	Valid Percent
Valid	0	96	99.0
	1	1	1.0
	Total	97	100.0

Q15.13:

		Frequency	Valid Percent
Valid	0	97	100.0

Q15.14:

		Frequency	Valid Percent
Valid	0	97	100.0

Q15.15:

		Frequency	Valid Percent
Valid	0	95	97.9
	1	2	2.1
	Total	97	100.0

`

Q15.16:

		Frequency	Valid Percent
Valid	0	95	97.9
	1	2	2.1
	Total	97	100.0

Q15.17:

		Frequency	Valid Percent
Valid	0	94	96.9
	1	3	3.1
	Total	97	100.0

Q15.18:

		Frequency	Valid Percent
Valid	0	94	96.9
	1	3	3.1
	Total	97	100.0

`

APPENDIX C: Flawed areas

Question 15: : "Which areas do you believe to be totally flawed and CANNOT be fixed."

	0	1
Administration and Procedures	92	5
Funding and Budgets	95	2
Communication	96	1
Awareness and Understanding	94	3
Objectives and Expectations	96	1
Project Application	94	3
Resources Availability	97	
Management and Coordination	95	2
Co-operation and Support	97	
Knowledge and Know-how	97	
Intellectual Property Issues	95	2
Policies and Programmes	94	3
Culture and Behaviour	90	7
Leadership and Mentorship	97	
Information Systems	96	1
Organisational structure	97	
Education and Training	96	1
Location and Facilities	97	

`

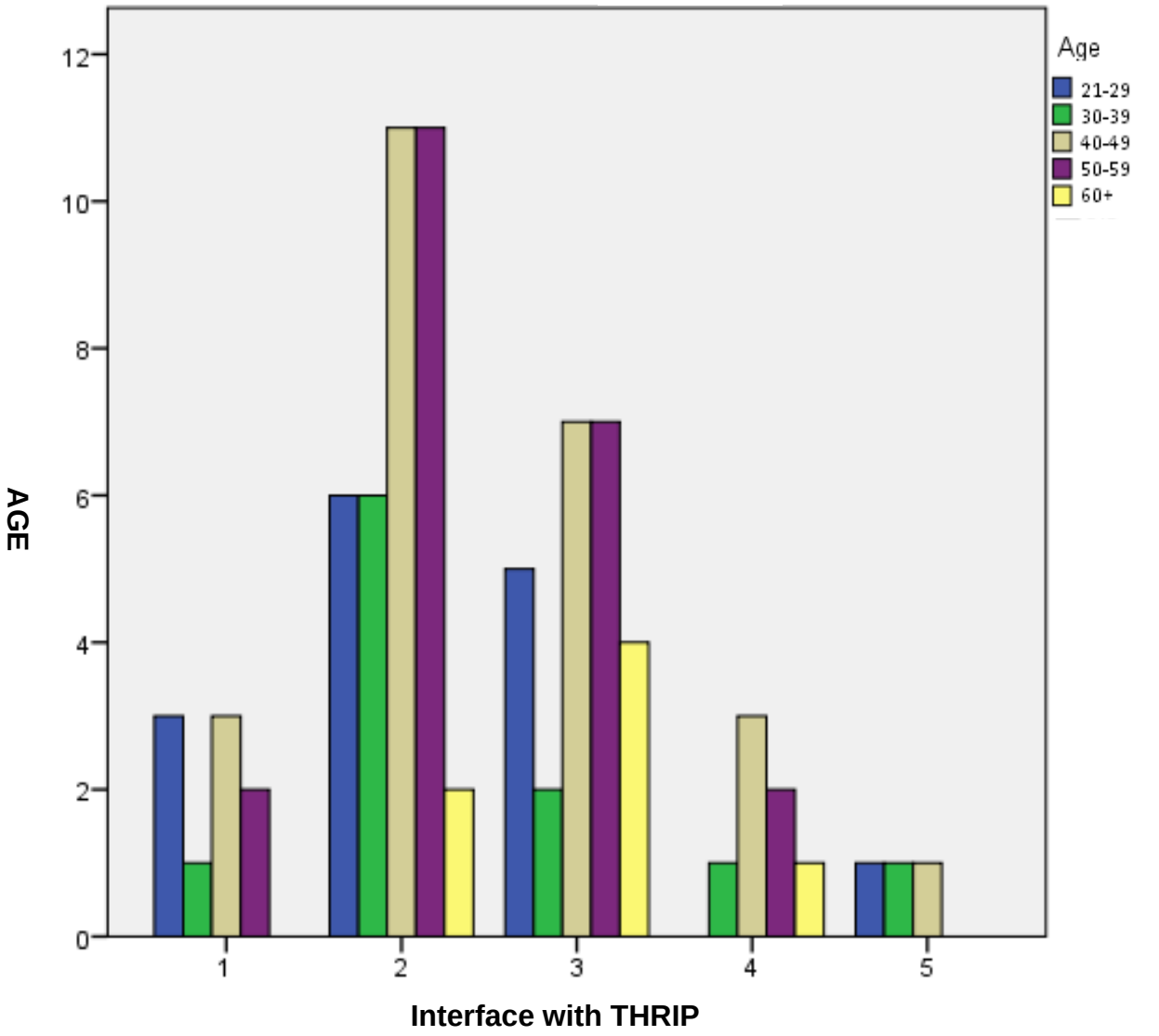
APPENDIX D: Spearman rho

Relationship	r - value	p - value	n
Q20 (Age) vs. Q10.6 (Industry)	-.280*	.35	57
Q1 (Innovation to you) vs. Q13.17 (Objectives and Expectations)	.406	.061	22
Q10.1 (Business) vs. Q13.7 (Objectives and Expectations)	-.534	.074	12
Q13.4 (Knowledge and Know-how) vs. Q13.3 (Resources availability)	-.726	.065	7
Q13.8 (Management and Coordination) vs. Q13.15 (Funding and Budgets)	-.492	.088	13

`

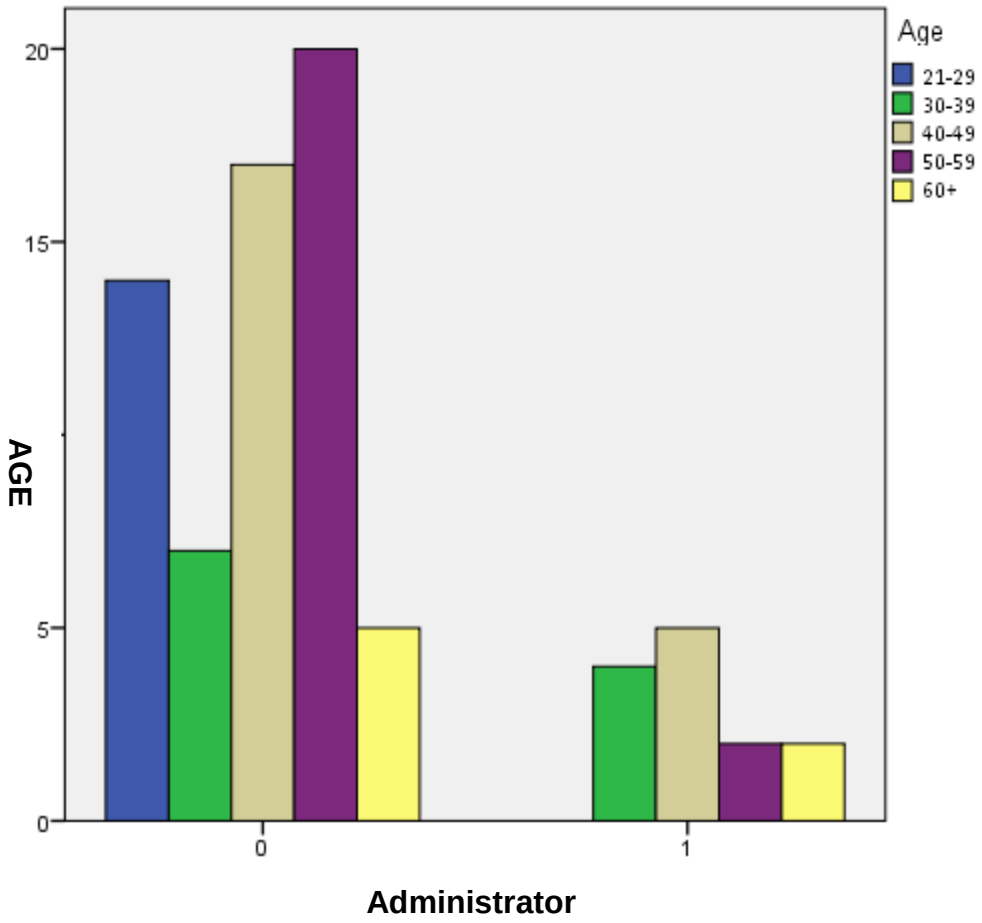
APPENDIX E: Cross Tabs

Age versus how often does your interface with THRIP



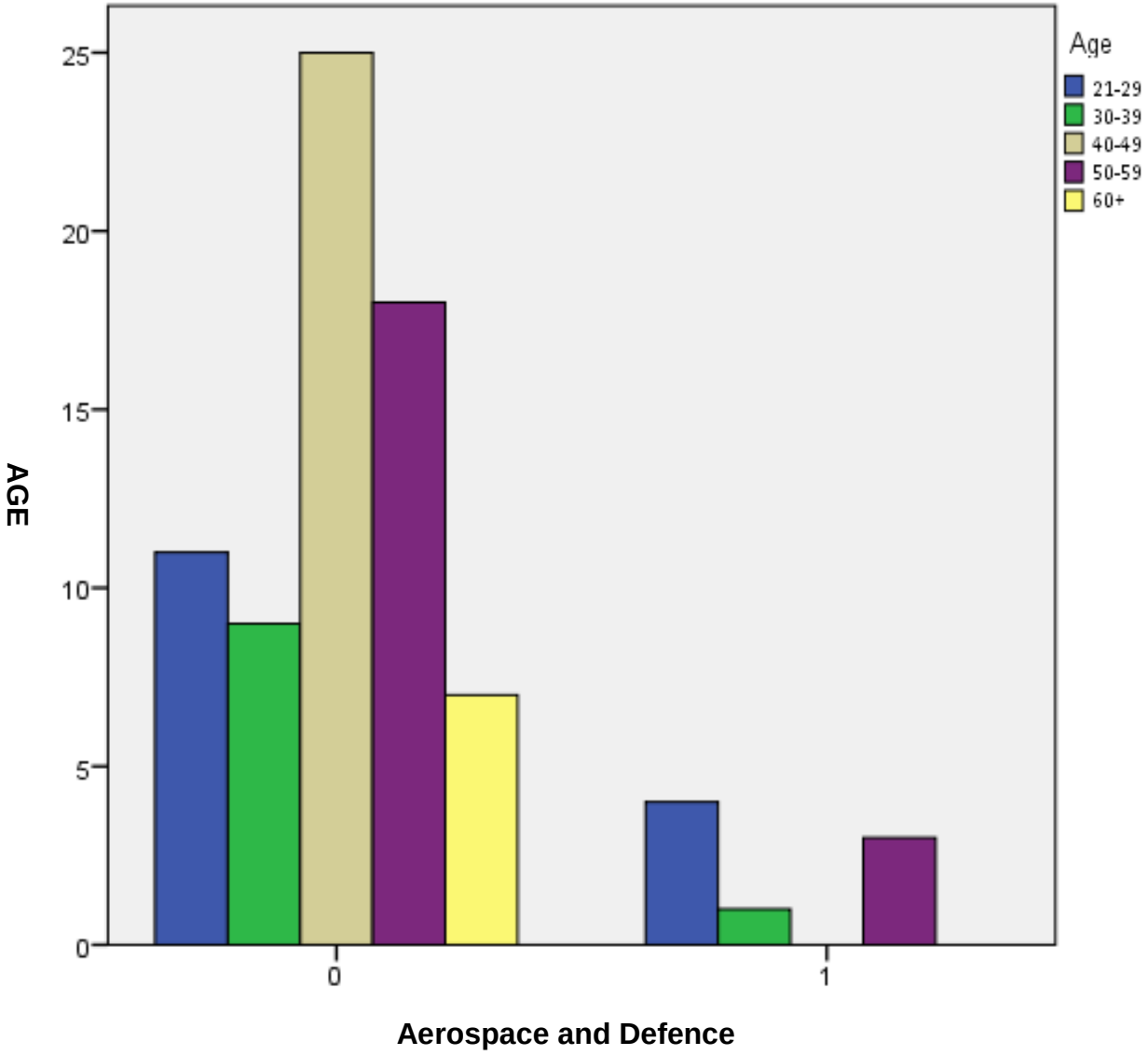
`

Age versus Administrator role within the TRHIP project



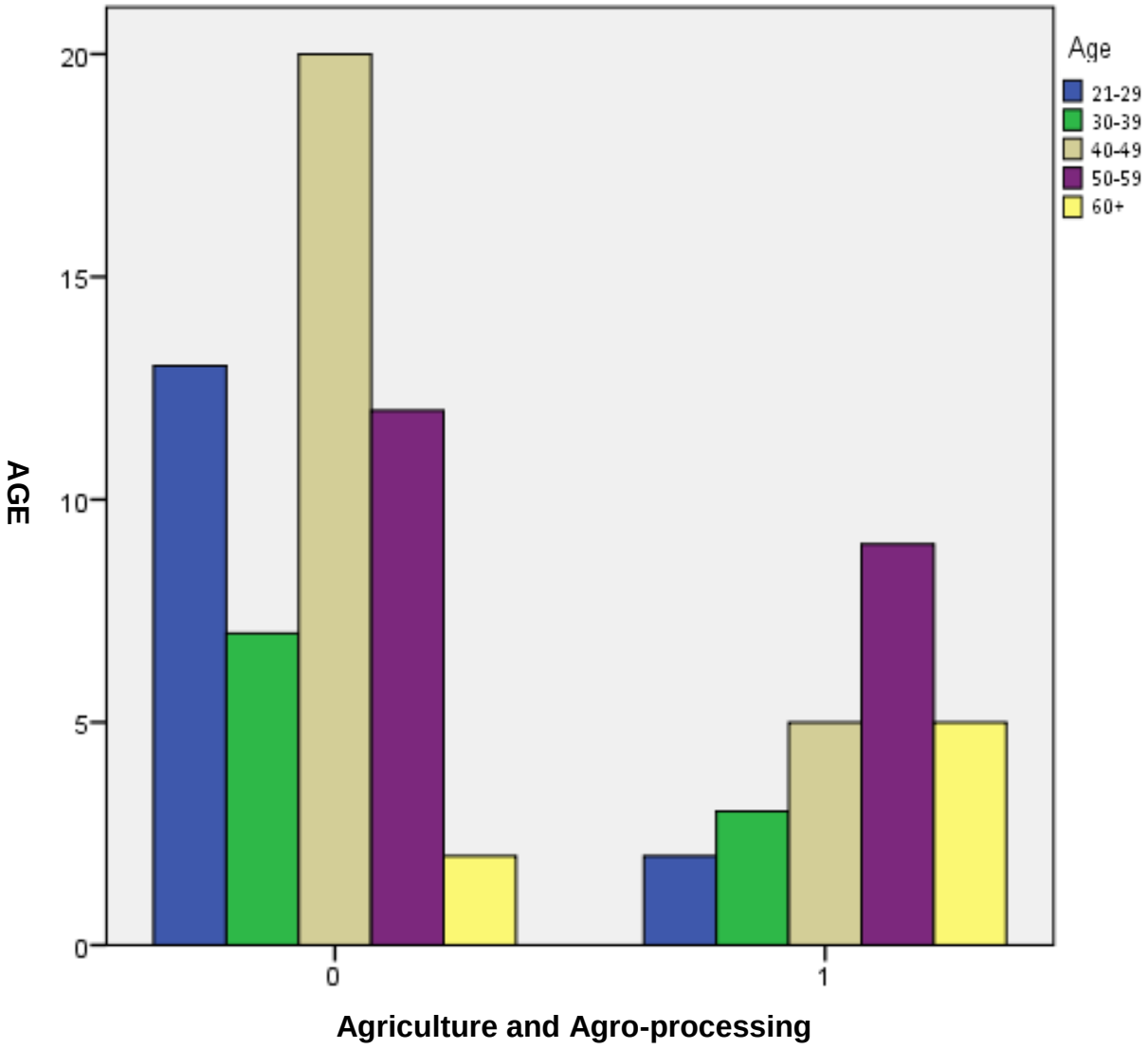
`

Age versus topic of personal interest



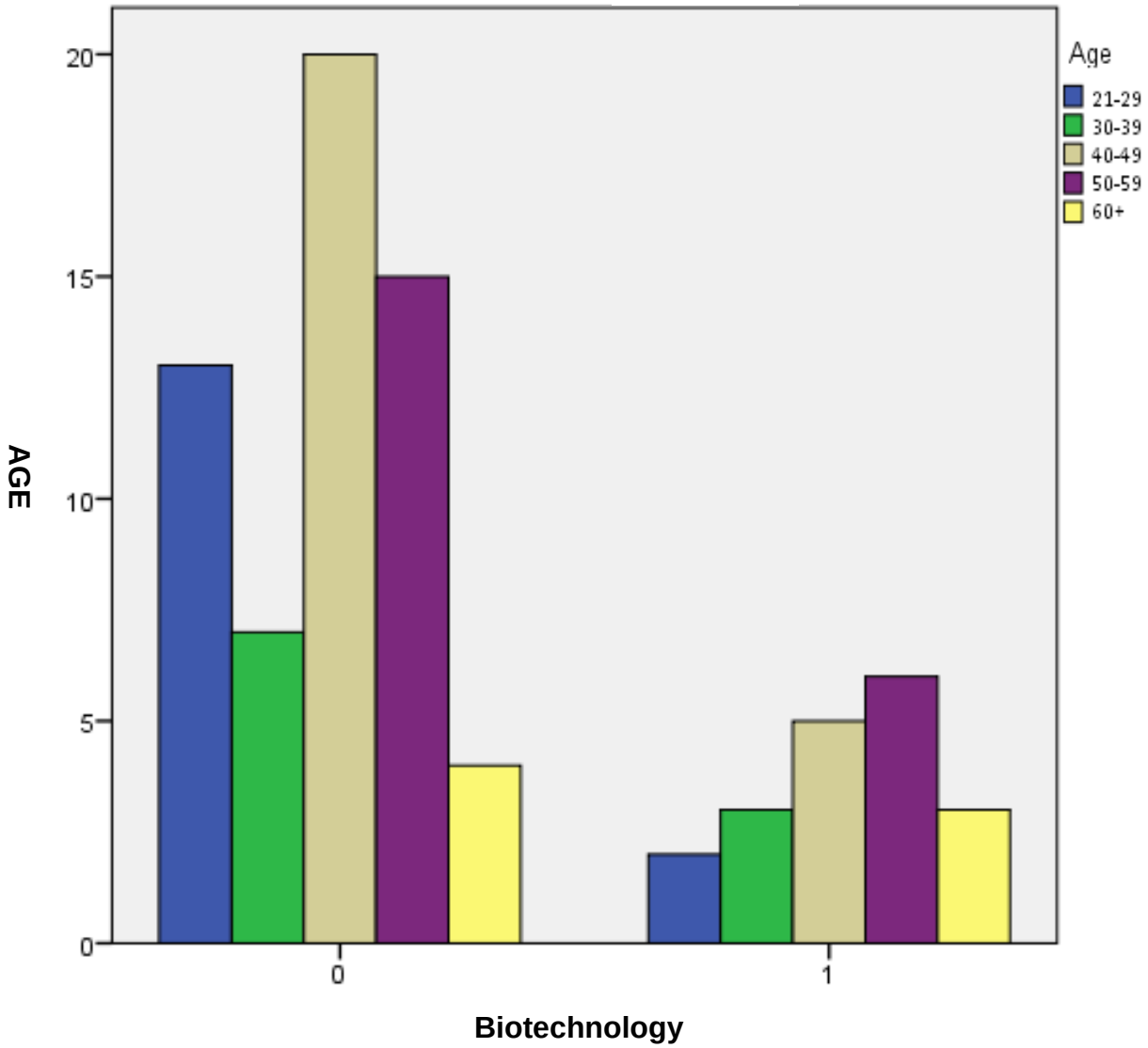
`

Age versus Agricultural and Agro processing as a topic of personal interested



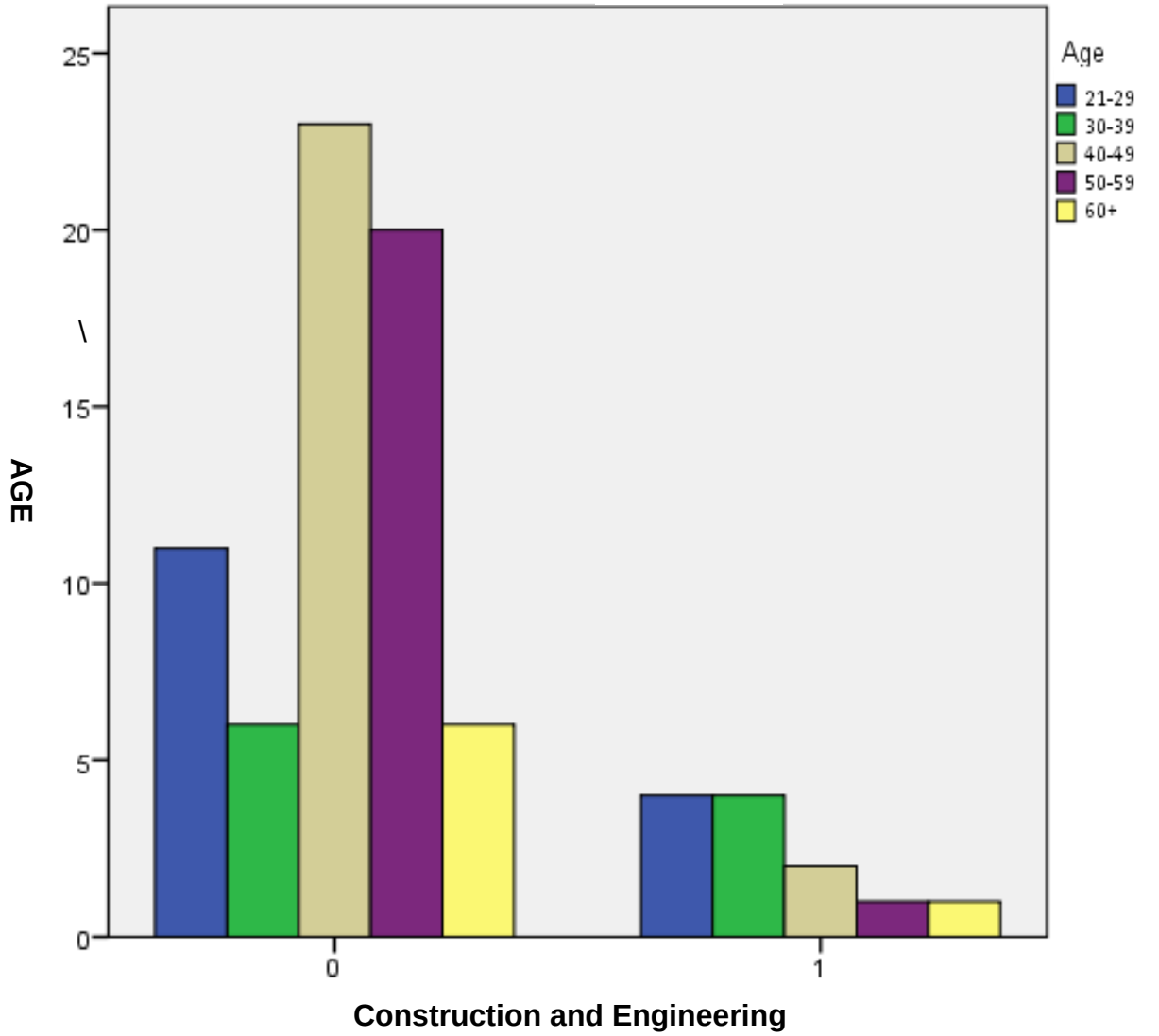
`

Age versus Biotechnology as topic of personal interested



`

Age versus Construction and Engineering as personal interest



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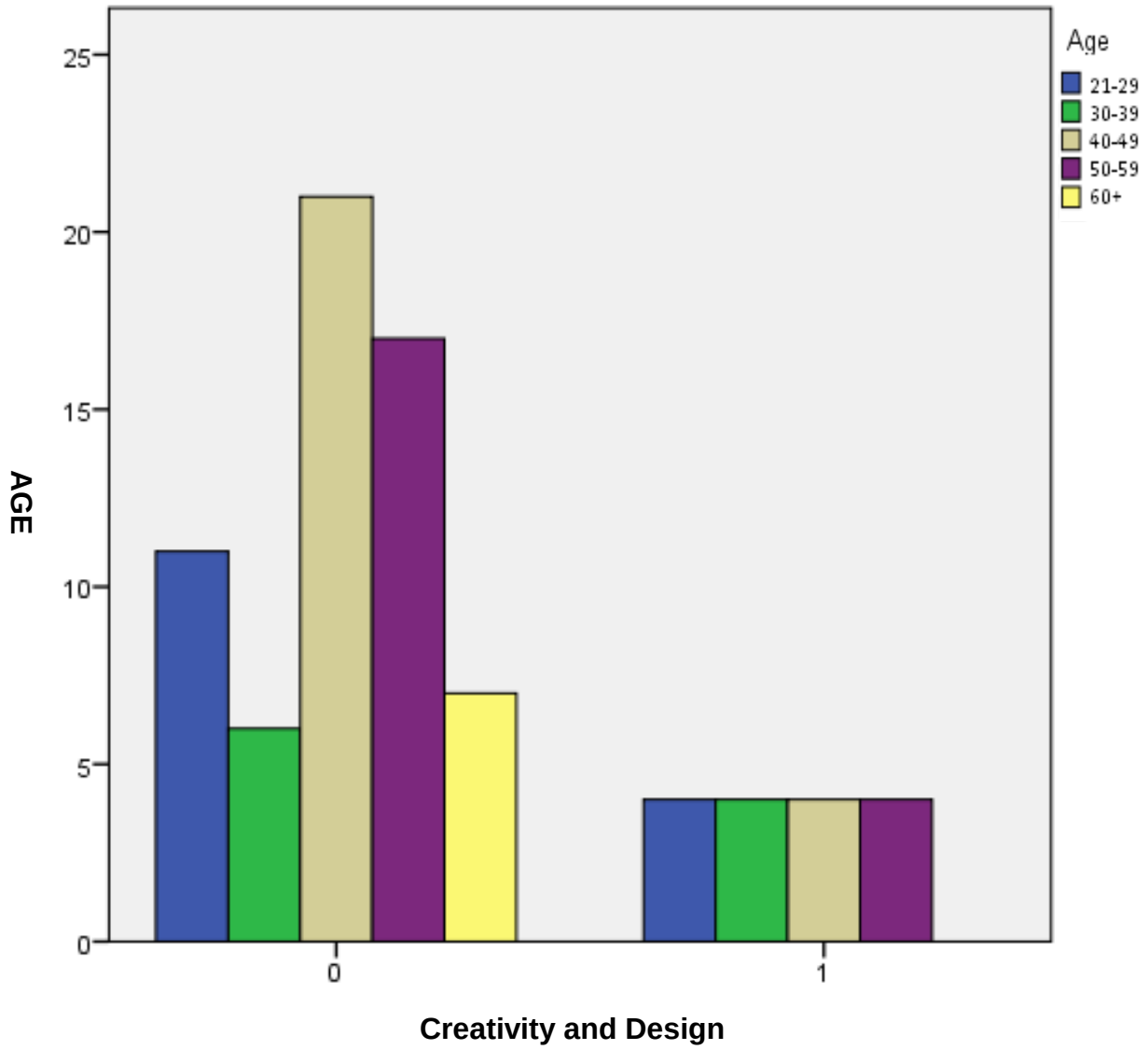
Age versus Creativity and Design as a personal interest



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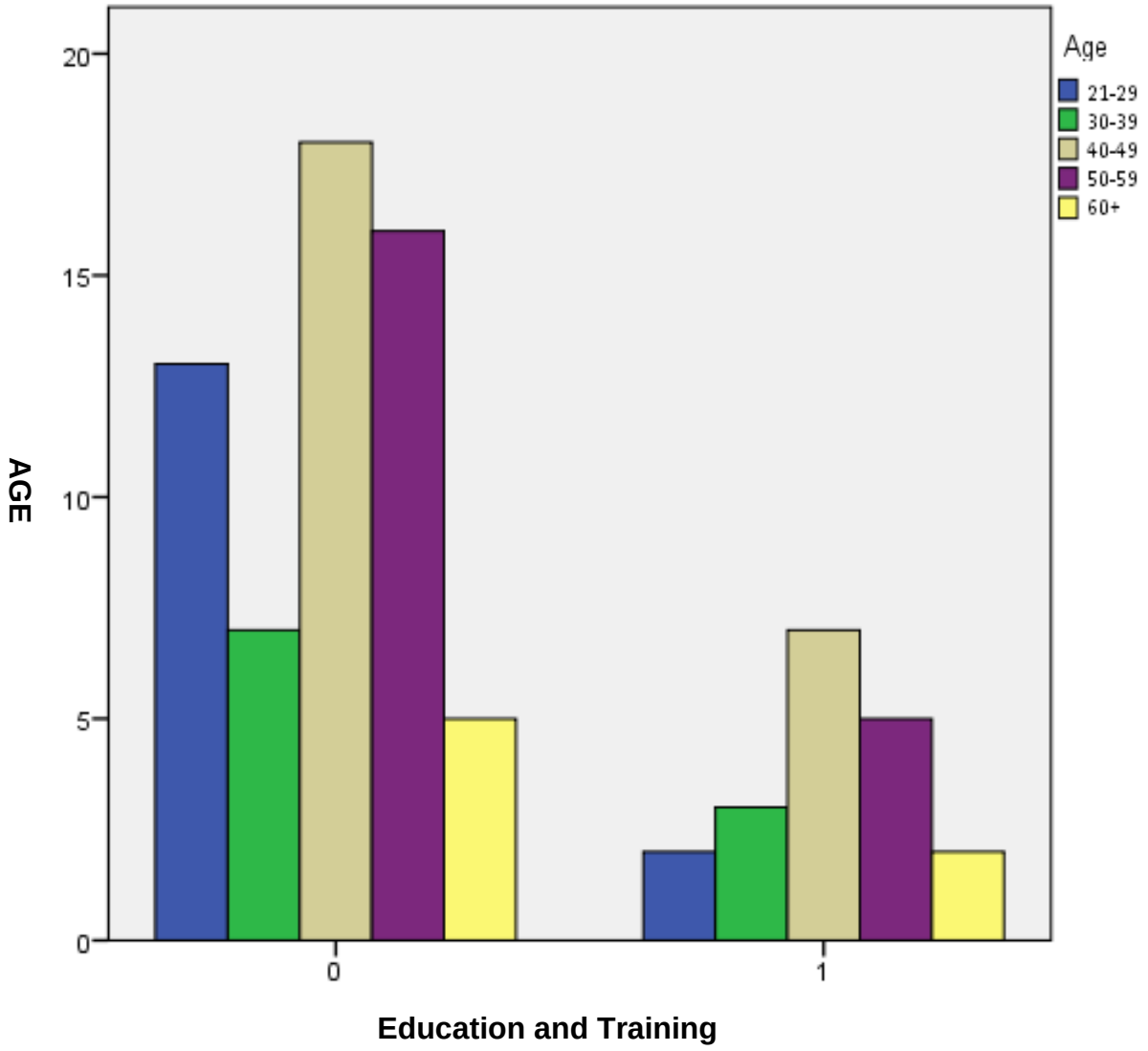
Age versus Education and Training as a personal interest



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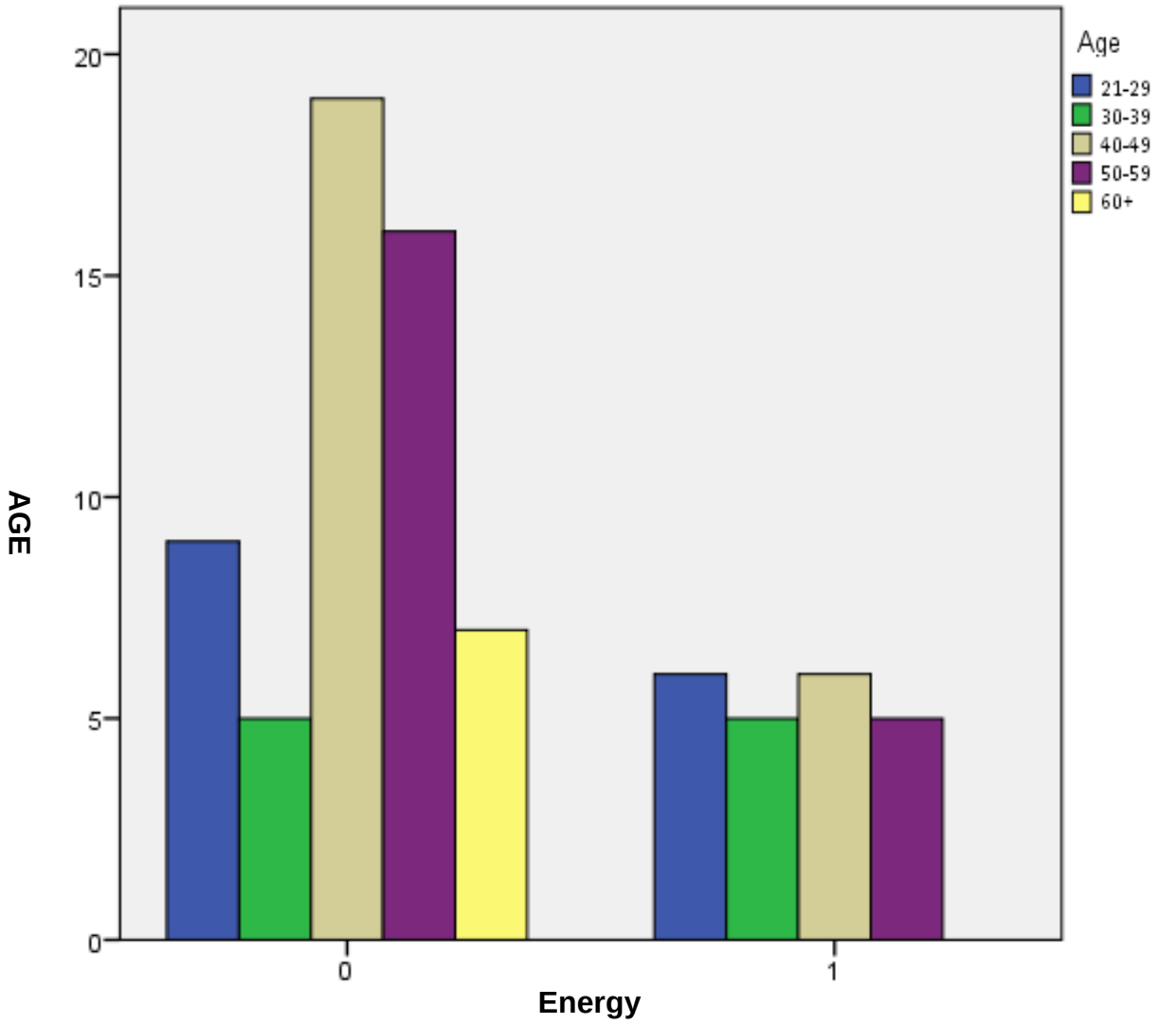
Age versus Energy as a personal interest



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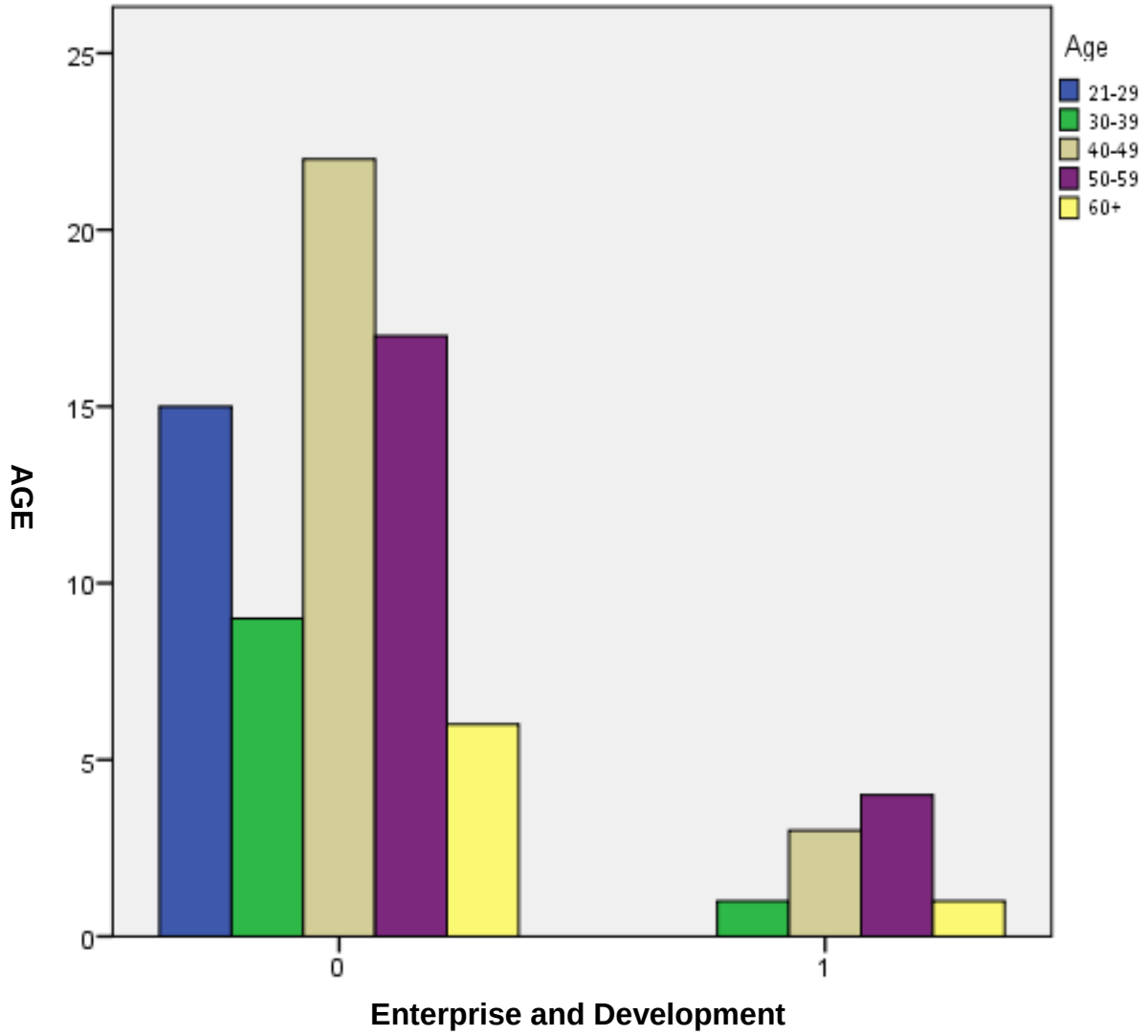
Age versus Enterprise and Development as a personal interest



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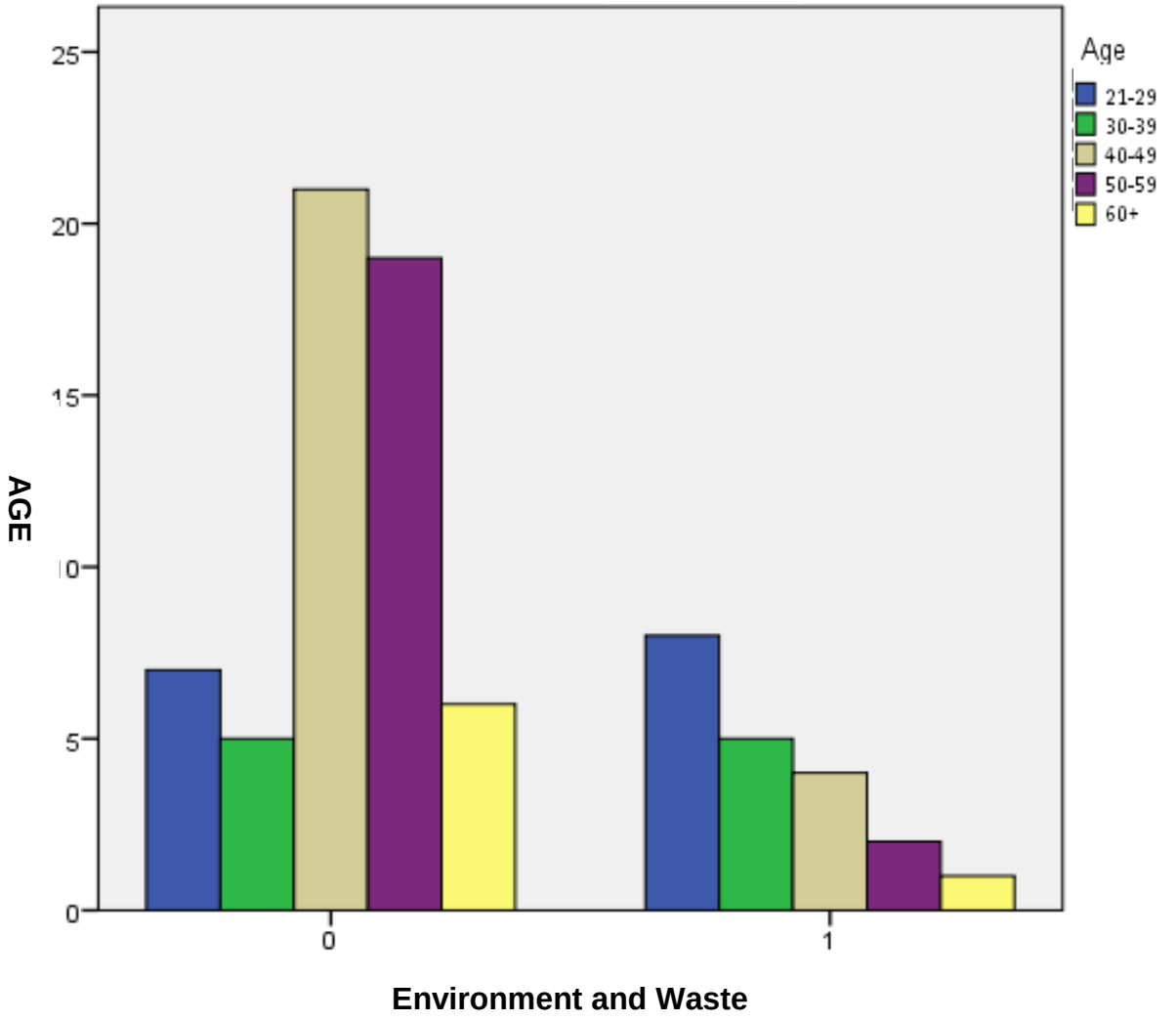
Age versus Environment and Waste as a personal interest



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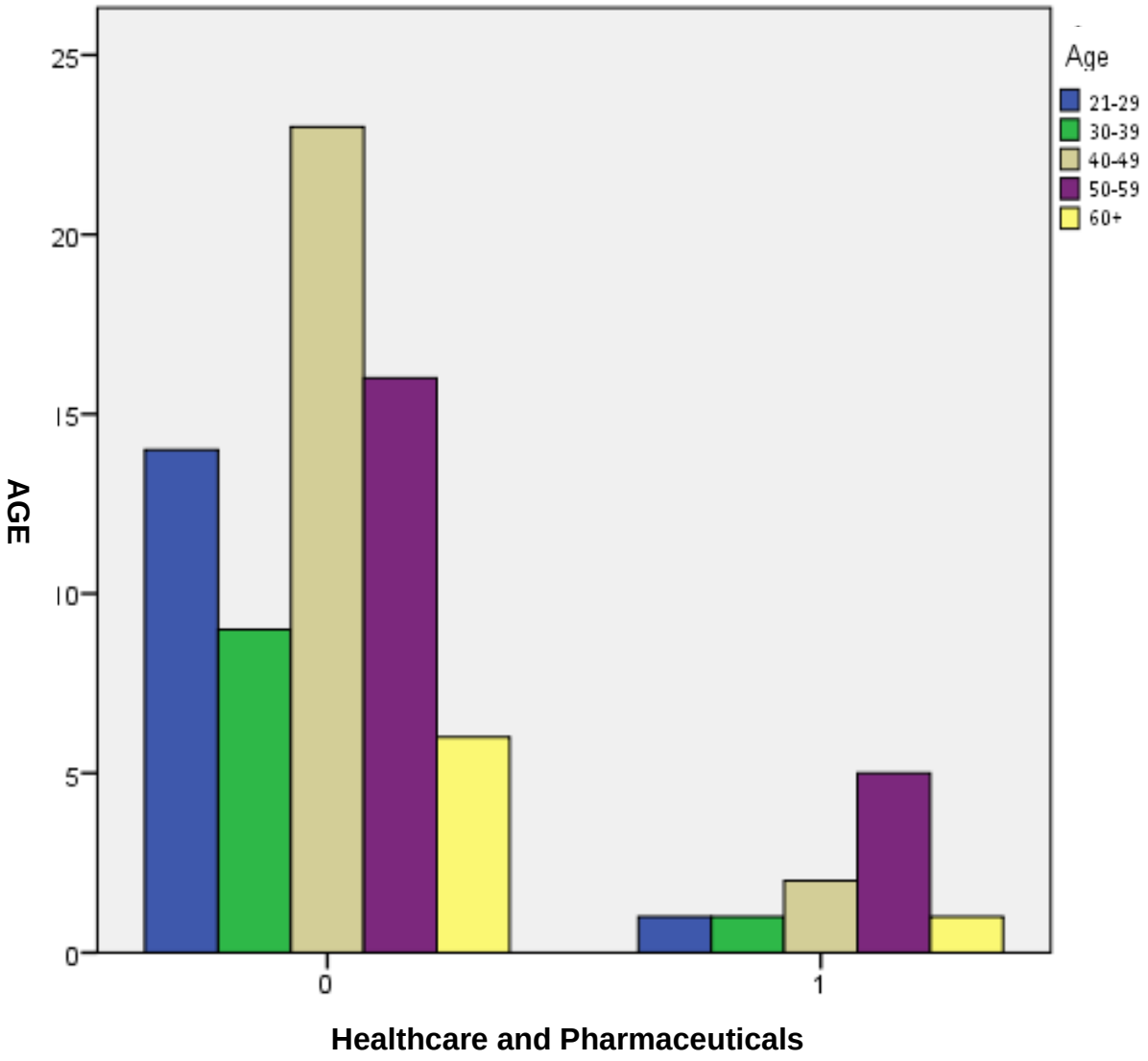
Age versus Age Healthcare and Pharmaceuticals as a personal interest



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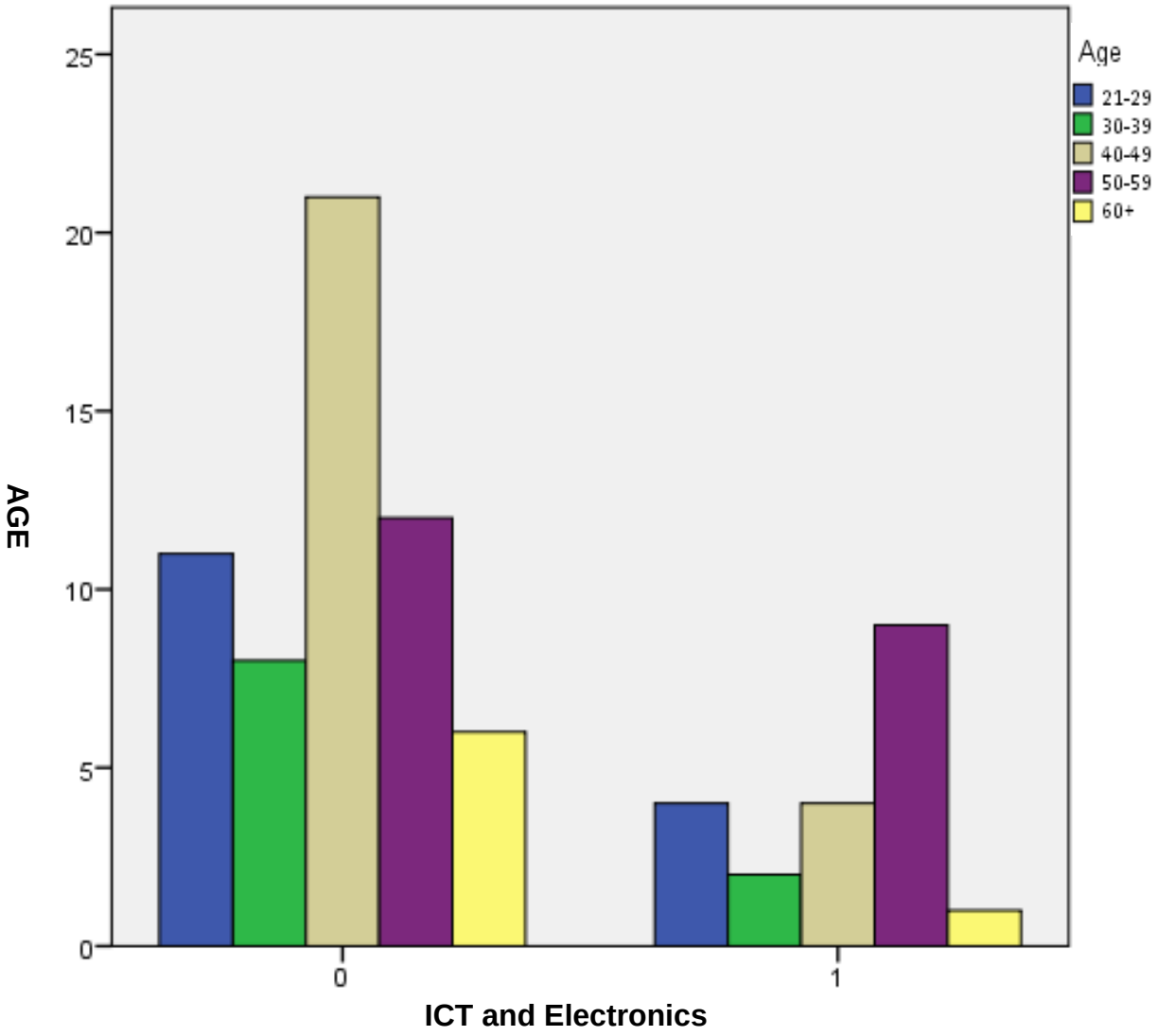
Age versus ICT and Electronics as a personal interest



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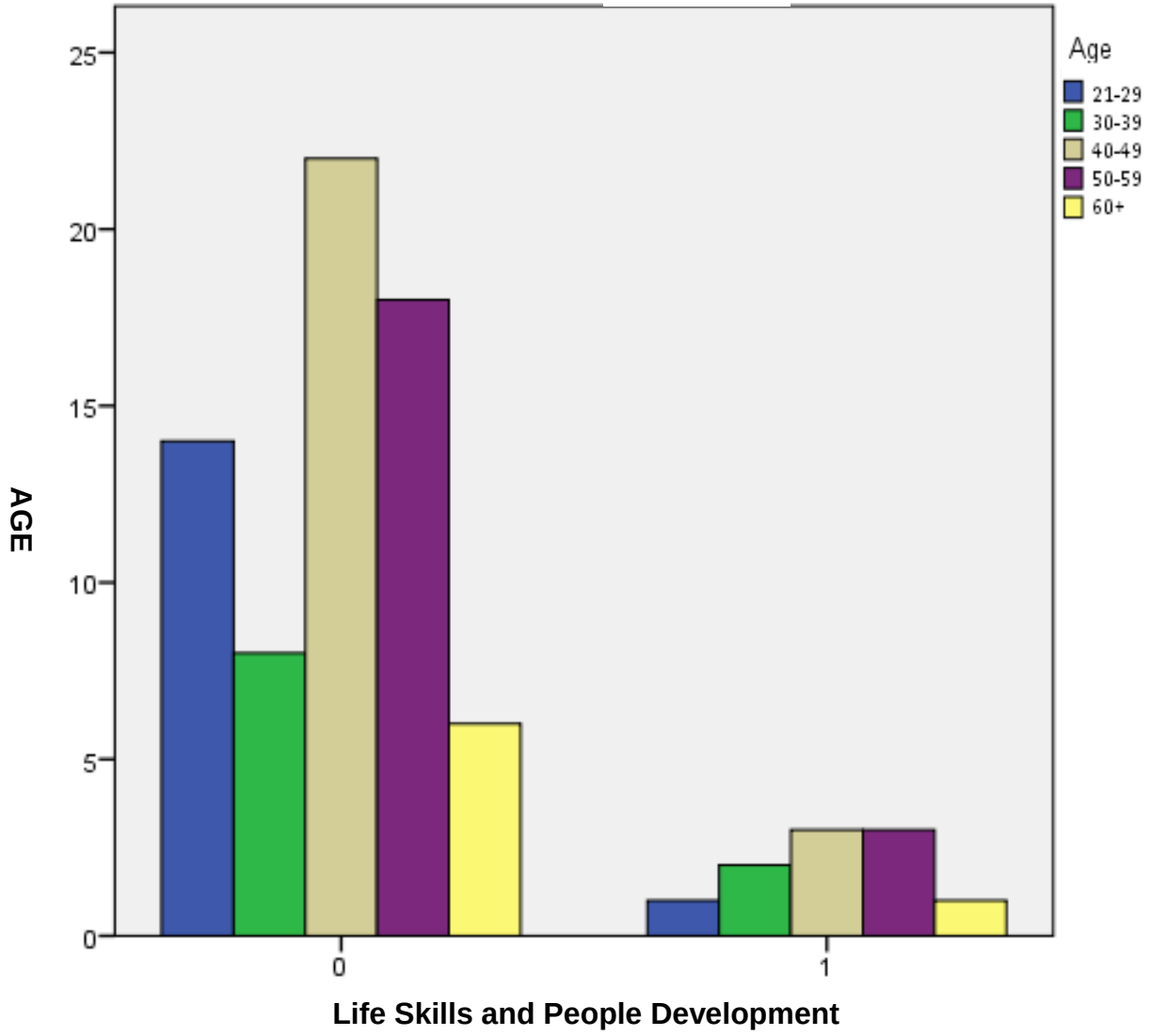
Age versus Life Skills and People Development as a personal interest Age versus a



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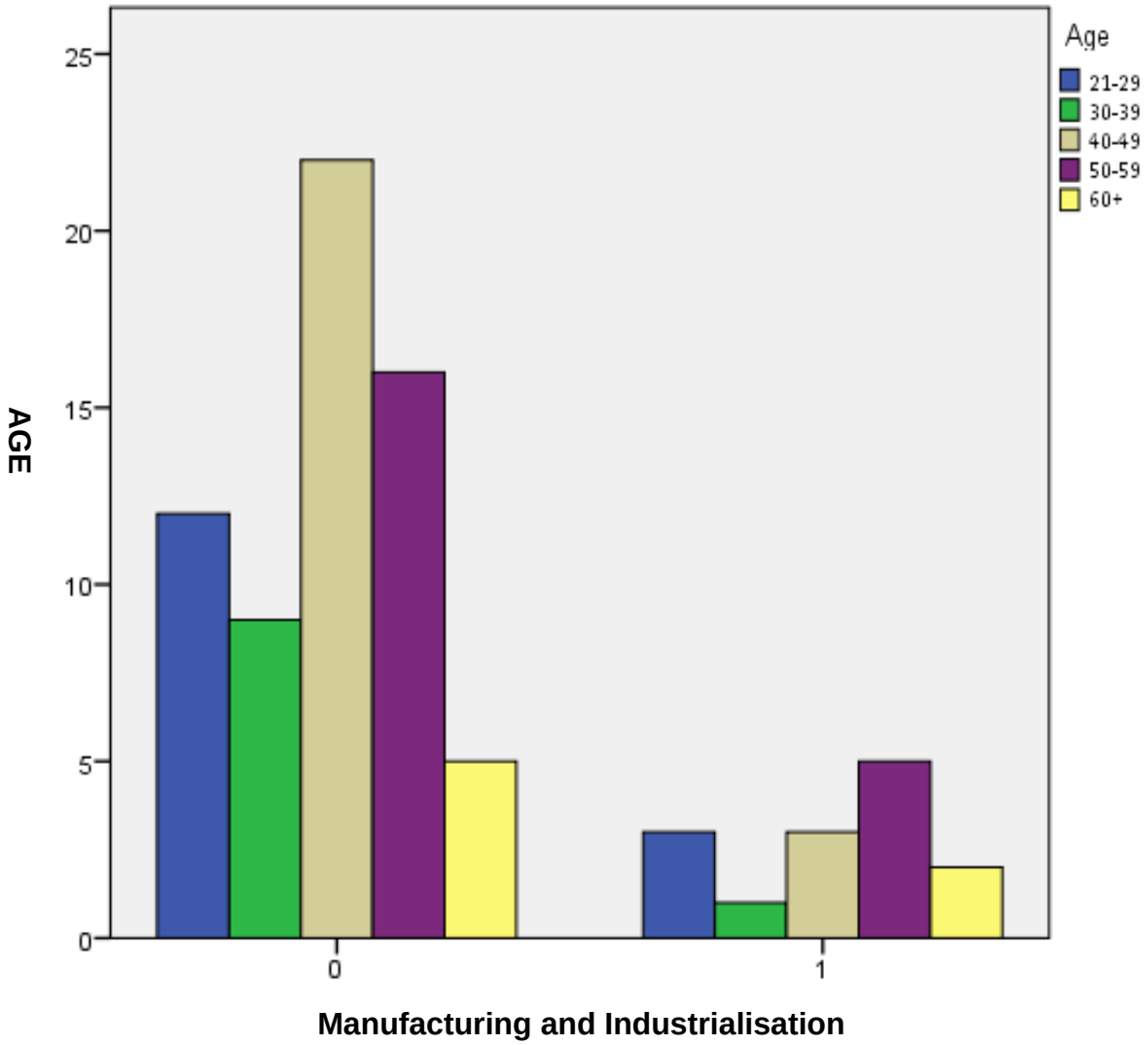
Age versus Manufacturing and Industrialisation



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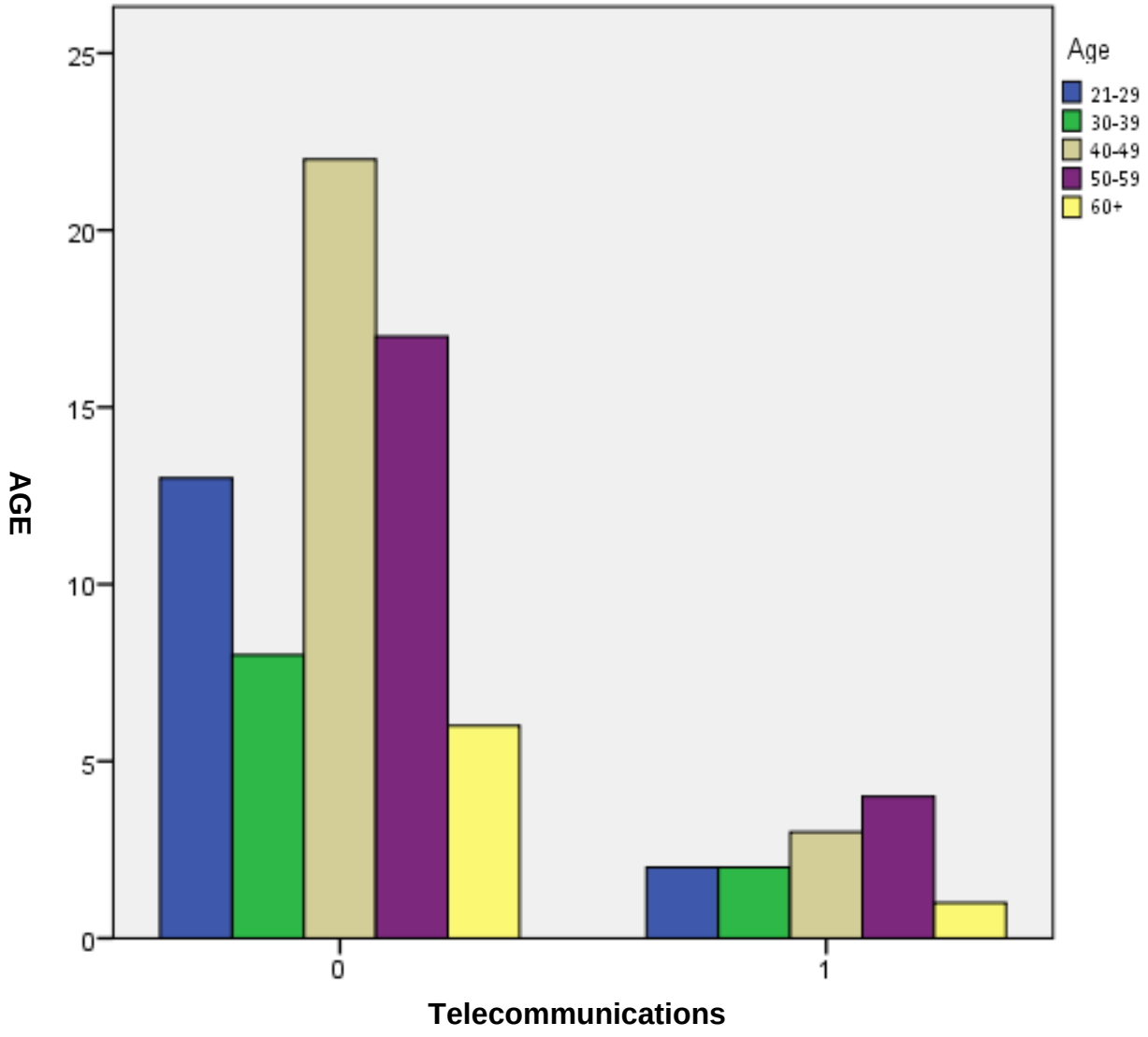
Age versus Telecommunication as a personal interest



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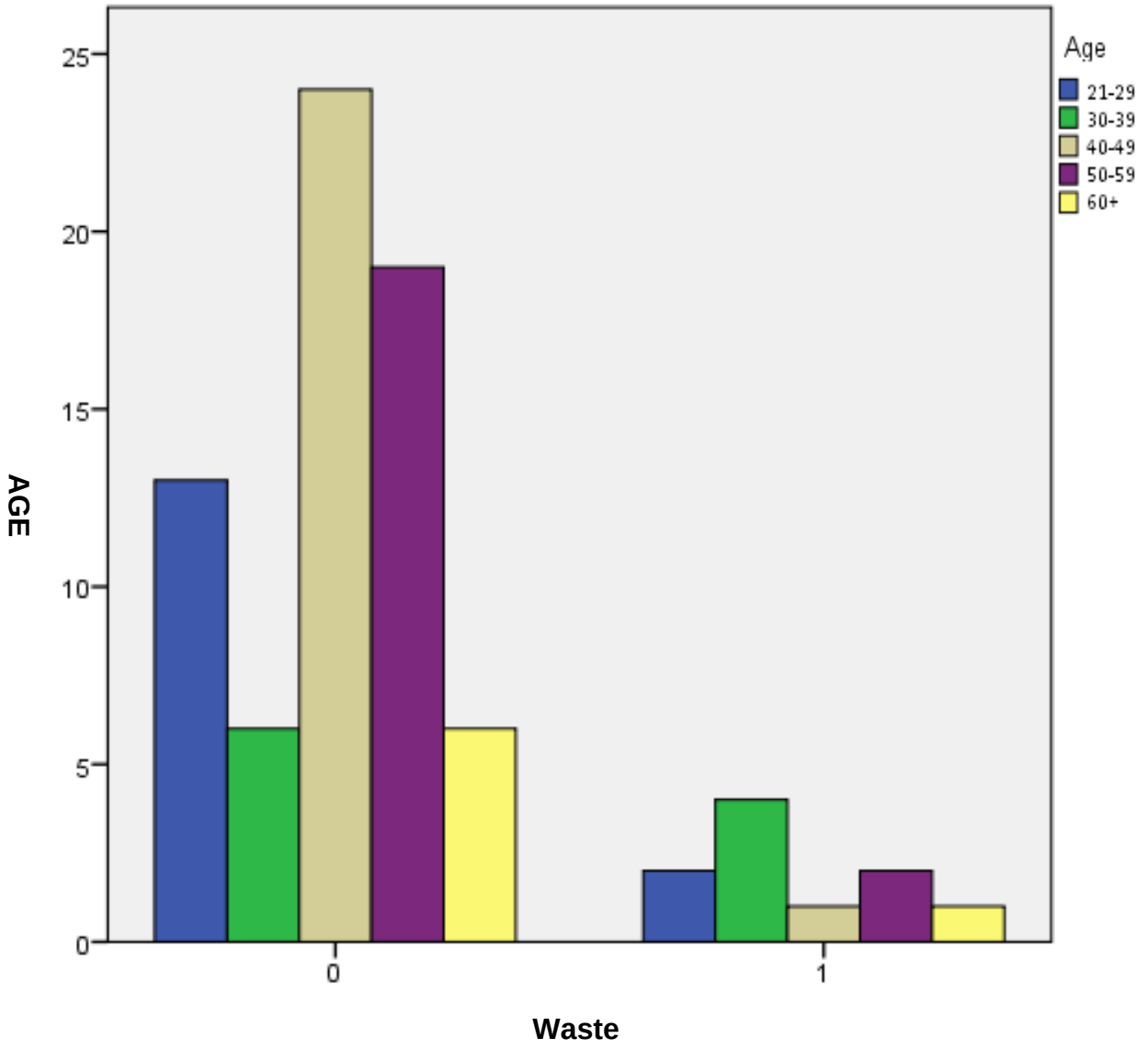
Age versus Waste as a personal interest



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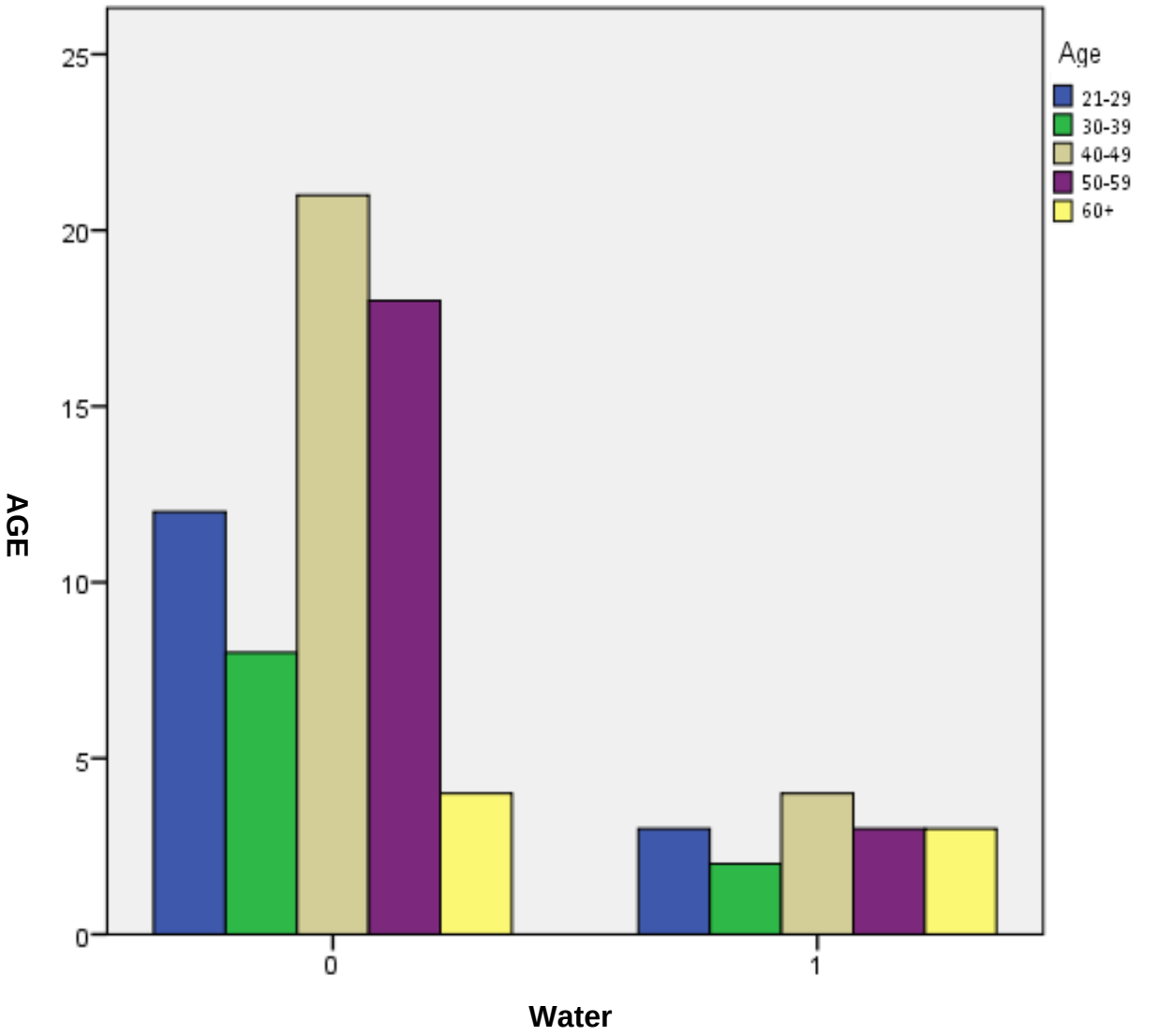
Age versus Water as a personal interest



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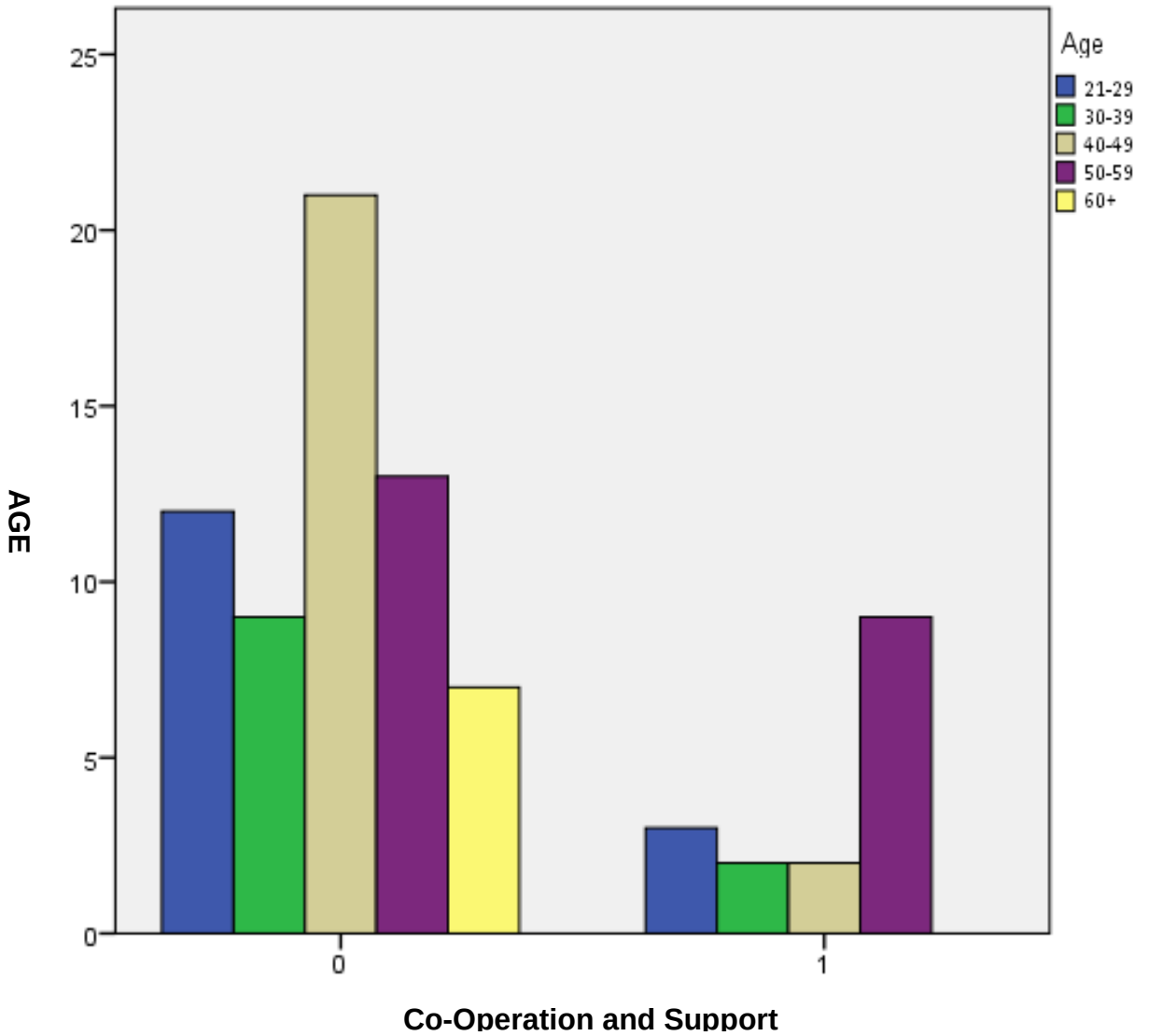
Age versus Co-Operation and Support as a constraint that can be improved or fixed



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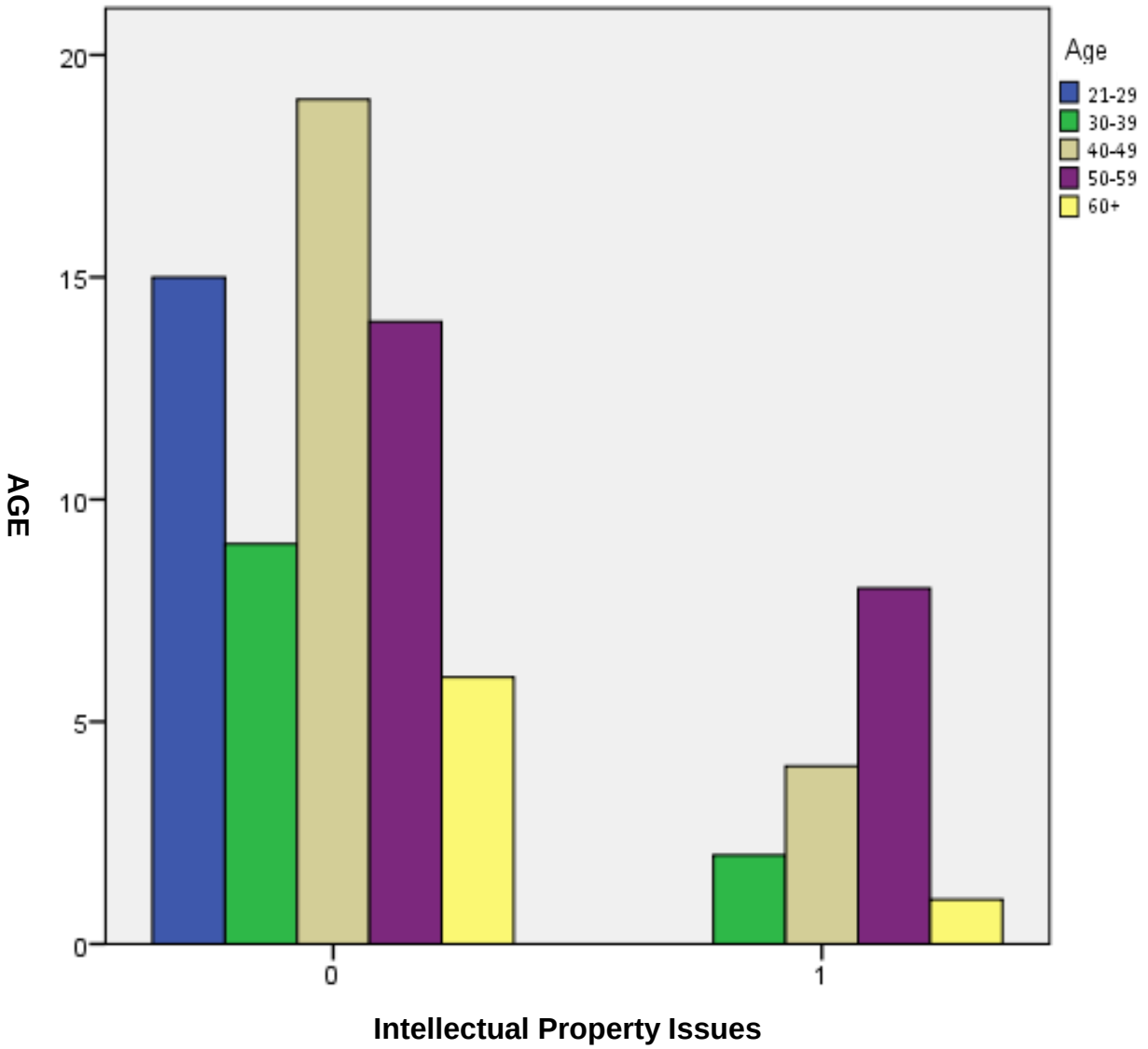
Age versus Intellectual Property Issues as a constraint can be improved or fixed



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APPENDIX F: T-test Administrators

T-test Administrators versus Non-Administrators

Administrators versus Business gain most from THRIP

Q8.1	Administrators	N	Mean	Std Dev	Independent T-test	
Question 10.1	Grouping				p-value	d-value
	Administrators	7	2.571	1.813	0.308	0.342
	Non-Administrators	47	3.083	1.316		

Administrators versus importance of research, development and innovation to respondent's organisation

Q8.1	Administrators	N	Mean	Std Dev	Independent T-test	
Question 2	Grouping				p-value	d-value
	Administrators	15	3.930	0.258	0.031	0.393
	Non-Administrators	76	3.740	5.000		

Administrators versus Communities gain most from THRIP

Q8.1	Administrators	N	Mean	Std Dev	Independent T-test	
Question 10.2	Grouping				p-value	d-value
	Administrators	6	4.000	0.894	0.068	0.697
	Non-Administrators	24	3.083	1.316		

`

Administrators versus Entrepreneurs gain most from THRIP

Q8.1	Administrators	N	Mean	Std Dev	Independent T-test	
Question 10.3	Grouping				p-value	d-value
	Administrators	6	3.833	0.753	0.148	0.450
	Non-Administrators	23	3.174	1.466		

Administrators versus Industry Managers gain most from THRIP

Q8.1	Administrators	N	Mean	Std Dev	Independent T-test	
Question 10.7	Grouping				p-value	d-value
	Administrators	2	4.500	0.707	0.160	0.906
	Non-Administrators	6	3.167	1.471		

Administrators versus Universities Staff gain most from THRIP

Q8.1	Administrators	N	Mean	Std Dev	Independent T-test	
Question 10.12	Grouping				p-value	d-value
	Administrators	5	3.800	1.303	0.386	0.428
	Non-Administrators	34	3.206	1.388		

`

Administrators versus Knowledge and Know-how as the most negative impact on the success of THRIP projects

Q8.1	Administrators	N	Mean	Std Dev	Independent T-test	
Question 13.4	Grouping				p-value	d-value
	Administrators	4	3.000	1.155	0.262	0.695
	Non-Administrators	17	3.824	1.185		

Administrators versus Administration and Procedures as the most negative impact on the success of THIRP projects

Q8.1	Administrators	N	Mean	Std Dev	Independent T-test	
Question 13.10	Grouping				p-value	d-value
	Administrators	8	3.000	1.069	0.910	0.626
	Non-Administrators	35	2.200	1.279		

Administrators versus Organisational structure as the most negative impact on THRIP

Q8.1	Administrators	N	Mean	Std Dev	Independent T-test	
Question 13.13	Grouping				p-value	d-value
	Administrators	4	2.500	1.732	0.305	0.625
	Non-Administrators	12	3.583	0.900		

`

Administrators versus Co-operation and Support as the most negative impact on THRIP

Q8.1	Administrators	N	Mean	Std Dev	Independent T-test	
Question 13.14	Grouping				p-value	d-value
	Administrators	2	4.000	1.414	0.456	0.454
	Non-Administrators	14	3.357	1.081		

`

T-test Researchers versus Non-researchers

Researcher versus Industry Managers gain the most from THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 10.7	Grouping				p-value	d-value
	Researcher	2	2.500	2.120	0.532	0.629
	Non-Researcher	6	3.833	1.169		

Researcher versus Investors gain the most from THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 10.9	Grouping				p-value	d-value
	Researcher	3	2.667	1.155	0.236	0.775
	Non-Researcher	13	3.769	1.423		

Researcher versus Communication as the most negative impact on the success of THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 13.2	Grouping				p-value	d-value
	Researcher	3	2.333	2.309	0.162	0.522
	Non-Researcher	26	3.540	1.272		

`

Researcher versus Culture and Behaviour as the most negative impact on the success of THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 13.5	Grouping				p-value	d-value
	Researcher	2	3.000	1.414	0.634	0.358
	Non-Researcher	20	3.550	1.538		

Researcher versus Awareness and Understanding as the most negative impact on the success of THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 13.6	Grouping				p-value	d-value
	Researcher	2	2.000	1.414	0.546	0.438
	Non-Researcher	21	2.619	1.359		

Researcher versus Objectives and Expectations as the most negative impact on the success of THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 13.7	Grouping				p-value	d-value
	Researcher	7	2.714	1.380	0.231	0.536
	Non-Researcher	11	3.455	0.128		

`

Researcher versus Management and Coordination as the most negative impact on the success of THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 13.8	Grouping				p-value	d-value
	Researcher	7	2.714	1.113	0.310	0.440
	Non-Researcher	16	3.375	1.500		

Researcher versus Location and Facilities as the most negative impact on the success of THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 13.9	Grouping				p-value	d-value
	Researcher	3	2.667	1.528	0.599	0.363
	Non-Researcher	7	3.286	1.704		

Researcher versus Administration and Procedures as the most negative impact on THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 13.10	Grouping				p-value	d-value
	Researcher	5	1.600	0.894	0.106	0.658
	Non-Researcher	38	2.447	1.288		

`

Researcher versus Education and Training as the most negative impact on the success of THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 13.12	Grouping				p-value	d-value
	Researcher	2	3.000	2.828	0.588	0.530
	Non-Researcher	4	4.500	1.000		

Researcher versus Co-operation and Support as the most negative impact on on the success of THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 13.14	Grouping				p-value	d-value
	Researcher	3	2.667	1.155	0.288	0.822
	Non-Researcher	13	3.615	1.043		

Researcher versus Funding and Budgets as the most negative impact on the success of THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 13.15	Grouping				p-value	d-value
	Researcher	7	2.857	1.215	0.358	0.358
	Non-Researcher	41	2.366	1.373		

`

Researcher versus Policies and Programmes as the most negative impact on the success of THRIP projects

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 13.17	Grouping				p-value	d-value
	Researcher	3	4.000	1.000	0.079	1.348
	Non-Researcher	18	2.333	1.237		

Researcher versus Project Application as the most negative impact on the success of THRIP

Q8.3	Researchers	N	Mean	Std Dev	Independent T-test	
Question 13.18	Grouping				p-value	d-value
	Researcher	3	3.667	1.154	0.377	0.517
	Non-Researcher	20	2.900	1.480		

`

Which areas of constraints do you believe can improve or be fixed

Communication

Q14.2	Communication	N	Mean	Std Dev	Independent T-test	
Question	Grouping				p-value	d-value
13.3	Communication	33	0.850	1.417	0.145	0.304
	Non-Communication	47	1.360	1.687		

Resource Availability

Q14.3	Resource Availabilty	N	Mean	Std Dev	Independent T-test	
	Grouping				p-value	*d-value*
Question Q13.7	Resource Availability	19	1.260	1.939	0.096	0.419
	Non-Resource Availability	62	0.450	1.082		

Knowledge and Know-how

Q14.4	Knowledge and Know-how	N	Mean	Std Dev	Independent T-test	
Question	Grouping				p-value	d-value
Q13.6 Organisational Structure	Knowledge and Know-how	16	1.130	1.455	0.229	0.340
	Non-Knowledge and Know-how	65	0.630	1.330		
Q13.14 Co-Opearation and Support	Knowledge and Know-how	16	1.130	1.821	0.183	0.364
	Non-Knowledge and Know-how	65	0.460	1.213		

`

Culture and Behaviour

Q14.5	Culture and Behaviour	N	Mean	Std Dev	Independent T-test	
Question	**Grouping**				**p-value**	**d-value**
Q13.4 Knowledge and Know-how	Culture and Behaviour	12	2.170	2.082	0.657	0.658
	Non-Culture and Behaviour	69	0.800	1.650		
Q13.8 Management and Coordination	Culture and Behaviour	12	0.330	1.155	0.089	0.416
	Non-Culture and Behaviour	69	1.030	1.671		
Q13.10 Administration and Procedures	Culture and Behaviour	12	1.830	1.697	0.197	0.414
	Non-Culture and Behaviour	69	1.130	1.424		
Q13.12 Education and Training	Culture and Behaviour	12	0.830	1.946	0.293	0.324
	Non-Culture and Behaviour	69	0.200	0.917		
Q13.13 Organisational structure	Culture and Behaviour	12	1.080	1.379	0.868	0.418
	Non-Culture and Behaviour	69	0.510	1.357		

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Objectives and Expectations

Q14.7	Objectives and Expectations	N	Mean	Std Dev	Independent T-test	
Question	**Grouping**				**p-value**	**d-value**
Q13.1 Information Systems	Objectives and Expectations	21	0.190	0.873	0.084	0.308
	Non-Objectives and Expectations	60	0.680	1.600		
Q13.11 Leadership and Mentorship	Objectives and Expectations	21	1.050	1.746	0.149	0.352
	Non-Objectives and Expectations	60	0.430	1.254		

`

Management and Coordination

Q14.8	Management and Coordination	N	Mean	Std Dev	Independent T-test	
Question	**Grouping**				**p-value**	**d-value**
Q13.3 Resource Availability	Management and Coordination	17	1.590	1.873	0.256	0.306
	Non-Management and Coordination	64	1.020	1.496		
Q13.4 Knowledge and Know-how	Management and Coordination	17	1.530	2.239	0.229	0.320
	Non-Management and Coordination	64	0.810	1.582		
Q13.10 Administration and Procedures	Management and Coordination	17	0.820	1.185	0.142	0.339
	Non-Management and Coordination	64	1.340	1.535		
Q13.11 Leadership and Mentorship	Management and Coordination	17	1.000	1.696	0.257	0.304
	Non-Management and Coordination	64	0.480	1.321		

`

Administration and Procedures

Q14.10	Administration and Procedures	N	Mean	Std Dev	Independent T-test	
Question	**Grouping**				**p-value**	**d-value**
13.7 Ojectives and Expectations	Administration and Procedures	45	0.420	1.196	0.115	0.326
	Non-Administration and Procedures	36	1.519	0.253		

Co-operation and Support

Q14.14	Co-operation and Support	N	Mean	Std Dev	Independent T-test	
Question	**Grouping**				**p-value**	**d-value**
Q13.2 Communication	Co-operation and Support	17	0.760	1.348	0.132	0.324
	Non-Co-operation and Support	64	1.390	1.932		
Q13.4 Knowledge and Know-how	Co-operation and Support	17	1.760	2.223	0.092	0.456
	Non-Co-operation and Support	64	0.750	1.553		
Q13.15 Funding and Budgets	Co-operation and Support	17	0.880	1.453	0.090	0.444
	Non-Co-operation and Support	64	1.590	1.601		

`

Intellectual Property Issues

Q14.16	Intellectual Property Issues	N	Mean	Std Dev	Independent T-test	
Question	**Grouping**				**p-value**	**d-value**
13.6 Awareness and Understanding	Intellectual Property Issues	15	1.270	1.831	0.200	0.361
	Non-Intellectual Property Issues	66	0.610	1.214		

Policies and Programmes

Q14.17	Policies and Programmes	N	Mean	Std Dev	Independent T-test	
Question	**Grouping**				**p-value**	**d-value**
Q13.1 Information Systems	Policies and Programmes	13	1.230	1.964	0.178	0.409
	Non-Policies and Programmes	68	0.430	1.319		
Q13.5 Culture and Behaviour	Policies and Programmes	13	1.620	2.181	0.269	0.336
	Non-Policies and Programmes	68	0.880	1.680		
Q13.10 Administration and Procedures	Policies and Programmes	13	1.770	1.536	0.186	0.414
	Non-Policies and Programmes	68	1.130	1.455		
Q13.16 Intellectual Property	Policies and Programmes	13	0.460	1.391	0.164	0.351
	Non-Policies and Programmes	68	1.100	1.830		

`

Project Application

Q14.18	Project Applications	N	Mean	Std Dev	Independent T-test	
Question	**Grouping**				**p-value**	**d-value**
Q13.3 Resource Availability	Project Applications	20	0.750	1.446	0.191	0.316
	Non-Project Applications	61	1.260	1.622		
Q13.11 Leadership and Mentorship	Project Applications	20	1.300	2.055	0.062	0.457
	Non-Project Applications	61	0.360	1.049		

`

APPENDIX G: ANOVA

					p values		
	Compared to …		Mean	Std Dev	ANOVA	Welch	Brown-Forsythe
Q3	Q7	NWU	3.951	3.324	0.001	0.003	0.001
		UP	6.357	3.543			
		Stellenbosh	8.545	3.387			
		Other	5.700	3.385			

	Compared to …		Games Howel p value	Cohen's d value
Q 3	Q 7	NWU vs UP	0.148	0.679
		NWU vs Other	0.144	0.517
		UP vs. NWU	0.148	0.679
		UP vs. Stellenbosch	0.415	0.618
		UP vs. Other	0.937	0.185
		Stellenbosch vs. NWU	0.005	1.357
		Stellenbosch vs. UP	0.415	0.618
		Stellenbosch vs. Other	0.117	0.840
		Other vs NWU	0.144	0.517
		Other vs UP	0.937	0.185
		Other vs Stellenbosch	0.117	0.840

`

					p values		
Compared to …			Mean	Std Dev	ANOVA	Welch	Brown-Forsythe
Q10.1	Q 7	NWU	3.136	1.490	0.012	0.013	0.004
		UP	4.125	0.991			
		Stellenbosh	4.250	0.957			
		Other	2.400	1.465			

	Compared to …		Games Howel p value	Cohen's d value
Q 10.1	Q 7	NWU vs UP	0.192	0.664
		NWU vs Stellenbosh	0.305	0.748
		NWU vs Other	0.383	0.494
		UP vs. NWU	0.192	0.664
		UP vs. Stellenbosch	0.996	0.126
		UP vs. Other	0.009	1.177
		Stellenbosch vs. NWU	0.305	0.748
		Stellenbosch vs. UP	0.996	0.126
		Other vs NWU	0.383	0.494

`

					p values		
Compared to …			**Mean**	**Std Dev**	**ANOVA**	**Welch**	**Brown-Forsythe**
Q13.2	**Q 7**	NWU	2.706	1.448	0.037	0.027	0.022
		UP	3.500	1.291			
		Stellenbosh	4.500	0.577			
		Other	4.143	1.215			

	Compared to …		**Games Howel p value**	**Cohen's d value**
Q13.2	**Q 7**	NWU vs UP	0.715	3.337
		NWU vs Other	0.108	0.992
		UP vs. NWU	0.715	3.337
		UP vs. Stellenbosch	0.551	0.775
		UP vs. Other	0.847	0.498
		Stellenbosch vs. UP	0.551	0.775
		Stellenbosch vs. Other	0.910	0.294
		Other vs NWU	0.108	0.992
		Other vs UP	0.847	0.498
		Other vs Stellenbosch	0.910	0.294

`

					p values		
Compared to …			Mean	Std Dev	ANOVA	Welch	Brown-Forsythe
Q3	Q 7	NWU	3.951	3.324	0.001	0.003	0.001
		UP	6.357	3.543			
		Stellenbosh	8.545	3.387			
		Other	5.700	3.385			

	Compared to …		Games Howel p value	Cohen's d value
Q3	Q 7	NWU vs UP	0.148	0.679
		NWU vs Other	0.144	0.517
		UP vs. NWU	0.148	0.679
		UP vs. Stellenbosch	0.415	0.618
		UP vs. Other	0.937	0.185
		Stellenbosch vs. UP	0.415	0.618
		Stellenbosch vs. Other	0.117	0.840
		Other vs NWU	0.144	0.517
		Other vs UP	0.937	0.185
		Other vs Stellenbosch	0.117	0.840

`

					p values		
Compared to …			**Mean**	**Std Dev**	**ANOVA**	**Welch**	**Brown-Forsythe**
Q10.1	**Q 7**	NWU	3.136	1.490	0.012	0.013	0.004
		UP	4.125	0.991			
		Stellenbosh	4.250	0.957			
		Other	2.400	1.465			

	Compared to …		**Games Howel p value**	**Cohen's d value**
Q10.1	**Q 7**	NWU vs UP	0.192	0.664
		NWU vs Stellenbosh	0.305	0.748
		NWU vs Other	0.383	0.494
		UP vs. NWU	0.192	0.664
		UP vs. Stellenbosch	0.996	0.126
		Stellenbosch vs. NWU	0.305	0.748
		Stellenbosch vs. UP	0.996	0.126
		Other vs NWU	0.383	0.494

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					p values		
Compared to …			Mean	Std Dev	ANOVA	Welch	Brown-Forsythe
Q10.6	Q 7	NWU	2.867	1.279	0.405	0.187	0.453
		UP	2.500	1.761			
		Stellenbosh	2.000	0.866			
		Other	2.765	1.562			

	Compared to …		Games Howel p value	Cohen's d value
Q10.6	Q 7	NWU vs UP	0.960	0.208
		NWU vs Stellenbosh	0.124	0.677
		NWU vs Other	0.996	0.065
		UP vs. NWU	0.960	0.208
		UP vs. Stellenbosch	0.914	0.284
		UP vs. Other	0.987	0.150
		Stellenbosch vs. NWU	0.124	0.677
		Stellenbosch vs. UP	0.914	0.284
		Stellenbosch vs. Other	0.395	0.873
		Other vs NWU	0.996	0.065
		Other vs UP	0.987	0.150
		Other vs Stellenbosch	0.395	0.873

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					p values		
Compared to …			Mean	Std Dev	ANOVA	Welch	Brown-Forsythe
Q10.10	Q 7	NWU	2.842	1.708	0.526	0.551	0.532
		UP	3.200	1.789			
		Stellenbosh	2.143	1.676			
		Other	3.333	1.414			

	Compared to …		Games Howel p value	Cohen's d value
Q10.10	Q 7	NWU vs UP	0.976	0.200
		NWU vs Stellenbosh	0.785	0.409
		NWU vs Other	0.853	0.288
		UP vs. NWU	0.976	0.200
		UP vs. Stellenbosch	0.734	0.591
		UP vs. Other	0.999	0.075
		Stellenbosch vs. NWU	0.785	0.409
		Stellenbosch vs. UP	0.734	0.591
		Stellenbosch vs. Other	0.464	0.710
		Other vs NWU	0.853	0.288
		Other vs UP	0.999	0.075
		Other vs Stellenbosch	0.464	0.710

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					p values		
Compared to …			Mean	Std Dev	ANOVA	Welch	Brown-Forsythe
Q10.13	Q 7	NWU	2.652	1.152	0.539	0.434	0.526
		UP	2.182	0.874			
		Stellenbosh	2.750	1.165			
		Other	2.800	1.207			

	Compared to …		Games Howel p value	Cohen's d value
Q10.13	Q 7	NWU vs UP	0.560	0.408
		NWU vs Stellenbosh	0.997	0.084
		NWU vs Other	0.982	0.122
		UP vs. NWU	0.560	0.408
		UP vs. Stellenbosch	0.660	0.488
		UP vs. Other	0.445	0.512
		Stellenbosch vs. NWU	0.997	0.084
		Stellenbosch vs. UP	0.660	0.488
		Stellenbosch vs. Other	1.000	0.041
		Other vs NWU	0.982	0.122
		Other vs UP	0.445	0.512
		Other vs Stellenbosch	1.000	0.041

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					p values		
Compared to …			Mean	Std Dev	ANOVA	Welch	Brown-Forsythe
Q13.2	Q 7	NWU	2.706	1.448	0.037	0.027	0.022
		UP	3.500	1.291			
		Stellenbosh	4.500	0.577			
		Other	4.143	1.215			

	Compared to …		Games Howel p value	Cohen's d value
Q13.2	Q 7	NWU vs UP	0.715	3.337
		NWU vs Other	0.108	0.992
		UP vs. NWU	0.715	3.337
		UP vs. Stellenbosch	0.551	0.775
		UP vs. Other	0.847	0.498
		Stellenbosch vs. UP	0.551	0.775
		Stellenbosch vs. Other	0.910	0.294
		Other vs NWU	0.108	0.992
		Other vs UP	0.847	0.498
		Other vs Stellenbosch	0.910	0.294

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					p values		
Compared to …			Mean	Std Dev	ANOVA	Welch	Brown-Forsythe
Q13.5	Q 7	NWU	3.875	1.356	0.663	0.504	0.472
		UP	3.750	1.258			
		Stellenbosh	4.500	0.707			
		Other	3.125	1.642			

	Compared to …		Games Howel p value	Cohen's d value
Q13.5	Q 7	NWU vs UP	0.998	0.549
		NWU vs Stellenbosh	0.807	1.239
		NWU vs Other	0.754	0.993
		UP vs. NWU	0.998	0.549
		UP vs. Stellenbosch	0.792	0.775
		UP vs. Other	0.882	0.498
		Stellenbosch vs. NWU	0.807	1.239
		Stellenbosch vs. UP	0.792	0.775
		Stellenbosch vs. Other	0.384	0.294
		Other vs NWU	0.754	0.993
		Other vs UP	0.882	0.498
		Other vs Stellenbosch	0.384	0.294

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					p values		
Compared to …			Mean	Std Dev	ANOVA	Welch	Brown-Forsythe
Q13.10	Q 7	NWU	2.263	1.327	0.740	0.162	0.147
		UP	3.200	1.095			
		Stellenbosh	1.571	1.134			
		Other	2.467	1.246			

	Compared to …		Games Howel p value	Cohen's d value
Q13.10	Q 7	NWU vs UP	0.422	0.706
		NWU vs Stellenbosh	0.570	0.521
		NWU vs Other	0.967	0.153
		UP vs. NWU	0.422	0.706
		UP vs. Stellenbosch	0.126	1.436
		UP vs. Other	0.615	0.589
		Stellenbosch vs. NWU	0.570	0.521
		Stellenbosch vs. UP	0.126	1.436
		Stellenbosch vs. Other	0.377	0.719
		Other vs NWU	0.967	0.153
		Other vs UP	0.615	0.589
		Other vs Stellenbosch	0.377	0.719

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					p values		
Compared to …			Mean	Std Dev	ANOVA	Welch	Brown-Forsythe
Q13.13	Q 7	NWU	3.571	0.787	0.297	0.474	0.539
		UP	2.500	2.121			
		Stellenbosh	4.500	0.707			
		Other	2.750	1.500			

	Compared to …		Games Howel p value	Cohen's d value
Q13.13	Q 7	NWU vs UP	0.889	0.505
		NWU vs Stellenbosh	0.539	1.180
		NWU vs Other	0.750	0.548
		UP vs. NWU	0.889	0.505
		UP vs. Stellenbosch	0.685	0.943
		UP vs. Other	0.998	0.118
		Stellenbosch vs. NWU	0.539	1.180
		Stellenbosch vs. UP	0.685	0.943
		Stellenbosch vs. Other	0.342	1.167
		Other vs NWU	0.750	0.548
		Other vs UP	0.998	0.118
		Other vs Stellenbosch	0.342	1.167

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					p values		
Compared to …			Mean	Std Dev	ANOVA	Welch	Brown-Forsythe
Q13.15	Q 7	NWU	2.450	1.432	0.184	0.079	0.134
		UP	1.500	0.837			
		Stellenbosh	3.000	1.333			
		Other	2.286	1.267			

	Compared to …		Games Howel p value	Cohen's d value
Q13.15	Q 7	NWU vs UP	0.222	0.664
		NWU vs Stellenbosh	0.729	0.384
		NWU vs Other	0.985	0.115
		UP vs. NWU	0.222	0.664
		UP vs. Other	0.392	0.620
		Stellenbosch vs. NWU	0.729	0.384
		Stellenbosch vs. Other	0.561	0.536
		Other vs NWU	0.985	0.115
		Other vs UP	0.392	0.620
		Other vs Stellenbosch	0.561	0.536

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					p values		
Compared to …			**Mean**	**Std Dev**	**ANOVA**	**Welch**	**Brown-Forsythe**
Q13.17	**Q7**	NWU	2.556	1.333	0.981	0.943	0.983
		UP	2.667	2.082			
		Stellenbosh	2.333	0.577			
		Other	2.714	1.380			

	Compared to …		**Games Howel p value**	**Cohen's d value**
Q13.17	**Q 7**	NWU vs UP	1.000	0.053
		NWU vs Stellenbosh	0.977	0.167
		NWU vs Other	0.995	0.115
		UP vs. NWU	1.000	0.053
		UP vs. Stellenbosch	0.992	0.160
		UP vs. Other	1.000	0.023
		Stellenbosch vs. NWU	0.977	0.167
		Stellenbosch vs. UP	0.992	0.160
		Stellenbosch vs. Other	0.924	0.276
		Other vs NWU	0.995	0.115
		Other vs UP	1.000	0.023
		Other vs Stellenbosch	0.924	0.276

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					p values		
Compared to …			Mean	Std Dev	ANOVA	Welch	Brown-Forsythe
Q13.18		NWU	2.900	1.370	0.896	0.927	0.906
		UP	3.250	1.708			
		Stellenbosh	3.333	1.528			
		Other	2.667	1.506			
	Compared to …				Games Howel p value		Cohen's d value
Q13.18	Q 7	NWU vs UP			0.981		0.205
		NWU vs Stellenbosh			0.967		0.284
		NWU vs Other			0.989		0.155
		UP vs. NWU			0.981		0.205
		UP vs. Stellenbosch			1.000		0.049
		UP vs. Other			0.942		0.342
		Stellenbosch vs. NWU			0.967		0.284
		Stellenbosch vs. UP			1.000		0.049
		Stellenbosch vs. Other			0.921		0.436
		Other vs NWU			0.989		0.155
		Other vs UP			0.942		0.342
		Other vs Stellenbosch			0.921		0.436

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					p values		
Compared to …			Mean	Std Dev	ANOVA	Welch	Brown-Forsythe
Q20	Q 7	NWU	5.543	1.336	0.076	0.086	0.047
		UP	6.455	0.934			
		Stellenbosh	6.375	1.061			
		Other	6.080	1.152			

	Compared to …		Games Howel p value	Cohen's d value
			Q 7	Q20
Q20	Q 7	Q20		
		NWU vs Other	0.352	0.402
		UP vs. Stellenbosch	0.998	0.075
		UP vs. Other	0.734	0.325
		Stellenbosch vs. NWU	0.276	0.623
		Stellenbosch vs. UP	0.998	0.075
		Stellenbosch vs. Other	0.906	0.256
		Other vs NWU	0.352	0.402
		Other vs UP	0.734	0.325
		Other vs Stellenbosch	0.906	0.256