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ABBREVIATIONS

CED	Centres for entrepreneurship development
DFI	Direct foreign investment
EDP	Entrepreneurship development programmes
FEA	Firm entrepreneurial activity
GEM	Global Entrepreneurship Monitor programme
GDP	Gross domestic product
HTSF	High technology small firms
IT	Information technology
ITC	Indigenous technological capability
ITI	Institute of technological Innovation
JSE	Johannesburg Stock Exchange
KZN	Province of KwaZulu-Natal in the Republic of South Africa
ME	Mature enterprise
MEM	Masters degree in Engineering Management
MIT	Massachusetts Institute of Technology
MOT	Masters degree in Technology Management
MPM	Masters degree in Project Management
NGO	Non-government organisations
NVCP	New venture creation process
OECD	Organization for Economic Cooperation and Development
P1-P3	Proposition 1 to 3
R & D	Research and development
RSA	Republic of South Africa
SMB	Small and medium businesses
SME	Small and medium enterprises
SMME	Small, medium and micro enterprises
STBF	Small technology-based firms
TE	Technological entrepreneur
TEA	Total entrepreneurial activity
TI	Technological innovation
UK	United Kingdom
USA	United States of America
VC	Venture capital

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CHAPTER ONE

INTRODUCTION

CHAPTER ONE

INTRODUCTION

'Entrepreneurship is neither a science nor an art. It is a practice'.

Peter F. Drucker (2001).

1.1 BACKGROUND

It is widely accepted that technology is an important ingredient in any nation's ability to prosper and compete within the global economy. Technology has been described as *'...the engine of economic growth…'* (Research Framework, Institute of Technological Innovation (ITI) 1998:7), which emphasises two critical aspects: Firstly, the core position of technology relative to other role players in the economy and secondly, the importance of growth. The latter aspect leads to the concept of innovation and more specifically technological innovation, which is described in the same publication as *'…the mechanism through which technology can be leveraged to create wealth and to contribute towards a better quality of life'* (Research Framework, ITI 1998:1).

In order to foster these concepts into full-blown and active role players, the endeavours of already established businesses to maintain technological supremacy alone, will not be enough to satisfy the growth requirements. According to Jones (1971:7) this scenario is particularly true for emerging economies, where growth needs are more demanding than in developed countries. A consistent stream of new entrants (entrepreneurs) is required to participate in the economic activities and to satisfy these needs.

South Africa is a classic example of an emerging economy where the critical role of technological innovation has been identified. The White Paper on Science and Technology, 'Preparing for the 21st Century', which was published in 1996 by the then South African Department of Arts, Culture, Science and Technology, proclaimed that 'This White Paper is built upon the twin concepts of 'innovation' and a 'national system of innovation' i.e. NSI', as quoted by the Research Framework, ITI (1998:8).

In addition, the tendency in the global economy is for developed countries to become more services orientated and to source production and manufacturing activities out to emerging economies (Wagner 1997:6). This sets the scene for emerging regions like South Africa to fully grasp the opportunities as part of their drive towards economic growth and prosperity well into the new millennium.

1.2 HISTORICAL DEVELOPMENT AND THE CURRENT STATE OF TECHNOLOGICAL ENTREPRENEURSHIP

1.2.1 Historical perspective

Entrepreneurship is a well-researched and documented term used in the management and business world today. Several pioneers from a wide variety of disciplinary backgrounds have researched and formulated theories on this topic. A research into the history of the term 'entrepreneur' by Herbert & Link (1988) traces it in the writings of Richard Cantillon as far back as 1755 when he used the term to describe *'…someone who exercises business judgement in the face of uncertainty'*.

Another early reference to the term 'entrepreneur' was made by the French economist J.B. Say around the late 1800's according to Drucker (2001:19). Names like Shapero, Schollhammer, McClelland, Timmons, Roberts, Drucker, Vesper, Carland, Gumpert and Sloan (Timmons 1994:189) are all synonymous with the term and theory of entrepreneurship but, arguably, Schumpeter's (1936) work in the early part of the twentieth century laid the foundation in this field.

Drucker (2001:12) cited Schumpeter's early views on the entrepreneurs as follows: '*Schumpeter was the first '…major modern economist … (who)… concerned himself with the entrepreneur and his impact on the economy'.*

Contributions towards the theory and knowledge of entrepreneurs and entrepreneurship were made by a diverse set of scholars with backgrounds in education, finance, history, marketing, agriculture, economics, psychology, sociology, political science, communications, engineering and anthropology. Despite the vast number of published papers, Bull, Thomas & Willard (1995:1) argue that no generally accepted theory of entrepreneurship has emerged to date. Several reasons are tabled for this phenomenon of which the most significant are Wortman's (1992) arguments that (a) the (entrepreneurship) field lacks sufficient framework to cut across disciplines and (b) the tendency of researchers to ignore entrepreneurship studies in other disciplines. Shane and Venkataraman (2000) acknowledge this lack of framework and propose a conceptual framework as follows:

- They define the field of entrepreneurship as *'the scholarly examination of how, by whom, and with what effects opportunities to create future goods and services are discovered, evaluated, and exploited'* (Shane et al 2000:218);
- They explain why organizational researchers should study entrepreneurship;
- They describe why entrepreneurial opportunities exist and why some people, and not others, discover and exploit those opportunities; and
- They consider the different modes of exploitation of entrepreneurial opportunities.

In another effort to produce such a general theoretical framework, Bull et al (1995:2) group the existing literature into five broad categories namely:

- *Definition* of the entrepreneur and entrepreneurship;
- The *trait approach* i.e. the study of the psychological traits of people identified as entrepreneurs;
- *Success strategies* which is the study of reasons offered to explain the success of the new and existing business ventures;
- Study of the *formation of new venture*; and
- The effect of *environmental factors* on entrepreneurial actions.

The complete theoretical spectrum on entrepreneurship will be explored later in Chapter 2, but the five-category framework of Bull et al (1995) above will be used as the basis for the research approach of this study.

Another key concept in this research project is the term 'technology', which is linked to entrepreneurship to form the focal point or study object i.e. technological entrepreneur.

Technology has been described as the application of science to achieve industrial or commercial objectives, where it constitutes the entire body of methods and materials used to achieve such objectives (Buys 2000:2). The same source describes technology as the utilisation of technical knowledge (equipment, materials, processes or systems based on natural sciences) through techniques to perform some useful function i.e. in the transport, communication, design, manufacture or services sectors.

The term technology is perhaps best described by Jones (1971:5) when he explains the differences between science and technology: *'…Technology is 'know-how' while science is 'know-why'. Science produces knowledge, technology helps to produce wealth'.*

The research subject of this study is entrepreneurs who operate in a high technology business environment and are referred to as high-tech entrepreneurs, technical entrepreneurs or technological entrepreneurs. A new term 'technopreneurs' has also been used in recent international publications (e.g. Nieman et al 2004:39), but the term *technological entrepreneurs* will be used throughout this study.

The foundation for research on this specific category of entrepreneurs was laid by two pioneers, Cooper (1972) and Susbauer (1972), who recorded their research findings at the first symposium in the USA on 'Technical Entrepreneurship' as it was named at the time. Cooper & Komives (1972:1) described (high) technology as follows: *'… (High technology)…. Is a term used to describe companies which*

engage in researching or producing or marketing a product or service which requires a fairly high degree of acknowledged technical sophistication'. Entrepreneurship was described at the same symposium as *'The act of founding a new company where none existed before'* (Cooper et al 1972:1).

The work of Susbauer, Cooper and Komives involved studies of technical entrepreneurs in Austin, State of Texas and several other centres and industries in the USA, including the then infant semiconductor industry. A more concise definition was formulated later in the proceedings as follows (Cooper et al 1972:68): *'…The Technical entrepreneur is the man who actively initiates a company that has a relative large amount of scientific and engineering labour in its final product or service'.*

The most comprehensive research literature found on this topic was recorded by Edward B. Roberts, Professor at the MIT School of Management, Massachusetts (1991). His research on the technology – based industrial development in Boston's famous Route 128 and California's Silicon Valley is invaluable in establishing a sound theoretical basis, backed by a broad spectrum of solid, practical case studies on the topic.

Other authorities on the subject have contributed significantly to the existing knowledge base, for example Smilor & Freese (1991) that is, however, mainly focussed on developed or industrial countries. Limited references and research results are available on technological entrepreneurs in developing regions or in the environment of emerging economies.

1.2.2 The entrepreneurship concept

The focus of researchers up to the early 1980's was on the entrepreneur as the dominant role player in the process of new venture creation. The focus has shifted away from the person towards the entrepreneurial process. A similar shift in focus was evident in the strategic/business policy field in the 70's. In this case the

strategic process was emphasised rather than the roles and functions of the general managers (Bull et al 1995:130).

Early authors such as David C. McClelland and his associates (1967) contributed significantly toward the understanding of the characteristics of entrepreneurs. McClelland's model of the three basic needs in individuals that influence the attainment of economic ends is well documented. These three needs are defined as (1) the need for achievement or *n Ach*, (2) the need for affiliation or *n Affil* and (3) the need for power or *n Pow*.

Roberts (1991:52) proposed a four-factor model of the development of the (technical) entrepreneur. Later authors such as Bolton & Thompson (2000) presented the entrepreneur within the dimensions of *talent*, *temperament* and *technique*. These two models will be explored in more detail later in the literature research. They all focus on the entrepreneur.

Bygrave & Hofer propagated the paradigm shift towards the process, as quoted by Bull et al (1995:130) when they proposed the following working definitions:

- The *entrepreneurial process* involves all the functions, activities and actions associated with perceiving opportunities and the creation of organisations to pursue them.
- The *entrepreneurial event* involves the creation of a new organisation to pursue an opportunity.

Authors such as Bull et al (1995:2), as well as Roberts (1991:30), Bolton et al (2000:18), Timmons (1994:17) and Gnyawali & Fogel (1994:56) all propagated the entrepreneurial process, plus the external or environmental influences on the entrepreneur and the process. Again, all these theories will be analysed in depth later. The importance of these examples during the introduction is to note that the term *entrepreneurship* encompasses all of these elements, factors, influences, processes, role players and events into one concept. The entrepreneurship concept used further in this study will therefore consist of the following key elements:

- The *entrepreneur* (person);

- The *new venture creation process* (start-up);
- The *mature business* after start-up;
- The *environmental influences* on all the role players and processes.

1.2.3 Modern perceptions

It is appropriate to view modern perceptions on specific related issues against the historical background of entrepreneurship, technology and technological entrepreneurs' development. The following paradigm shifts will be explored briefly to complete the background setting of the research project:

- The shift in focus from viewing the entrepreneur, or the entrepreneurial process, or the entrepreneurial event as individual entities, to a more holistic approach.
- The realisation that innovation and entrepreneurship are disciplines on their own, with their own, fairly simple rules.
- The international trend to move away from reference terms such as 'Third World' to 'Developing Countries' and more recently 'Emerging Economies or Countries'.

Despite the free enterprise revolution that is sweeping the world, there seem to be a reluctance to explore, understand and promote entrepreneurs and entrepreneurship according to Bull et al (1995). Former Soviet Republics are transforming centrally planned economies into free markets; South American countries are privatising large sectors of their nationalised industries; and the last major communist bastion, China, has embarked on the road to free enterprise. Yet students to date have not been able to universally define the ideal entrepreneurial profile.

Furthermore, economists, business academics and especially mathematicians have been unable to fully explain the rise of the entrepreneur and the business enterprise. Bull et al (1995:130) argue that one possible reason is the intractability of entrepreneurship to 'classical' mathematical economics. Schumpeter's (1936) remark that the entrepreneur destroys the equilibrium with a *'perennial gale of*

creative destruction' is perhaps the reason for the uneasiness of mathematicians in a world of quantitative models that are based on analytical and continuous functions.

The trend in the 1990's has therefore been to focus entrepreneurship research away from the entrepreneur itself toward the entrepreneurial process and later to approach the concept of entrepreneurship from a holistic point of view.

Peter F. Drucker (2001) played a major role in the United States of America (USA) in formulating management theories in the years 1950 – 2000. He explored the entrepreneur as an 'innovator'. His persistent view was that up until the early 1980's, most prominent businesses in the Western World *'…believed that innovation is inspiration and entrepreneurship good luck'*. He argued that the successful Japanese firms had re-organised their innovative and entrepreneurial activities during the early 1990's and established the principle that innovation, like entrepreneurship, is a practice with simple purposeful and systematic rules. They are disciplines in their own right that can be mastered through learning, practice and hard work. This research project uses the principles advocated by Drucker (2001) as one of its theoretical cornerstones.

The last modern perception that forms part of the research topic is the focus on emerging economies. Heeks, Bhatt, Huq, Lewis & Shibli (1995:1) expressed the opinion that the term 'Third World' although still in common usage may be of declining value as *'…its apparent homogeneity hides a great range of differences'.* Large discrepancies in recent economic growth rates of regions such as Asia (South Korea, Taiwan and Malaysia), Latin America (Brazil and Argentina) and sub-Saharan Africa have highlighted the need for a more descriptive and refined classification. Hence the increasingly popular reference to 'developing countries' or 'emerging economies' by politicians, academics and journalists. Developing versus developed countries are generally classified by using yardsticks such as Gross National Product (GNP) per head (Jones 1971:2), which again is rigid and non-refined when used for specific reference purposes.

The more appropriate modern and flexible term ‘emerging’ will be used in this study, which refers to the dynamic, upward movement of any entity such as a country, community, economy, market etc.

1.3 RATIONALE FOR THE STUDY

1.3.1 The importance of the study

The importance of this research can best be illustrated by examining several examples where the lack of or inadequate development of entrepreneurship in the technological world has resulted in poor economic performances of industries, business sectors or even countries.

The modern world has witnessed the dramatic growth and phenomenal emergence of the information technology (IT) industry over the past two decades. Young millionaires from the IT industry dictating international stock markets captured the imagination of technological entrepreneurs worldwide. Examples are the high-tech entrepreneurs from Silicon Valley to whom Drucker (2001:11) refers to as ‘from rags to riches and back to rags again in five years’. He regards them as inventors rather than innovators, speculators rather than entrepreneurs. The instant success of these idols in the traditional business world inspired many technically trained participants in the economies of most developed and emerging regions to become IT entrepreneurs.

The rise of this industry was surpassed by its collapse during the first few months of the new millennium. The effect of the poor performing IT sector was one of the major influences in the steep and continuous decline of stock markets during the same period. One explanation for this ‘rise and fall’ phenomenon is that the IT entrepreneurs were technically competent, well-trained in their disciplines and that they spotted and seized the opportunities which presented themselves. However, they lacked sufficient training, work experience and exposure to entrepreneurship and to a lesser degree small business management skills. Many of these participants could also be classified as opportunists rather than entrepreneurs.

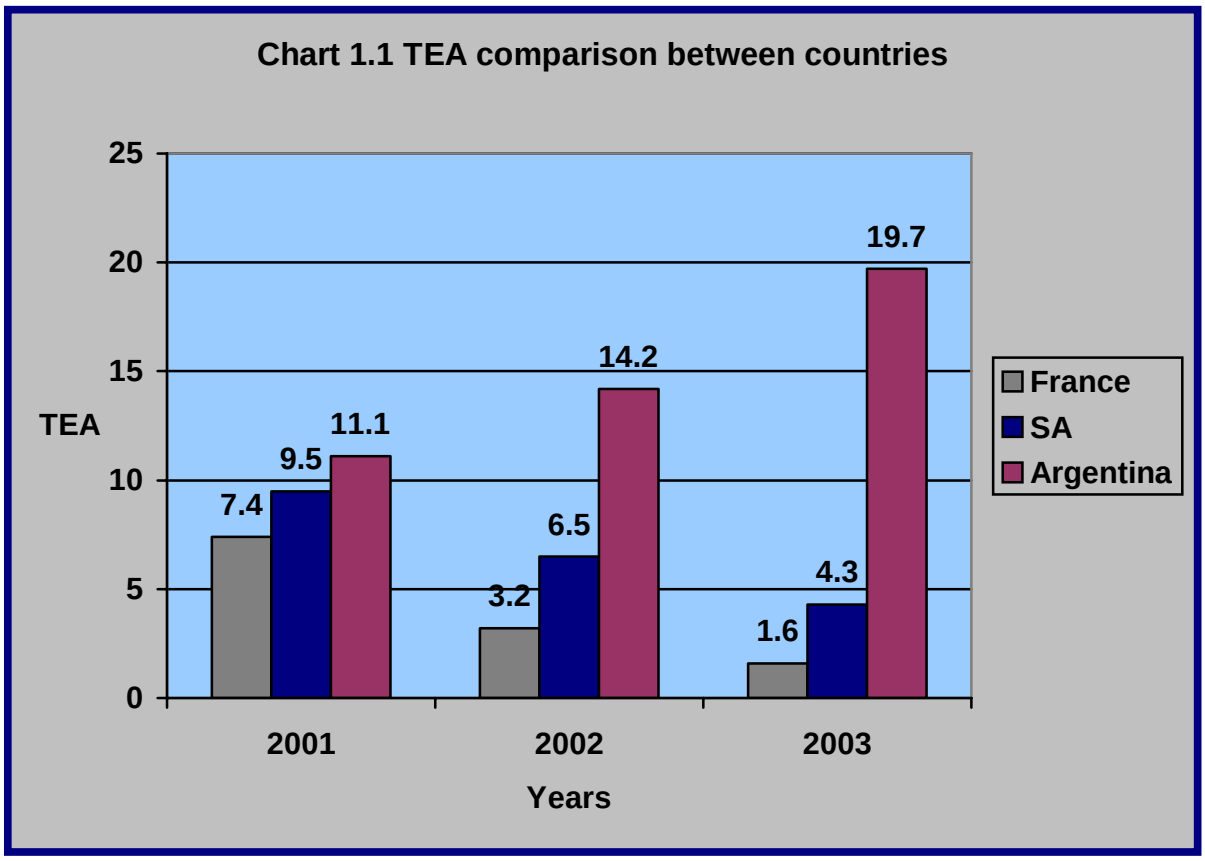
1.3.2 A South African perspective

In South Africa, which is by modern standards classified as an emerging or developing economy, the level of entrepreneurship has been measured since 2001 as part of the Global Entrepreneurship Monitor (GEM) programme. This programme was launched in 1999 with ten countries and in 2003 encompassed over 40 countries with a combined total population of 4-billion, nearly two thirds of the world's total population (GEM 2003:3). GEM 2002 measured the entrepreneurial activities of 37 countries (GEM 2002:2) in accordance with a universal set of indicators and research methodologies. Of the 37 countries participating in the programme in 2002, seven were classified as developing or emerging countries, while the rest form part of the developed world. South Africa was also the only country from Africa to participate in the programme until 2002. The following statistics were released by the 2002 GEM report on South Africa:

- The official unemployment rate was 29.4%;
- Only 6.5% of the country's adult (working age) population was involved in entrepreneurial ventures, which is measured as the *Total Entrepreneurial Activity (TEA) index;*
- Informal entrepreneurs do 88% and formal 12% of all business in previously disadvantaged communities**.** The term previously disadvantaged refers to population groups who were disadvantaged during the so-called 'apartheid' era in the country's political history;
- Two thirds of informal entrepreneurs do not have a senior certificate at high school level (Grade 12 at secondary education level);
- The country measures high in necessity entrepreneurship but very low in opportunity entrepreneurship. A necessity entrepreneur is involved in a new business because he/she has no other choice for work, while an opportunity entrepreneur is involved to pursue an opportunity;
- The start-up firm versus newly established firm participation ratio of South Africa measured 2.4:1 compared to the 1.3:1 average of the rest of the participating countries. This indicates that South Africa has a higher than normal failure rate of businesses after the start-up phase;

- South Africa is ranked 19th overall on the TEA index, with Thailand rated first and Japan 37th;
- South Africa is also rated last of the seven developing or emerging countries (after Thailand, India, Chile, Argentina, Brazil and Mexico).

The 2003 GEM survey shows a decline in the entrepreneurial activities of South Africa compared to other countries, as shown in Chart 1.1.



Source: GEM (2003)

The following is a summary of the findings (GEM 2003:3):

- South Africa's TEA rate has fallen from 6.5% in 2001/2 to 4.3% in 2003. The GEM average for all the countries was 8.8% in 2003;
- South Africa's ranking has also fallen to 22nd out of 32 countries;
- South Africa ranks last again of the six developing countries (after Brazil, Chile, Argentina, Venezuela and Uganda);

- Uganda, which is the second African country participating in the survey in 2003, had a TEA index of 29.3% and was the highest of all developing and developed countries;
- South Africa's TEA index of 4.3% is substantially lower than the average of 21.2% of the developing countries (excluding South Africa);
- 41% of entrepreneurs in developing countries are motivated by necessity, while only 34% of South Africa's entrepreneurs are motivated by necessity. The average for the G7 countries in the survey is 16%;
- The start-up rate in South Africa has also fallen from 4.7% in 2002 to 2.7% in 2003, compared to the average of 12.8% of developing countries;
- Another key measurement in the GEM is the *Firm Entrepreneurial Activity (FEA)* index (GEM 2003:9), which is a harmonised measure of the proportion of existing firms in each country that are both innovating (introducing new products or services) and that have high short-term employment growth expectations. Again, South Africa ranked lowest of all the developing countries with a FEA index of 1.1 versus the average of 2.7;
- In the adult population survey, there is evidence that South African respondents are not only less likely to report characteristics associated with entrepreneurial activity (such as the belief that you have skills to start a new business), but they are also less likely to report that entrepreneurship is perceived positively in the country as a whole (GEM 2003:11).

The entrepreneurial activities of developing or emerging countries are generally higher than those of industrialized or developed countries. Table 1.1 illustrates this difference, as well as South Africa's low TEA index compared with the other developing countries.

Table 1.1: Percentage 18-64 year olds active in starting a business or in owner-managing a business less than 3.5 years old

Country	2001	2002	Average
Argentina	10.5	14.2	12.3
Brazil	12.4	13.5	13.0
India	11.1	17.9	14.5
Mexico	19.7	12.4	16.1
South Africa	9.5	6.5	8.0
All GEM developing countries	12.0	14.2	13.1
All GEM countries	8.4	8.0	8.2

Source: GEM (2003:8).

Interesting findings emerged from the expert's survey conducted as part of GEM 2003. The most important factors limiting entrepreneurship activities in South Africa were identified by the experts as follows:

- Financial support, specifically the availability, accessibility and structure of debt capital, loans and credit (24%);
- Education and training, specifically teaching and encouragement of entrepreneurship skills amongst teenagers and adults in secondary and post-secondary teaching institutions (12%);
- Cultural and social norms, specifically attitudes to women and other discriminated or disadvantaged groups (12%);
- Capacity in society for entrepreneurship, specifically lack of entrepreneurial expertise (12%).

Although the 2003 GEM survey indicates a decline in the entrepreneurial activities since its first participation in 2001, the 2004 survey suggests that South Africa's ranking within GEM has stayed the same since its inclusion (GEM 2004:3). The country consistently ranks in the group of countries with mid- to low TEA rates; data also suggests that annual variations in TEA in South Africa are not significant. This supports the confidence level in the research data published by the GEM report.

The 2004 GEM survey supports the findings of previous years as follows (GEM 2004:10): South Africa has lower than average TEA rates and has significantly lower TEA rates than developing countries on average. In 2004 the average TEA rate for developing countries (including South Africa) was almost four times higher than that in South Africa. In 2003 the average developing country TEA was five times higher than in South Africa.

The statistics above are examples of the necessity to improve entrepreneurial activities in an emerging country like South Africa. The GEM report (2002:5) suggests that the way forward should include:

- Increasing access to and success in secondary and tertiary education will ensure a higher rate of entrepreneurial activity among future generations of South Africans;
- To increase economic growth and employment creation, South Africa needs a higher proportion of entrepreneurs to progress beyond the start-up phase.

GEM 2003 (2003:13) suggests two priorities for South African policy makers:

- Changes in the school education system are required to raise entrepreneurial awareness and create a good grounding in basic financial and business skills;
- Effective training in specific financial administration skills is required on a fairly large scale amongst existing entrepreneurs.

The GEM 2004 report highlights the importance of education for entrepreneurship as follows (GEM 2004:4): *'Preliminary research suggests that entrepreneurship education can have a significant positive influence on four areas crucial to entrepreneurship:*

- *Learners' self-confidence about their ability to start a business;*
- *Learners' understanding of financial and business issues;*
- *Learners' desire to start their own business; and*
- *Learners' desire to undertake higher education'.*

The direct relationship between entrepreneurial success and level of education correlates well with the findings of Roberts (1991:60) in his research of technological entrepreneurs in the USA. His studies indicate that more than 40% of his research population had post high school education.

The most recent findings of GEM (2005) compare technological innovation levels in South Africa with those of the developed and emerging world. Globally, higher levels of use of new technologies are reported by early-stage entrepreneurs in developing countries (30%) than by their counterparts in developed countries (13%). The use of new technologies (less than one year old) reported by South African owner-managers declined from 28% in 2003 to 0% in 2005, while the use of old technologies (more than one year old) increased from 72% in 2003 to 100% in 2005. This suggests that owner-managed firms in South Africa are significantly

less likely to use the latest technology than entrepreneurs in both the developed and developing countries. Three reasons are given for this decline (GEM 2005:34):

- High cost of new technology;
- Lack of science and technology skills of the South African population; and
- Time lag in building new technology into products and services.

Another source that illustrates the importance of research of this nature is the South African Innovation Survey 2001 (Oerlemans, Pretorius, Buys & Rooks 2003:11). A survey was conducted by the University of Pretoria, in collaboration with the Eindhoven University of Technology in the Netherlands, on the innovative behaviour and performance of South African firms in the manufacturing and services sectors for the period 1998–2000. The following is a summary of the main findings of the survey:

- About 58% of the firms were manufacturing firms, whereas 23% were service providers and 19% of the firms were involved in wholesale activities;
- The majority of firms were small to medium-sized organisations, where only 7% of the firms employed 250 or more employees in 2000;
- About 22% of the firms involved in the production of products or services were using foreign sources of production technology (e.g. production licences);
- About 44% of South African firms had technological innovations in the period 1998–2000. This figure is high for a developing country and comparable to that of many developed countries in Europe;
- A relatively large part of the development of new or improved products and/or services was done by or together with a third party (32%), indicating a dependency on external knowledge and contributions;
- About 51% of firms have not implemented any R & D activities. This figure is very high compared to European countries;
- About 18% of innovating firms actively work together with South African partners on innovation, which is significantly lower than the proportion of European firms that form partnerships;
- About 26% of innovating firms participated in innovation partnerships with organisations outside South Africa, particularly with firms located in Europe; and

- About 31% of innovative firms reported that their relative market position improved substantially due to their innovative activities, which is comparable to European levels.

The survey reported further that about 40% of innovating firms experienced seriously delayed innovation projects due to:

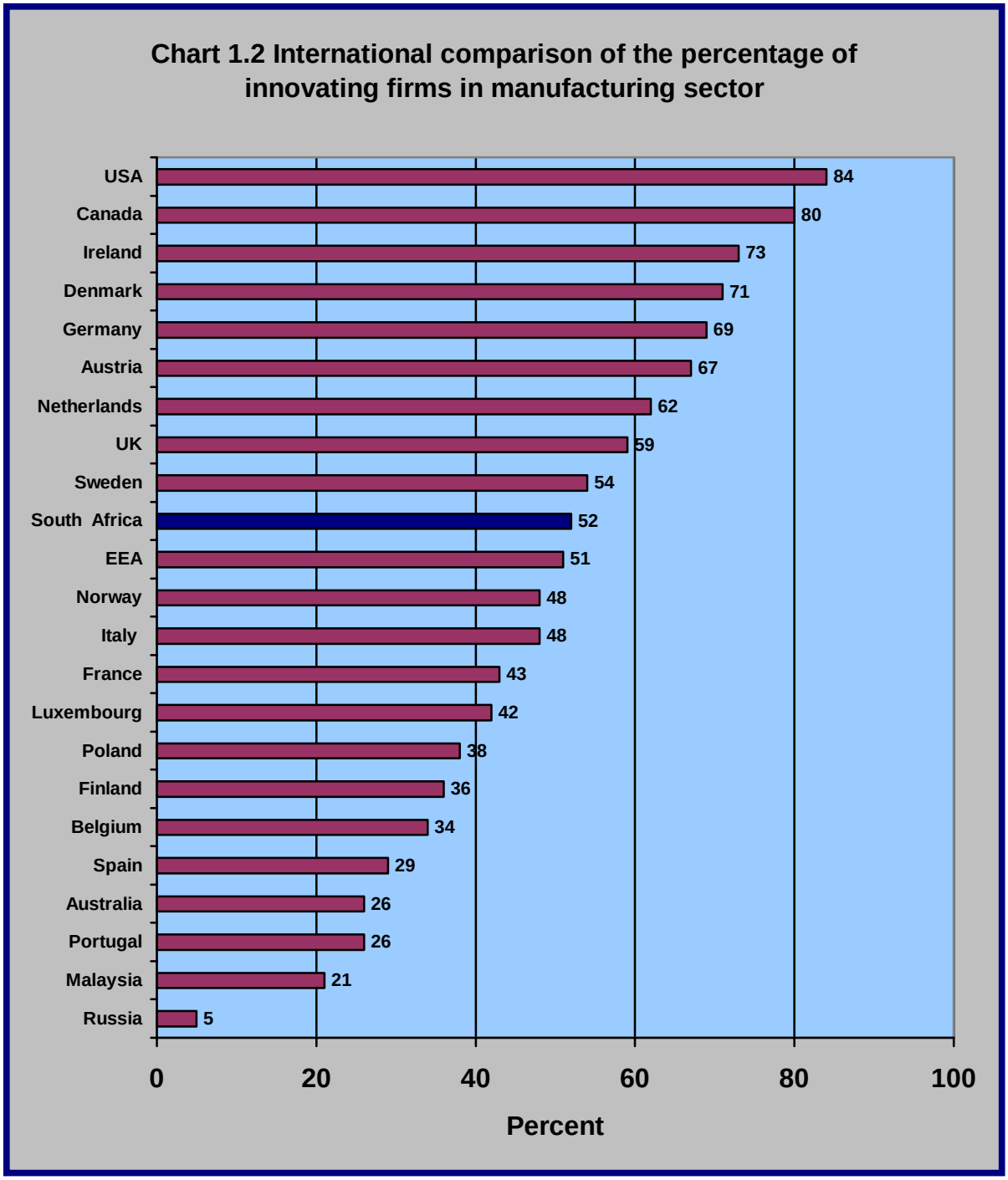
- A lack of qualified personnel;
- A lack of information/familiarity with technologies;
- High costs;
- Economic risks;
- Shortage of financial resources;
- Time constraints; and
- Market problems.

The innovation propensity of South African firms is comparable to that of many developed countries in Europe. It is higher than that of Eastern and South European countries and countries in the Far East such as Australia and Malaysia, although not as high as some countries in Europe and North America.

The international comparison of innovating percentages in manufacturing sector is given in Chart 1.2.

The survey concluded its findings as follows (Oerlemans et al 2003:12): *'In conclusion, the South African industry can be characterised as being predominantly engaged in the improvement of products and processes using foreign technology. South Africa can therefore be characterised as a type of technological colony, whose industries are dependent on foreign technology for the improvement of its products and processes. The primary mode of innovation seems to be imitation rather than invention'.*

The increasing importance over the last three decades of technology versus other resources, measured in terms of its contribution to the GDP, is highlighted by the resource index comparison given in Table 1.2.



Source: Oerlemans et al (2003:98).

Table 1.2: Percentage contributions by resources to South Africa's GDP growth over the past three decades

Decade	Growth in real GDP	Contribution by labour	Contribution by capital	Contribution by technology
1970's	3.21%	1.17%	1.55%	0.49%
1980's	2.20%	0.62%	1.24%	0.34%
1990's	0.94%	-0.54%	0.41%	1.07%

Source: Mohr (1998).

The influence of culture on the entrepreneurship domain is another cornerstone of this research project. The work of Shane (1993) and Aldrich & Waldinger (1990) has significant relevance. Shane (1993:59) examines the effect of the cultural values of individualism, power distance, uncertainty avoidance, and masculinity on national rates of innovation. His findings suggest that *'…nations may differ in their rates of innovation because of the cultural values of their citizens'.* In their research on ethnicity and entrepreneurship, Aldrich et al (1990:111) examine various approaches to explaining ethnic enterprise, using a framework based on three dimensions: an ethnic group's access to opportunities, the characteristics of a group, and emergent strategies. They conclude that *'a common theme pervades research on ethnic business: ethnic groups adapt to the resources made available to their environments, which may vary substantially across societies and over time'.* Frederking (2004:197) supports this notion in a cross-national study of culture and economic activities with findings that *'the structural context of immigration laws, housing and education policies affect the way in which groups organize in the respective neighbourhoods, and it is these patterns of organization that dictate the subsequent relevance of culture in entrepreneurship'.* South Africa is a multi-cultural society with its four prominent ethnic groups, eleven official languages and diverse religious composition (Table 1.3).

The last scenario that is used to illustrate the importance of this research is the work of De Wet (1995), where he discusses the concept of 'technology colonies'. He refers to the many developing countries that gained political independence after World War II, but remained dependant on their host countries for technological 'know-how' and their subsequent long-term economic survival. South Africa was mentioned as an example, where *'…more than 80% of the value in*

*industrial business activity is done under (foreign) licence, and more than 50% of this activity is subject to market constraints' (*De Wet 1995:2).

It is against this background that the critical need arises to create a better understanding of the technological entrepreneurship concept. It is also important for future research efforts to recognise its importance as a major role player in the economies of emerging and multi-cultural nations such as South Africa. New theory and models to enhance the development of technological entrepreneurship need to be explored to supplement the existing knowledge on entrepreneurship in general.

1.3.3 Study population

The importance of establishing a feasible study population which meets the criteria of the research project was identified during the research proposal stage. The study population had to comply with the following primary criteria:

- The study population has to operate in a geographical region which is classified as an emerging economic region;
- The region has to consist of several relatively large cultural population groups;
- The study population of technological entrepreneurs has to operate a business within this region.

Such a region is the province of KwaZulu-Natal, one of the nine provinces of South Africa. It is situated on the east coast of the country and has the following characteristics:

- It has at least four prominent cultural or ethnic groups as well as four major religious groups;
- The province's economical performance is representative of South Africa as an emerging region. It is the second largest contributor to the South African economy (16.6% of GDP) (Statistics SA 2004), has a comparable economic growth rate, with representative sector contribution ratios and a lower than $10,000 per annum per capita income; and

- KwaZulu-Natal is the second most populous province of South Africa and has a no-schooling educational profile of 21.9% (Statistics SA 2004).

Table 1.3: Comparison between KwaZulu-Natal and other economic emerging regions

Category	KwaZulu-Natal	South Africa	Malaysia	Brazil
Population	9.4m	45.5m	24.9m	183.9m
Size (sq km)	0.1m	1.2m	0.3m	8.5m
Prominent ethnic groups	Black 85% Indian 8% White 5% Colour 2%	Black 75% White 14% Colour 9% Indian 3%	Malay 58% Chinese 24% Indian 8% Other 10%	White 55% Mixed 38% Black 6% Other 10%
Religions	Christian 72% Hindu 5% Muslim 2% Other 21%	Christian 68% Muslim 2% Hindu 2% Indigenous 28%	Muslim Budd Daoist Hindu Christian	R. C. 80% Other 20%
Prominent languages	3	11	10	4
Per capita annual income	$2,920	$3,630	$4,520	$3,000
Economic growth rate	2.5%	3.7%	7.1%	4.9%
Sector contribution to GDP	Agriculture 7% Industrial 33% Services 60%	Agriculture 4% Industrial 31% Services 65%	Agriculture 7% Industrial 34% Services 59%	Agriculture 10% Industrial 39% Services 51%

Sources: http://www.statssa.gov.za (2004), http://www.odci.gov/cia/factbook (2005), http://www.worldbank.com (2004).

In order to benchmark the findings of the research project with available and recent data of other emerging countries, a demographic and economic comparison is presented in Table 1.3. Both Malaysia and Brazil can be classified as multi-cultural emerging countries. Recent data on entrepreneurship levels of Brazil is available in the GEM reports and Malaysia's innovative capacity is explored in the South African Innovation Survey (Oerlemans et al 2003). The multicultural profile of each of the four regions in Table 1.3 is clearly illustrated in their respective ethnic composition and prominent religious groups. Although the annual per capita income of KwaZulu-Natal is comparable to those of Brazil and Malaysia, both these countries display significantly higher economic growth rates. As far as entrepreneurial activity is concerned, the TEA of KwaZulu-Natal as measured in GEM (2003:20) is 7.2% versus 6.5% for South Africa and 13.5% for Brazil.

The province is indicated in lime green in the geographical map Figure 1.1.

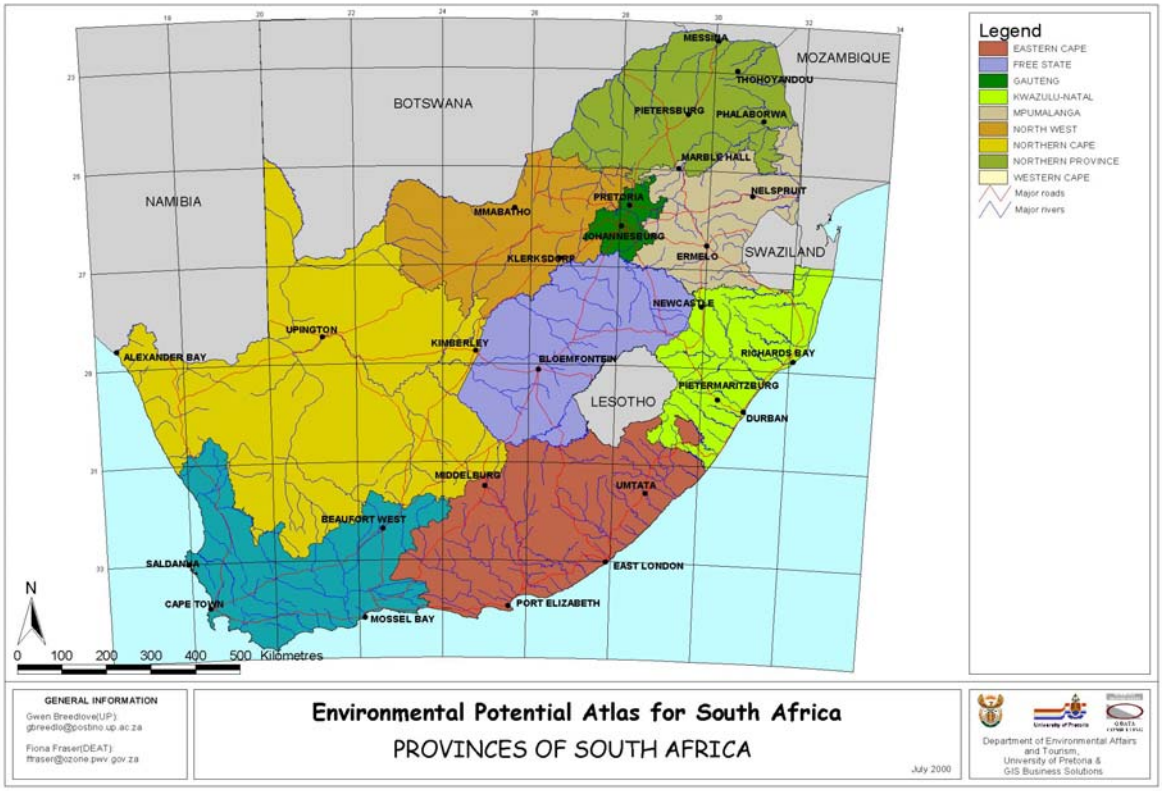


Figure 1.1: Provincial map of South Africa

Source: http://www.safrica.info (2005).

1.3.4 Key challenges

The following key challenges have been identified which concern those involved in the development of entrepreneurial capacity in modern day societies:

1.3.4.1 General entrepreneurship is well researched (Bull et al 1995:2) and development drives have traditionally been directed more towards entrepreneurs in sales and non-technical process or services sectors. The result is that the development of entrepreneurs in the technology intensive sectors is lagging behind.

1.3.4.2 Both modern concepts of technology and entrepreneurship are traditionally and historically foreign to the majority of the population in South Africa and other developing countries, according to Du Preez, Van Eldik, Möhr & Van der

Watt (1996). Specific and unique efforts to educate and train future technological entrepreneurs will be required to ensure that future demands are met.

1.3.4.3 The national education and training model in South African and other developing countries has arguably been structured (historically) to produce technically competent participants in the economy, primarily suitable for employment by large established corporations or formal government institutions (Rwigema et al 2004:15). Entrepreneurship and business management skills were traditionally treated on a post-education 'as-and-when-required' basis. The high failure rate of technology-based business ventures and professional practices (Wagner 1997:8), with the resultant high cost to both individual and the national economies, is evidence of this observation.

1.3.4.4 South Africa and several other developing countries can be referred to as 'Technology Colonies' according to De Wet (1995), due to their position in global production chains. 'Technology Colonies' have traditionally acted as either human resource providers or commodity providers and were importers of foreign developed technologies. The challenge for these importers of technology is to develop their own innovative capabilities and to utilize them for the incubation of local technologies.

1.3.4.5 The legacy of the so-called 'apartheid' policies on the development of South African society is well debated. The influence of these policies on the economic development of the country is significant, especially in the development of entrepreneurship and cultural views on new job creation. The quote by Van Aardt & Van Aardt (as cited by Rwigema et al 2004:14) illustrates this influence on the South African society as follows: *'In general, South Africans are not socialized or educated to become entrepreneurs, but to enter the labour market as employees. In becoming employees, they become consumers of existing jobs instead of creators of new jobs… The trend of people being socialized and educated to become employees appears to be especially true in respect of Africans…'.*

1.3.5 Beneficiaries

The following three groups could benefit from the findings of this research project:

- Institutions;
- Individuals; and
- Regions.

Specific examples of such beneficiaries are:

- The tertiary educational institutions in emerging regions such as Universities, Technikons (Technical Universities) and Technical Colleges which offer technological courses, to enhance their entrepreneurship subject contents;
- Technically trained persons who are potential entrepreneurs but lack the necessary formal training in entrepreneurship and small business management skills in a technological environment;
- Emerging regions in general through an improving climate for technological entrepreneurship and its direct positive effect on economical development, new job and wealth creation;
- Development aid institutions and organisations to improve the efficiency of educational and development aid fund applications; and
- Governments, policy formulating and regulatory bodies to structure their frameworks and guidelines in an optimum manner. This will create a healthy climate for sustained entrepreneurship education and training in the technology-intensive sectors of their economies.

1.4 THE RESEARCH PROBLEM

1.4.1 Statement of the problem

The research problem is formulated as follows:

Limited theory and models are available on technological entrepreneurship in emerging regions.

1.4.2 Statement of the research questions

The research problem can be further categorised into the following three research questions:

The first research question is: *Can the domain of technological entrepreneurship in emerging regions be represented by several entities that are sufficiently inter-correlated to form a basic model?*

The second research question is: *Does the profile of technological entrepreneurs in emerging regions differ from the profile of their counterparts in developed regions and what are the similarities, if any?*

The third research question is: *To what extent does formal education and training in all educational structures in an emerging country such as South Africa enhance the development of technological entrepreneurs?*

1.5 RESEARCH OBJECTIVES

1.5.1 The research objectives

The primary objective of the study is to produce a structured model that would lead to the more effective and efficient development of entrepreneurship in technology-based sectors of countries with emerging economies.

This primary objective is achieved by the following two secondary objectives:

- To create *new theory* on technological entrepreneurship in emerging regions;
- To derive *a model* for the development of technological entrepreneurship in these regions.

1.5.2 Specific research goals

The primary and secondary research objectives are supported by the following specific research goals:

1.5.2.1 To investigate the personality traits of people classified as technological entrepreneurs;

1.5.2.2 To investigate the external influences such as culture, society, education, role models etc. on the development of successful technological entrepreneurs;

1.5.2.3 To collect data on the environmental influences such as technology transfer, business environment, government policies and initiatives etc. on new enterprise formation, as well as on further enterprise development;

1.5.2.4 To investigate the specific influence of entrepreneurship training (or the lack thereof) on the development of technological entrepreneurs by formal educational institutions such as primary and secondary schools, Universities, Technikons and Technical colleges;

1.5.2.5 To compare the research data with those from developed regions and draw some analogies between them;

1.5.2.6 To formulate a model which represents the domain of technological entrepreneurship and simulates the optimum development of the specific form of entrepreneurship in emerging regions such as South Africa;

1.5.2.7 To contribute to the knowledge of and theory on technological entrepreneurs;

1.5.2.8 To identify further research areas and topics in this field; and

1.5.2.9 To formulate recommendations for the implementation of the model, as well as for further research.

1.6 KEY ATTRIBUTES OF THE DESIRED THEORY AND THE DERIVED MODELS

1.6.1 Key attributes

The key attributes of the theory and model proffered in this research project are the following:

1.6.1.1 It consists of a model (a graphical, mathematical or schematic description or analogy of a system of postulates, data and inferences) that represents technological entrepreneurship in emerging regions;

1.6.1.2 The model comprises of the following key entities (properties):

- The entrepreneur;
- The new venture creation process;
- The mature business;
- The environmental factors affecting the entities;

1.6.1.3 The model describes the interaction between the entities, their interrelationships and the relative importance of their influences on each other;

1.6.1.4 The theory and model create new knowledge and a better understanding of the concept of technological entrepreneurship in emerging regions;

1.6.1.5 It proposes pointers to policy makers for the development of technological entrepreneurship in these regions; and

1.6.1.6 It identifies further research areas.

1.6.2 The delimitations

The research project has the following delimitations:

1.6.2.1 Only entrepreneurs operating in a technology-based business environment are investigated and not entrepreneurs in the buy, sell, non-technical services or general business sectors;

1.6.2.2 The field of research is limited to emerging or developing regions only and will not include developed or industrialised regions. The literature study however, investigates research results obtained from studies conducted in developed countries such as the USA and the United Kingdom, as well as results obtained from studies in related fields in emerging economies. An example of the latter case is the incubation of technology intensive new businesses at Universities in South Africa (Wagner 1997);

1.6.2.3 The research population is entrepreneurs who have founded a technology-based enterprise registered within the boundaries of the province of KwaZulu-Natal on the east coast of South Africa and who have operated the business for a period of time. A sample will be drawn from this population;

1.6.2.4 The research on the entrepreneurial training in formal technological education programs includes postgraduate students at the University of Pretoria, Department of Engineering and Technology Management; and
1.6.2.5 The effect of other factors such as informal training, private sector and government initiatives etc. which play a role in the development of technological entrepreneurs and their enterprises, are not researched in depth.

1.6.3 The definition of the terms

1.6.3.1 *Technology* - Technology is the utilisation of technical knowledge through techniques to perform some useful function according to Buys (2000:2). Technology utilises the knowledge produced through science to create wealth (Jones 1971:5).

1.6.3.2 *Entrepreneur* – An entrepreneur is a person who habitually creates and innovates to build something of recognised value around perceived opportunities (Bolton et al 2000:5). The entrepreneur always searches for change, responds to it, and exploits it as an opportunity (Drucker 1991:25).

1.6.3.3 *Entrepreneurship* – Entrepreneurship in the context of this study is the collective concept which encompasses the following elements, as well as the interactions between them:

- The *entrepreneur* (person);
- The *new venture creation process* (start-up);
- The *mature business* after start-up;
- The *environmental influences* on all the role players and processes.

1.6.3.4 *Technological entrepreneur* – The technological entrepreneur is the person who practices entrepreneurship in a technology-based industry or enterprise. A technology-based enterprise has a relative large amount of scientific and engineering labour, knowledge and techniques in its final product or service (Cooper et al 1972:68).

1.6.3.5 *Innovation* – Innovation is the act that endows resources with a new capacity to create wealth (Drucker 2001:27). Innovation can also be described as: '*...the introduction of new and/or improved products, services and production processes*' (Oerlemans et al 2003:11). Innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or a different service (Drucker 1991:33). The innovation process takes the technology from the scale of innovation to the state of first commercial application.

1.6.3.6 *Emerging* – The term emerging is used to describe the dynamic upwards movement of any entity such as a country, community, economy, nation or market. The reference to an 'emerging country' in the context of this research project has the same meaning as the internationally accepted term 'developing country'. The qualifying definition of 'developing or emerging' countries is an annual per capita income of less than US$10,000 (GEM 2004:10).

1.7 SUMMARY

This first chapter describes the background to the problem, as well as the historical development of entrepreneurship, modern perceptions and the current state of the industry. The research problems, as well as several research questions were stated, followed by the rationale for the research project and key challenges. The research framework, including the delimitations and definitions, are outlined. The primary research objectives, followed by the specific goals, were identified against the background of value and importance of the study. Finally the key attributes of the desired theory and derived models were proposed.

The next chapter contains the literature overview and focuses on the current available theory on the key concepts of entrepreneurship in general and technological entrepreneurship specifically. This chapter also highlights the theory-gap that exists on technological entrepreneurship within the milieu of emerging economies, markets and communities.

CHAPTER TWO

THEORY

AND

RESEARCH REVIEW

CHAPTER TWO

THEORY AND RESEARCH REVIEW

> *'Daring as it is to investigate the unknown, even more so it is to question the known'.*
>
> Kaspar (Timmons 1994:283).

2.1 THEORY AND RESEARCH REVIEW

2.1.1 General overview

2.1.1 Eclectic perspective on this research project

It is important to present an eclectic perspective on the literature study of this research project as an introductory note. The relevance will be illustrated to the reader as the theoretical framework in Chapter 2 is explored. The perspective is contained in the following three elements:

- The standard academic practice, where the most recent (typically 5 to 8 years) theories, research results and international views are taken as the benchmark upon which new theory is built, still remains the primary assessor of any contribution to the existing body of knowledge;
- There are however, cases where generic contributions to theory were made in the pioneering days, which have been fundamental building blocks in the theory creation process and which remain unchallenged principles up to the present day. References to these contributions, irrespective of the dates on which they were made, are crucial in any literature review. A typical example of

one such contribution is the work of Einstein, who laid the cornerstone of relativity theories during 1905 and 1915; and

- Thirdly, specific scenarios occurred in specific time frames, with specific principles that are relevant to that specific scenario at a given point in time. The contribution may not be generic or universally true for multiple applications, but it has unique relevance to scenarios with similar conditions, variables and circumstances as the original study subject. References to such cases are crucial to offer a complete overview of the available body of knowledge, again irrespective of the time frame. An example of such a scenario is the unique conditions that prevailed when the former East Germany was incorporated into the West German economy. There are several analogue principles in such an occurrence, which are indispensable in creating solutions for later transient economic situations.

It is against this background that the literature review in Chapter 2 should be viewed. It is acknowledged that the theoretical base of the study subject is extraordinarily broad, with four mature, stand-alone topics that constitute the subject, i.e. *technology, entrepreneurship, emerging regions* and the various aspects of *development*. This necessitates the careful selection of applicable theories and models amongst the huge body of knowledge of these four major study directions.

2.1.2 International perspectives on entrepreneurship research

In the Proceedings of the First Annual Global Conference on Entrepreneurship Research which was held at the Imperial College in London, UK from 18th to the 20th February 1991 (Birley, Macmillan & Subramony 1992), the papers were presented in the following four categories:

- Framework for understanding entrepreneurship;
- Cultural perspectives on entrepreneurship;
- Environment and entrepreneurship; and
- Entrepreneurial strategy and behaviour.

In one of the papers delivered at the same conference, Thomas Köllermeier defined a major problem within the entrepreneurship research fraternity as follows: *'One of the major problems facing the field of entrepreneurship research is the lack of a common set of agreed-upon frameworks and definitions'* (Birley et al 1992:37).

The same sentiments were echoed by Bull et al (1995) in their book 'Entrepreneurship: Perspectives on Theory Building'. Their view is presented in the following statement: *'Despite the number of published papers that might be considered related to the theory of entrepreneurship, no generally accepted theory of entrepreneurship has emerged'* (Bull et al 1995:1).

It seems as if global research efforts in the entrepreneurship field, primarily concentrate on three elements:

- The entrepreneur, his/her characteristics and behaviour;
- The entrepreneurial process; and
- The factors enhancing or impeding the development of entrepreneurs and entrepreneurial activity.

This perspective forms the basis of the literature research of this research project.

2.1.3 Literature categories

Although the literature on entrepreneurship and small business management has increased significantly in recent years, the knowledge in this field, however, remains fragmented. Due to the lack of an agreed-upon framework and set of definitions, *'…partly contradictory concepts are utilised, such as trait versus behavioural, uni- versus multi-dimensional, or static versus process approaches"* (Birley et al 1992:39).

Gartner (1989) in his paper entitled '"Who is an Entrepreneur?" Is the wrong question' formulates the characteristics of the trait approaches and contrasts it with the behavioural approach. Gartner's objective in his paper was to initiate a paradigm shift in the field of entrepreneurship research, as he claimed that the trait

approaches do not have predictive power as they focus on a fixed state of existence. He advocates the use of a behavioural approach instead, which views entrepreneurship as the process by which new organisations come into being. This view is also supported by Vesper (1980). The different approaches can be summarised as follows:

- *The trait* approach focuses on the personality of the entrepreneur, while the
- *Behavioural* approach focuses on the activities of the entrepreneur.

The trait approach is based on the principle that entrepreneurs are different from non-entrepreneurs. Researchers such as McClelland (1976), Brockhaus (1982), Carland (1984) and Milner (1990) have all searched for the elusive set of personality-based predictors of new venture success.

The earlier focus of entrepreneurship research was on the personality traits, but the modern notion that there is no 'typical' entrepreneur, has become the driving force to rather focus on the activities of the entrepreneur or on the entrepreneurial process. Low & Macmillan (1990:148) offer a meaningful insight with the following conclusion: *'…being innovators and idiosyncratic, entrepreneurs tend to defy aggregation. They tend to reside at the tails of population distributions, and though they may be expected to differ from the mean, the nature of these differences is not predictable. It seems that any attempt to profile the typical entrepreneur is inherently futile'.*

Bull et al (1995:5) concludes on the importance of the trait approach with the remark that *'…the psychological traits of the entrepreneur are not a significant variable in the theory of entrepreneurship within the economic domain'.*

The behavioural approach with scholars such as Gartner (1989), Kao (1989), Roberts (1991) and Timmons (1994) studied the entrepreneurial process and more specifically the activities of the entrepreneur. The theory and models of later researchers such as Bolton et al (2000), who expanded on this approach, are discussed in more detail in Chapter 3.

The grouping of the literature on entrepreneurship into five categories by Bull et al (1995:2) as mentioned in Chapter 1 has a significant contribution to make in the debate to establish a generally agreed-upon framework. Four of the five categories (with the exception of the definition of the entrepreneur) can be classified into the two broad approaches above as follows:

- Trait approach;
- Behavioural approach – success strategies:
  - Formation of new ventures;
  - Environmental factors.

2.1.4 Entrepreneurship

2.1.4.1 Historical development

Bolton et al (2000:4) records the origin of the word *entrepreneur* as follows: 'The word '*entrepreneur'* is derived from the French words *entre* meaning 'between' and *prendre* being the verb 'to take'. The verb *entreprendre* therefore means 'to undertake'.

The word *entrepreneur* in French means a contractor and the German word *unternemer* is an undertaker if translated directly. A historical summary of the research focus areas of academics, which contributed in this field, is given in Table 1.

Table 2.1: Summary of research on entrepreneurship.

Date	Author	Characteristic	Norma-tive	Empiri-cal
1848	Mill	Risk-bearing	X	
1917	Weber	Source of formal authority	X	
1934	Schumpeter	Innovation; Initiative	X	
1954	Sutton	Desire for responsibility	X	
1959	Hartman	Source of formal authority	X	
1961	McClelland	Risk-taking; need for achievement		X
1963	Davids	Ambition; desire for independence, responsibility; self-confidence		X
1964	Pickle	Drive/mental; human relations; communication		X

		ability; technical knowledge		
1971	Palmer	Risk measurement		X
1971	Hornaday & Aboud	Need for achievement; autonomy; aggression; power; recognition; innovative/independent		X
1973	Winter	Need for power	X	
1974	Borland	Internal locus of control		X
1974	Liles	Need for achievement		X
1977	Gasse	Personal value orientation		X
1978	Timmons	Drive/self-confidence; goal-oriented; moderate risk-taker; locus of control; creativity/innovation	X	X
1980	Sexton	Energetic/ambitious; positive setbacks		X
1981	Welsh & White	Need to control; responsibility seeker; self-confidence/drive; challenge taker; moderate risk taker		X
1982	Dunkelberg & Cooper	Growth oriented; independence oriented; craftsmen oriented		X
1982	Hoy & Hellriegel	Preference for technical versus managerial tasks		X
1983	Pavett & Lau	Conceptual, human, and political competence; technical familiarity in a specialised field	X	
1985	MacMillan, Siegel & SubbaNar-isimha	Familiarity with the market; a capacity for intense effort; leadership ability	X	
1986	Ibrahim & Goordwin	Ability to delegate, manage customer and employee relations; interpersonal skills	X	
1987	Aldrich & Zimmer	Networking with people who control important resources and who have relevant skills and abilities	X	
1987	Hofer & Sandberg	Drive to see firm creation through to fruition; ability to clearly communicate goals; ability to motivate others to behave in synergistic manner		X
1987	Schein	Strong management skills with high levels of responsibility and authority; specialist versus general manager		X
1987	Timmons, Muzyka, Stevenson & Bygrave	Ability to recognise and envision taking advantage of opportunity		X
1989	Wheeler & Hunger	Ability to implement strategy with programs, procedures, budgets, evaluations, etc.		X
1992	Chandler & Jansen	Self-assessed ability to recognise opportunity	X	
1992	McGrath, Mac-Millan & Scheinberg	High individualism; poor distance; uncertainty avoidance; and masculinity		X

Source: Timmons (1994:189).

Later authors who contributed significantly to the body of knowledge on entrepreneurship are:

- Kuratko and Hodgetts on contemporary entrepreneurship (Kuratko and Hodgetts 1998);

- Shane and Venkataraman on entrepreneurship research framework (Shane et al 2000);
- Von Hippel on management of technology and innovation (Von Hippel 2005);
- Wickham on strategic entrepreneurship (Wickham 2004);
- Hisrich, Peters & Shepherd on general entrepreneurship and new venture creation (Hisrich et al 2005).

Two recent publications summarize the state of entrepreneurship research:

- Ucbasaran, Westhead and Wright (2001) focus on the contextual and process issues of entrepreneurship research. They suggest that *'…..additional research attention should be directed towards understanding of the behaviour of different types of entrepreneur (i.e. nascent, novice, serial and portfolio entrepreneurs) and the different organizational forms selected (i.e. corporate venturing, management buy-outs and buy-ins, franchising and the inheritance of a family firm) by entrepreneurs'* (Ucbasaran et al 2001:57); and
- Grégoire, Noël, Déry and Béchard (2006) investigate whether there is conceptual convergence in entrepreneurship research over the past twenty years. They provide evidence that the field relies increasingly on its own literature and the unique contribution that it makes to the management sciences.

The most recent researchers all tend to follow the modern trend to see the personality traits as only one of the ingredients of the entrepreneurial process. Similarly, the activities or the behaviour of the entrepreneur, also do not constitute the full picture. There is still a further dimension that is a crucial ingredient to complete the picture: the environment and its influence on the person and his/her activities.

Bolton et al (2000) in their publication *Entrepreneurs: Talent, Temperament, Technique* differentiate distinctly between the following three components in the entrepreneurial paradigm:

- What entrepreneurs are like – the *personality* factors;
- Where entrepreneurs come from – the *environmental* factors; and
- What entrepreneurs do – the *action* factors.

The work of Bolton and Thompson provides a framework which is not only in line with modern perceptions on the entrepreneur and entrepreneurship, but is concise, simple and contains the three main 'role players' in the entrepreneurial stable: the *person*, the *environment* and the *process*. This particular framework is used throughout this study for:

- The literature review;
- The research design;
- The research results comparison.

2.1.4.2 The person

As mentioned earlier, a single psychological model of entrepreneurship has not been developed to date. The earlier research efforts that supported the trait approach all endeavoured to define the characteristics of successful entrepreneurs. Brockhaus & Horwitz (1986:42) supported the view with their remark: *'The literature appears to support the argument that there is no generic definition of the entrepreneur, or if there is we do not have the psychological instruments to discover it at this time'.*

Another researcher on the subject Gartner (1989), came to the conclusion that while a large number of traits have been attributed to the entrepreneur, a clear picture of the entrepreneur in comparison with other occupational groups in the population is still to emerge. This has not transpired in the past decade and the theory is still lacking the same structure as mentioned by the early 90's researchers. On a more local note, Boshoff, Bennett & Owuso (1992:51) concluded with reference to the South African context: *'Our knowledge of the traits of an entrepreneur is consequently inadequate'.*

It is appropriate to review the major contributors to existing theory on the entrepreneur as a person, and in particular the work of early pioneers in the field. The work of McClelland (1967) arguably is worth mentioning, mainly due to its contribution to the understanding of the need hierarchy of entrepreneurs.

McClelland's theory of psychological motivation is a fundamental part of the literature on entrepreneurial behaviour. The theory states that people are motivated by three principal needs, as quoted by Timmons (1994:187):

- The need for achievement – *n Ach* – is the need to excel and for personal accomplishment against self-imposed standards;
- The need for power – *n Pow* – is the need to influence others and to achieve an 'influence goal' i.e. the goal of outperforming someone else or an externally derived standard; and
- The need for affiliation – *n Affil* – is the need to attain an 'affiliation goal' i.e. to build a warm relationship with someone else or to enjoy mutual friendship.

McClelland (1967) concluded that the n Ach is the source of the motivational drive shown by the entrepreneurial personality. He and his associates also postulated that the n Ach can be strengthened or developed. They designed an educational program for developing n Ach in the individual and attained satisfactory results in their training programs. Their efforts are summarised by Schöllhammer & Kuriloff (1979:22) who states that *'…n Ach may be significantly heightened through appropriate training'*.

Timmons (1994:191) formulated six dominant themes into which the characteristics of successful entrepreneurs can be categorised. These themes have emerged from what successful entrepreneurs do and how they perform, rather than what their personality traits are. It confirms the paradigm shift from the trait approach to the behavioural approach. These six themes are:

- **Commitment and determination**

Entrepreneurs are often confronted with challenges and obstacles during their venture establishment process, which require persistence and commitment to resolve. In order to overcome these hurdles, they have to be disciplined, tenacious and persistent in their efforts. Most entrepreneurs live under constant pressures, first to survive the start-up, then to stay alive and finally to grow into a sustainable enterprise.

- **Leadership**

Successful entrepreneurs have amongst other qualities strong leadership characteristics. They are experienced in their specific technologies, have an intimate knowledge of the market place in which they will compete and they have good general management skills. Unlike their counterparts in the corporate world, successful entrepreneurs have *'…a well developed capacity to exert influence without formal power'* (Timmons 1994:193). This ability is important for entrepreneurial success, as they are required to get along with a large spectrum of different personalities, such as accountants, bank officials, government employees, suppliers and many more. They are diplomats rather than autocrats, mediators rather than dictators. Above all, they have to inspire colleagues and employees, show strength and courage in the face of adversity and offer insight and vision for the enterprise's future – all leadership qualities which are essential for the young enterprise to survive.

- **Opportunity obsession**

The remarks of Mark Twain on opportunity, as cited by Timmons (1994:87) are quite appropriate: '*I was seldom able to see an opportunity until it has ceased to be one'.* Timmons (1994:194) also calls the successful entrepreneur someone who is *'..obsessed with opportunity'.* These may be harsh words and the word 'orientated' in stead of obsessed may have been more appropriate, but the intensity of the entrepreneur's drive to spot and exploit opportunities is perhaps best illustrated with the inherent analogy.

It is important to note that there is a distinct difference between an idea and an opportunity. An opportunity *'…has the qualities of being attractive, durable, and timely and is anchored in a product or service which creates or adds value for its buyer or end user' (*Timmons 1994:87). Schöllhammer et al (1979:28) classify entrepreneurs according to their ability to exploit opportunities as follows: *'Entrepreneurs are those persons who search for and see the opportunity latent in a novel idea, then to work energetically to convert the opportunity to the reality of business'.* Similarly, Bolton et al (2000:95) echo the holistic sentiments of Schöllhammer in their views on opportunity: *'Entrepreneurship is about opportunity. Successful entrepreneurs spot opportunities, often where others fail to see the same idea at the same time, although the same information is available to*

them'. It is evident that successful entrepreneurship is closely associated with the ability to recognise and commercially exploit opportunities in the business world.

- **Tolerance of risk, ambiguity and uncertainty**

Successful entrepreneurs are not gamblers. They calculate the risks facing them carefully, try to get the odds in their favour and then only decide whether to take the risk or not. Risk, ambiguity and uncertainty are almost a given in the world in which entrepreneurs operate and their ability to deal with these factors will often determine their success. The well-known phrase by Adam Smith *'The ordinary rate of profit rises…with the risk',* as quoted by Bolton et al (2000), are well appreciated by entrepreneurs. Bolton et al (2000:331) suggest that entrepreneurs might see risk (or the threat that it poses) differently than other persons. Doing something new or in a different way than before inherently contains risk elements, but entrepreneurs might not notice them or will just accept it in their stride.

Peter F Drucker (2001:128) remarks about the entrepreneur and risk as follows: *'The successful entrepreneurs have one thing – and only one thing – in common: they are not risk takers'*.

- **Creativity, self-reliance, and ability to adapt**

The ability to innovate and apply creative ideas in the world of the entrepreneur is not only crucial for survival, but it is also part of the personality make-up of successful entrepreneurs. Successful entrepreneurs are typically dissatisfied with the status quo and are restless initiators (Timmons 1994:195). They believe in themselves, are self-reliant and independent. They show initiative, are action orientated and are adaptive and resilient. They can adapt rapidly to changes in the dynamic world of business and are not afraid of failure. Instead, they have the ability to use incidents of failure as a way of learning. This is particularly evident if the high previous business failure rates of successful entrepreneurs are analysed.

- **Motivation to excel**

The last of the six themes of entrepreneurs' characteristics is their motivation to excel beyond the norms of their peer group. It is commonly believed that entrepreneurs *'…are self-starters, who appear to be driven internally by a strong*

desire to compete against their own self-imposed standards…' (Timmons 1994:196). The strong need to achieve according to McClelland (1967), strongly dominates the need structure ahead of other needs such as the need for power or the need for status. Entrepreneurs also have a high self-imposed set of personal standards that include aspects such as integrity, loyalty, reliability and discipline. They know their strengths and weaknesses, as well as those of their partners and competitors. The ability to gain and maintain perspective in all circumstances, plus a good sense of humour, is all characteristics that have been attributed to successful entrepreneurs.

Bolton et al (2000) categorise the personality factors in their framework in the following four components:

- **Motivation and emotion**

The notion that motivation comes from the head and the heart according to Goleman (1996) affirms the link that psychologists draw between motivation and emotion. The work of McClelland (1967), Roberts (1991), Whybrow (1991) and Buttner (1992) are all relevant in this field, of which most of the significant contributions were included in the six main themes summarised by Timmons (1994) in his work mentioned earlier.

- **The born or made debate**

The debate whether entrepreneurs are 'made' or 'born' has been debated by several disciplines, for example by the management and leadership fraternities. In order to obtain a better understanding of the complexity of the problem, it is necessary to review what the subject discipline of psychology contributed to theory.

Psychologists believe that *genetics* shape a certain proportion of a personality and *environmental influences* shape the remainder. The figures vary between researchers from 75% genetic (Woods 1998) to 40% genetic (Whybrow 1999). Whatever the ratios, it is important to understand that personalities have an inborn component and an environmental component. Contrary to the findings of psychologists, other contributors to the literature on entrepreneurs (Burns &

Dewhurst 1989 and Kent 1984) have concluded that only environments shape entrepreneurs. This argument supports the notion that entrepreneurs are 'made' and not 'born'. Drucker (2001) certainly holds the strong opinion that entrepreneurship, like innovation, is a discipline with its own unique set of rules that can be learned.

Bolton et al (2000:15) believe that entrepreneurs are both 'made' and 'born'. They conclude as follows: *'Whilst it may be true that the techniques of entrepreneurship can be 'taught' or more correctly 'learned', we do not believe that educators can make people into entrepreneurs'.* The debate is most certainly not concluded yet and for the purpose of this study the notion that a significant portion of the person's (entrepreneur) activities (the process) is influenced by environmental factors, is presupposed. The person or the personality aspect, over which the question is debated, is left out of the research equation for this purpose.

- **Behavioural characteristics**

Similar to the contribution of Timmons (1994), Bolton et al (2000) list eight dominant characteristics from a list of forty-two which was drawn up by Hornaday (1982).

This list includes the following:

- Perseverance and determination;
- Ability to take calculated risks;
- Need to achieve;
- Initiative and taking responsibility;
- Orientation to clear goals;
- Creativity;
- Honesty and integrity; and
- Independence.

The correlation with the list of Timmons (1994) and other researchers is obvious, but the inclusion of two ethical issues in the list i.e. honesty and integrity, needs more focus. It is generally accepted that ethical issues such as trust and honesty form part of the business society today and social responsibility and business

ethics are key subjects in most of the courses taught at modern business and management schools.

- **Personality attributes**

The last category proposed by Bolton et al (2000) is the personality attributes of entrepreneurs. This aspect of people has been studied extensively and a wide range of tests, termed 'psychometric testing', has been developed and applied with significant results in practice. One such popular test is the Myers-Briggs type Indicator (MBTI) that researchers such as Roberts (1991) have used in their research on technological entrepreneurs. Research of this aspect in particular falls outside the scope of this study and is mentioned for the sake of completeness of the literature survey.

A recent publication by Mitchell, Busenitz, Lant, McDougall, Morse and Smith (2005:93) states that *'…the failure of past 'entrepreneurial personality'-based research to clearly distinguish the unique contributions to the entrepreneurial process of entrepreneurs as people, has created a vacuum within the entrepreneurship literature'*. They suggest that *'….the constructs, variables, and proposed relationships under development within the cognitive perspective offer research concepts and techniques that are well suited to the analysis of problems that require better explanations of the contributions to entrepreneurship that are distinctly human'* (Mitchell et al 2005:93).

2.1.4.3 Environmental influences

Earlier researchers, who mainly focussed on the person and the behaviour of the entrepreneur, neglected the environment in which entrepreneurship is conducted. It is only late in the 1980's when researchers like Drucker (2001) and Roberts (1991) acknowledged the importance of the environmental influences on the development of the entrepreneur, as well as on the entrepreneurial process. Most entrepreneurship models recognise the importance and role that different environments play in entrepreneurship and the entrepreneurial process. Such models, which are discussed more in detail in Chapter 3, include:

- The model of Birley et al (1992) for entrepreneurship in transition;
- The integrative model for entrepreneurship education and training of Gnyawali et al (1994);
- The entrepreneur development model of Roberts (1991);
- The model for economic development of the Technology and Development Institute of Hawaii as presented by Tran (1975);
- The model for entrepreneurship education of Klandt & Müller-Böling (1993); and
- The entrepreneurship-training model of the University of Tulsa in the USA (Klandt et al 1993).

The acknowledgement of the importance of entrepreneurial environments and the growing body of knowledge on the subject is evidence of the importance of this element. Despite the recent growth, gaps are still evident in the literature. Gnyawali et al (1994:43) formulated a model to resolve the problems in the literature spectrum, which addressed four major areas:

- A conceptual framework to integrate the available literature on entrepreneurial environments;
- Establish links between the needs of entrepreneurs and how environments can fulfil these needs;
- Propose guidelines to conduct empirical research on entrepreneurial environments; and
- Address the needs of policy makers as an important audience for research on entrepreneurship.

According to Gnyawali et al (1994:84), an entrepreneurial environment is *'…a combination of factors that play a role in the development of entrepreneurship'*. It refers firstly to the overall economic, socio-cultural, and political factors that influence people's willingness and ability to undertake entrepreneurial activities. Secondly, it refers to the availability of assistance and support services that facilitate the start-up process. Their work also distinguishes between three broad streams in the available literature on entrepreneurial environments:

- General environmental conditions for entrepreneurship;

- Descriptive studies of the environmental conditions of a particular country or region; and
- The role of public policy in shaping the entrepreneurial environments.

Research results indicate a strong potency of regional factors in influencing entrepreneurial behaviour in communities. Cécora (1999:74) suggests the following important factors in the cultural and socio-environment of entrepreneurs:

- Socio-structural variables (size and composition of populations, including age, gender, ethnic origin);
- Norms of society and culture (tastes and interests, cultural contexts);
- Institutions and power structures (legal and political contexts) and
- Social networks and peer groups (informal affiliations).

The remarks of Cécora (1999:122) sum up the mood that should prevail in regulatory bodies when the entrepreneurial environment is considered: *'In conclusion, formulation of adequate policy measures for sustainable regional development must be founded on better understanding of non-economic determinants of endogenous innovation and entrepreneurship which are dismissed by conventional, neoclassical economists'*.

In his book 'Entrepreneurship and Self-help amongst Black Americans', John Butler (1991) examines the tradition of entrepreneurship and self-employment amongst ethnic groups in general and specifically black Americans. He categorises his work as a study of the *'…sociology of entrepreneurship, which takes as its subject matter the relationship between group characteristics and the development of business activity'* (Butler 1991:1). The following fundamental issues presented by Butler are relevant to this research project:

- The primary group characteristics examined were race and ethnicity;
- The notion that the more a group is assimilated into society, the higher the probability of economic stability for that group;
- The notion that groups develop economic stability as a result of entrepreneurship;
- The role of minority groups as the 'middleman' as documented in the literature, where oppressed ethnic groups resorted to negotiate products between the

producer and the consumer, owner and renter, elite and masses and employer and employee;

- Literature references to the Jews in Europe, the Asians in East Africa, the Japanese in the USA and the Chinese in Southeast Asia as middlemen in the capital societies are given;
- The study of the relationship between collectivism and business activity and the interaction of cultural attributes of ethnic groups and the development of entrepreneurship within the group;
- The ethnic enclave theory, where the development of minority business enterprises within a central economy occurs, with the resultant dynamics of such an enclave with its surroundings;
- The effect of political and social hostility on the Afro-American and the resultant strong drive of self-help and entrepreneurship;
- The effect of Governmental programs which forced Afro-Americans on an 'economic detour';
- The evolvement of Afro-Americans from the 'economic detour' culture to the 'middleman culture'.

2.1.4.4 The process

Bolton et al (2000:27) use two process models to illustrate the body of knowledge of the entrepreneur termed 'expertise'. The first model is the process model as given in Figure 2.1.

The second entrepreneurial process model condenses the action factors (i.e. what entrepreneurs do) into two distinct phases as indicated in Figure 2.2.The first stage or area of activity is *spotting the opportunity* and the second stage is the *project championing* of the opportunity. The true entrepreneur is the person who is able to combine and execute both roles of spotting the opportunity and project champion successfully.

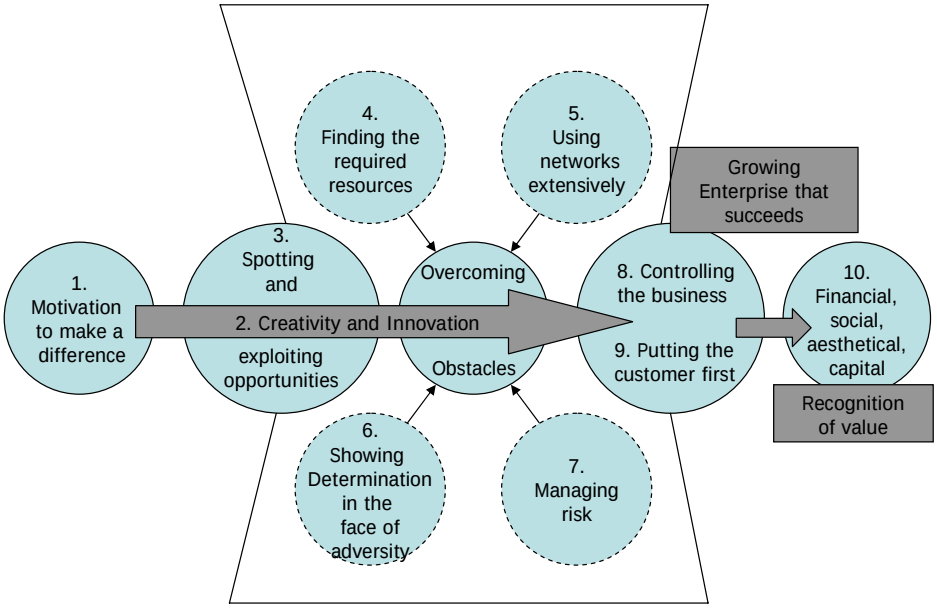


Figure 2.1 The entrepreneurial process diagram

Source: Bolton et al (2000:27).

2.1.4.5 Small business management

Literature has for several decades acknowledged the difference between entrepreneurs and managers of small businesses. The notion that the entrepreneurial founder of an organisation is a different type of person from the manager, who is required at subsequent stages of growth, had already been propagated by early researchers such as Chandler (1962), Steinmetz (1969), Thain (1969), Greiner (1972), Clifford (1973) and Smith & Miner (1983). Schöllhammer et al (1979:181) analyse the differences between small and large businesses and conclude as follows: *'Although the scope and complexity of management problems and decision making may be different, the basic managerial functions and the operational activities are essentially the same in both small and large companies'.*

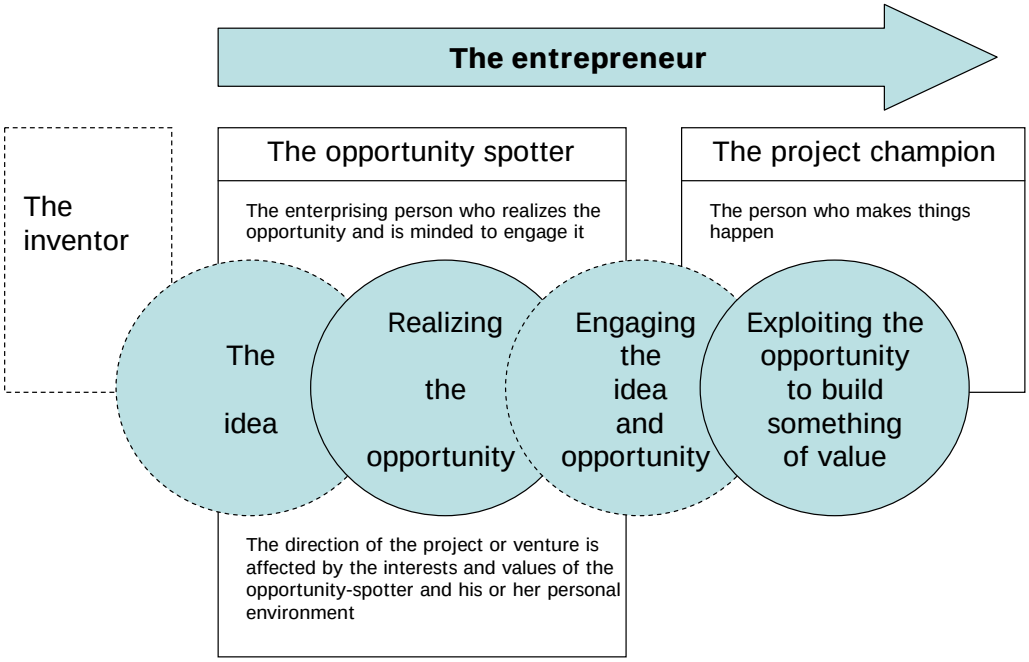


Figure 2.2 The entrepreneur, the opportunity spotter and the project champion
Source: Bolton et al (2000:28).

It is the management portion of the small business that is important to this study, as the ingenuity and capabilities of management team (including the entrepreneur or founder) determine the success of the newly established venture through its development stages.

2.1.4.6 Intrapreneurship

People with entrepreneurial talent who are motivated to use their abilities and initiative and do something on their own, but who may not want to start their own business, are important role players in the innovative enterprise or service institution. These internal entrepreneurs have been called *intrapreneurs* by

Pinchot (1985) and *corporate entrepreneurs* by Kanter (1983). The term is derived from *intra-corporate entrepreneurs*. Bolton et al (2000.63) define intrapreneurship as follows: *'Intrapreneurship then is the term given to the establishment and fostering of entrepreneurial activity in large organisations which results in incremental improvements to existing products and services and occasionally to brand new products'* .

Intrapreneurship's broadest definition is perhaps *entrepreneurship within an existing organisation.* According to Antoncic & Histich (2003:9) previous researchers have defined intrapreneurship as:

- A process by which individuals inside organisations pursue opportunities independent of the resources they currently control (Stevenson & Jarillo 1990);
- Doing new things and departing from the customary to pursue opportunities (Vesper 1990);
- A spirit of entrepreneurship within the existing organisation (Hisrich & Peters 1998); and
- Creation of new organisations by an organisation, or as an instigation of renewal and innovation within that organisation (Sharma & Chrisman 1999).

The views of Antoncic et al (2003:9) are contemporary within the modern paradigms of innovation and entrepreneurship and are relevant to the domain of this project as follows: *'Intrapreneurship refers not only to the creation of new business ventures, but also to other innovative activities and orientations such as development of new products, services, technologies, administrative techniques, strategies and competitive postures. Its characteristic dimensions…. are new business venturing, product/service innovation, process innovation, self-renewal, risk taking, proactiveness, and competitive aggressiveness"*.

There is a strong similarity between entrepreneurs and intrapreneurs. The most significant difference is that intrapreneurs do not necessarily want to start their own businesses or manage an independent business. Hisrich et al (2005:46) provide a comparison between entrepreneurs, intrapreneurs and traditional managers. As for the rest of the personal attributes, literature (Drucker 2001:131,

Wickham 2004:574, Rwigema et al 2004:78) suggests that these two categories of entrepreneurs display virtually similar profiles.

2.1.5 Entrepreneurship education and training

2.1.5.1 Formal education

One of the contentious issues still debated by scholars of entrepreneurship is the question: Can you teach someone to become an entrepreneur? Despite the importance of the issue, few have studied entrepreneurship education from a research point of view. According to Brockhaus in a paper delivered in Dortmund at The International Conference on Entrepreneurship IntEnt 92, even fewer have done empirical research and very few have compared a group that have received entrepreneurship training with a similarly matched group that have not received the education (Klandt et al 1993:3).

Entrepreneurship education in formal programs such as universities and colleges, are well-researched and documented in the following regions, as presented in the annual Proceedings of the Conference on Internationalizing Entrepreneurship Education and Training (IntEnt):

- America;
- Western Europe;
- Central and Eastern Europe;
- Africa;
- Australia; and
- Asia.

Apart from Eastern Europe, Africa and certain parts of Asia, most of the other regions represent developed and industrialised countries. The Asian and African experience, as well as the South American scenarios, is significant in their relevance to this research project. It is appropriate, as the research will be conducted in South Africa, to take a closer look at the educational background in South Africa, with particular reference to entrepreneurship education.

South Africa has several unique characteristics as an emerging economy, as well as common grounds and similarities with other emerging countries. A typical unique characteristic of South Africa is the political inheritance of the post-apartheid era. South Africa also has typical characteristics of an economy in transition similar to the former East Germany. Several universities in South Africa, including the Potchefstroom University, University of Stellenbosch, University of South Africa, University of Pretoria and University of Cape Town all have active entrepreneurship education and training programmes, which are primarily aimed at the local conditions and indigenous population groups. The work of Antonites (2000) on educational models for entrepreneurship training also has relevance to this research project. The South African context will be discussed in more depth in Chapter 4 when the research methodology and design are discussed.

One of the key issues in the formal educational program restructuring in the 1990's in South Africa is the formulation of new course structures at tertiary educational institutions. In this instance, experience of the developed world is of significant value and this includes the experience gained by other emerging countries such as Korea, Taiwan, Malaysia and the former East Germany.

In an effort to synthesize available research on the process of entrepreneurial learning, Politis (2005:399) formulates a framework which identifies three main components:

- Entrepreneurs' career experience;
- The transformation process; and
- Knowledge in terms of effectiveness in recognizing and acting on entrepreneurial opportunities and coping with the liabilities of newness.

In order to formulate a course structure for any entrepreneurship-training program, Brockhaus (Klandt et al 1993) suggests that the following questions be asked:

- *Who are the entrepreneurship students?*

To which categories of potential entrepreneurs will the training be given – will it be future potential entrepreneurs, current entrepreneurs who have started their own business already, others who have bought an existing business or franchise, or

who have inherited a business and want to learn more about aspects such as marketing, management of finances? Another group could be entrepreneurs within large corporations who want to practice the principles of entrepreneurship within their current environment – the so-called 'intrapreneurs'?

- *What are the needs of the students?*

Some students may require knowledge about entrepreneurship; others may want to learn more about management aspects, others about the procedures and start-up process.

- *Who provides the education?*

In formal training programs presented by educational institutions it may be a permanent faculty member or an entrepreneur from the business fraternity who teaches on a part time basis. It could also be somebody with a particular skill who teaches students to be entrepreneurial in that particular area of expertise.

- *How does it all occur?*

Is it a credit course at university or college taught at pre- or post graduate level, or is it part of continuous education which is open to the general public?

- *How long is the program?*

If the course is an elective subject or is it a major for the student? It could also be in the form of a seminar lasting a few days or at the most, a few weeks.

- *In what format is it presented?*

Another aspect is whether the program is presented in a passive or experiential format. Passive would be reading a book, listening to a lecturer or watching a video. Experiential methodology would include case studies, or working in simulated or real business situations under mentorship.

- *What are the outcomes?*

Certainly one of the key issues of any educational process is the expected outcome of the program. And how are these outcomes measured? There is also the short-term versus the long-term outcomes. The short-term outcomes would be measured in terms of the student enrolment figures or their formal class performance statistics, while the longer-term measures could be the level of entrepreneurship stimulated by the course amongst ex-students. How many start-ups occurred after say five years and how many businesses survived and prospered after ten years?

Another building block in the process of understanding the role of formal education in the development of entrepreneurship is highlighted by Visser as stated in Klandt et al (1993:397). The role of student resources at tertiary institutions of developing countries was assessed as a major contributor in the process of entrepreneurial stimulation and education. The summary of the research findings is significant in its support for the rationale of this particular study (Klandt et al 1993:406): *'Tertiary institutions, by their very nature, are the captive markets and the homes of the intellectually and academically-minded youth of a country. These persons have a duty towards those individuals who do not have the means, financially or otherwise, of improving skills to assist them with their endeavour to provide consumer and industrial goods, products and services. Failing such assistance will be an injustice to all. In development models tertiary institutions increasingly feature as one of the key components that work together to conceive of, and give birth to, new businesses'*.

The need for training in disciplines such as entrepreneurship, innovation and even invention has been recognised in most of the modern economies, even the developed countries such as the USA. Furthermore, it is proposed by researchers to commence formal education in these subjects at an early as possible age and at all levels of the curriculum. Kleppe (2002) reported positive results from research conducted on a group of high school pupils in Northern Nevada, USA. Apart from the need to broaden the base of students in technology at tertiary educational institutions, which is crucial in developing the technological base of emerging countries (Beute 1992), the content of engineering courses also came under the spotlight. The commercialisation of technology and the need to include entrepreneurship in formal engineering educational programs is recognised by Whittaker (2001). According to Whittaker, two sets of traits are to be developed in the training of engineers:

- Typical traits which engineering favours, such as conservatism, pro-active approaches, risk-aversion and a commitment to technological feasibility;
- Typical traits which entrepreneurship favours, including being visionary, optimistic, risk seeking and being good communicators.

As the full set of skills seldom resides in any one individual, the educational outcomes should be directed to develop both sets in an optimum manner.

2.1.5.2 Informal training

In Europe, the training of entrepreneurs beyond formal education has been studied extensively. Johannisson in his paper at IntEnt 92 (Klandt et al 1993:96) suggests that the *practice* of entrepreneurship must also be the generic training ground for entrepreneurship. He proposes the following key points of departure for a training strategy for entrepreneurs:

- Entrepreneurs should be provided with contexts for self-organised learning, not just with training programmes which are planned in detail;
- Entrepreneurial training should be integrated with everyday business operations;
- The personal network of the entrepreneur should be mobilised during the learning process; and
- Formal education must be actively mediated in order to become an integrated feature of the entrepreneurial company's rationale.

Business simulation games as an entrepreneurship training aid were developed in the early 1990's. The business game 'Eva' (Klandt et al 1993:192), which simulated the start-up and early development phase of a software firm, was used in the entrepreneurship education of a range of groups including business students, engineering students, employees, executives and real entrepreneurs. Similarly, computer-based methods, artificial intelligence and multi-media systems have also been applied successfully in training and educational programmes for entrepreneurs in Europe (Klandt et al 1993:201). Schumacher & Summers (2001) also explore management simulations as an ideal change agent or teacher and concludes that it facilitates learning without risking the business itself.

One of the main challenges facing policymakers and educators in South Africa is the urgent need to train and bring into the economic mainstream the so-called 'lost generation' of South Africans whom have been relegated to the mass of illiterate, semi-illiterate, unskilled and therefore basically unemployable group of inhabitants (Klandt et al 1993:333). Nortje (in Klandt et al 1993) in his paper entitled 'A

training concept for entrepreneurs' at the IntEnt 92 proceedings, outlines five phases of basic training of entrepreneurs, starting with functional literacy in the mother tongue to the more advanced 'B' and 'M' phases, where business skills training and mentorship and guidance are provided for entrepreneurs commencing their own businesses.

2.1.5.3 Government initiatives

The role of government on the development of entrepreneurship in developing countries is stated by Tran (1975:12) as follows: *'Scarcity of entrepreneurship has important political significance as well, for, unless capable entrepreneurs come forward in sufficient numbers, the government must necessarily play an increasingly active role in the field of economic development. As agents of economic development, entrepreneurs perform the coordinating function of bringing into existence new enterprises. They create jobs for a growing population, improve terms of trade for local producers of raw materials, turn the country toward industrialization, and free the national economy from dependence by promoting exports'*.

Tran (1975:159) proposes the following strategy for the development of entrepreneurship in developing countries:

- The creation of a substantial market-orientated, profit-orientated sector of the economy;
- The development of a class of indigenous and economically rational traders and craftsmen and the provision of opportunities for the more capable of them to acquire business experience and capital; and
- The provision of opportunities and economic incentives for the indigenous businessmen to move into larger-scale organisations and modern industry.

2.1.5.4 Private sector initiatives

The private sector is, together with the public sector, a major role player in the activities of any modern economy. Where the public sector is the policy instrument whose regulatory influence is primarily of an external nature, the private sector has to influence the economy from within the playing field. Being an active participant in the competitive markets, both locally and internationally, the private sector is on many occasions at a disadvantage to exert its influence effectively. Own company benefits and profit driven considerations are determining factors when private sector initiatives alone are the driving forces behind for example, entrepreneurial development. The very nature of the benefits that are to accrue to companies from such initiatives carries the label of self-beneficiation, which largely overshadows any national or group benefits that might result from the initiatives. The embedded difference between the driving mechanisms of these two sectors and the interdependence between them, make co-operation between them of critical importance. Acceptable limits of government regulation are difficult to determine and too much interference can eventually blunt private initiative and result in an increasing bureaucratisation of the private sector.

In a country such as South Africa, co-operation between the public and private sectors is severely impeded by certain politico-economic factors (Falkena 1980:74). With its diverse cultural composition and rich political history, public sector dominance by certain cultural groups is a common phenomenon. In the apartheid era, the public sector was dominated by the Afrikaans speaking population, with the English speaking fraternity resorting to participating in the economy through the private sector. In the post apartheid era, the situation has changed dramatically. Within the first decade of political supremacy representatives from previously disadvantaged population groups are dominating the ranks of all levels in the public sector.

2.1.5.5 Small, medium and micro enterprises

The role of small enterprises in the modern economies of the developed and emerging world is unique. Konecna (in Klandt et al 1993:298) sees the uniqueness of small enterprises as follows: *'They represent an element of competition and*

counter monopolistic tendencies, provide consumers with a broader choice and push prices down. Their great flexibility drives them towards innovations and structural changes. Small- and medium-sized enterprises can effectively meet individualized demand and specific needs. Due to their flexibility and adaptability to change they are well equipped to deal with market fluctuations. The experience of foreign countries has shown that, in the periods of recession, they can partly outbalance the increase of unemployment'.

Despite their flexibility, simple structures and other attributes, SME's also have a number of disadvantages such as limited access to capital, higher unit production costs due to economics of scale implications, limited research and development capabilities, small and unreliable markets, limited foreign trade abilities and limited marketing and promotion budgets. If their importance as a key role player in the economic growth of a country is accepted, then it becomes a primary function of government institutions and policy making authorities to do everything in their power to remove these barriers and obstacles in order to create a fertile environment for SME prosperity.

In the 1990's, national governments of both the developed and emerging worlds recognised the importance of the small and informal business sectors in the economic growth of modern economies. Their contribution to job and wealth creation were acknowledged to the point that special public policies and legislation were introduced to address the specific environment in which these enterprises operate. The trend was to classify these sectors according to enterprise indicators such as performance, size, investment capacity and employment category. The most accepted and widely used terminologies used in this regard are Small, Micro and Medium Enterprises (SMME) or simply Small and Medium Enterprises (SME). Another terminology that is used by the Indian government is Small, Tiny and Village Enterprises (Awasthi & Sebastian 1996:24). Liu (1998) refers to them as small and medium businesses (SMB's).

Small and medium-sized firms play a strategic role in the creation of resources and employment. In most European countries they represent more than 99% of all

firms and they provide approximately 75% of employment (Oakey, During & Mukhtar 1999:52).

Worldwide, the most popular method used to define a small business is to use economic (qualitative) and statistical (quantitative) guidelines. The most popular approach is to define SMME's using four quantifiable aspects, namely (Kroon et al 1998:28):

- Turnover or income: Typically the figure is $100 000 (services) to $500 000 (construction and wholesalers) per annum (maximum);
- Employees in full-time service: Less than 100;
- Total assets (excluding property): Maximum $100 000; and
- Number of business units or branches: Maximum 5.

2.1.5.6 Entrepreneurship and the economy

The importance of entrepreneurs in the economies of the modern world has been recognised by economists in all spheres of society, from the Schumpeterian era to modern students of the global economy. According to Radley (1996:37) *'…entrepreneurial activities are a pre-condition for successful economic growth, development, social well being and political stability'*. Kuratko & Hodgetts (1998:10) state that: *'Economic as well as social contributions by entrepreneurs worldwide made the most significant impact on job creation, innovation and economic renewal compared with the formal sector'.*

The modern inclination to promote 'bottom-up' strategies for sustainable regional development is perhaps the answer to the centralisation of the global economy. Sustainable regional development is not on the global agenda. The view of Cécora (1999:1) provides a clear perspective: *'Independent, innovative, and enterprising owner-managers of small and medium-sized firms are identified as key players in regional development, as contrasted to corporate managers often mistaken in regional development policy for entrepreneurs but who are shown to have many characteristics of bureaucratic, organisational man'.*

A mistake often made by policy-makers in economic development programs, is that sustainable regional development depends largely on their ability to attract exogenous capital into the region. In many cases, induced investments prove to be, outright disadvantageous, especially in the long run. Quite often, internationally mobile investment companies cash in on localised incentives, up to the point that regional markets cease or more lucrative opportunities arise outside the region. In such instances, key personnel are relocated, factory equipment and facilities are moved and subsidiaries are sold off or liquidated, which leaves only bank loans and empty premises. The counter-practice, according to Cécora (1999:1) is the following strategy: *'A very common community development policy for inciting capital investments ('commercial and industrial recruiting') is granting financial incentives (tax rebates, subsidies) to draw investors into target areas'.*

Cécora (1999:3) also refers to 'spontaneous combustion' of entrepreneurship, with the focus of policy makers and economists shifting to the 'indigenous entrepreneur'. They are firmly rooted in their regions and are those least prone to relocation outside of the region. Cooper & Dunkelberg (1987) noted that three-quarters of entrepreneurs do not move from their places of residence when starting their own firms. This, plus the tendency in the developed world such as the USA towards self-employment and smaller, more efficient and controllable businesses, provide fertile ground for the emerging regions upon which to base their development strategies. This perspective is paramount in the literature survey of this study, as it supports the underlying hypothesis that the development of indigenous technological entrepreneurship is a key aspect of emerging regions' success in the modern global economic arena.

Tran (1975:11) defines economic development in emerging countries as *'..the process of overcoming the three main problems facing the developing countries:*

- *technology*
- *employment*
- *export'.*

The relationship between these three factors according to Tran (1975) is the following:

- The diffusion of technology, if adapted to local conditions, increases production, which in turn increases the level of local employment;
- In this process, part of the increased production can be exported for needed foreign exchange earnings; and
- Entrepreneurs, through the institutional framework, play the role of change agents: They form the critical link in the process of technology adaptation, employment creation, and export-promotion to further the course of economic development of the country.

Tran (1975:12) also states the role of the entrepreneur in the economic development process as: '*The entrepreneur is by definition the organizer of society's productive resources and contributes much to economic development. His role is particularly important in developing countries where capital is scarce, investors cautious, and markets severely limited because of low purchasing power*'.

The important role of the entrepreneur in the economies of both the developed and the emerging world is generally supported by the available literature. What is not so clear, is how entrepreneurship with particular emphasis on the technological fraternity, could be enhanced to meet the unique demands of the globalising economy. Cécora (1999:23) refers to the global economy as *'…the sea on which National and Regional economies sail'*.

2.1.6 Technology

2.1.6.1 Technological base

The importance of Small Technology-Based Firms (STBF's) in the hierarchy of SME's has been recognised in recent economic models. SME's have increased their influence upon innovative activities (Acs & Audretsh 1988). Technology is

being increasingly recognised as a strategically competitive weapon, not only in large companies, but also in small enterprises (Oakey et al 1999:52). Typically, a STBF has a disproportionate number of R & D employees (i.e. scientists and/or engineers), is active in a recent or emergent technology (e.g. biotechnology, microelectronics, information technologies), a large need for funds to finance R & D projects, and often links with Universities and/or public laboratories in order to access to new knowledge (Forrest 1990; Dodgson et al 1991).

The accurate and universal classification of firms into high-, medium- or low-technology sectors have been debated over the past decade, without significant agreement amongst role players. The existing classification schemes have focussed on broad aggregate characteristics when classifying individual industries (Oakey et al (1999:186). The Organisation for Economic Cooperation and Development (OECD 1997) proposed a high-tech classification scheme that has certain deficiencies in that it focuses mainly on the manufacturing sector while ignoring the activities of the services sector. Secondly, other classification schemes treat industries as homogeneous entities in which all firms within an industry are treated as if they share the same key characteristics. Baldwin & Gellatly in their efforts to develop a more accurate high-tech classification scheme (in Oakey et al 1999:184) explore the notion of 'technological prowess' as a measure of a firm's technological capacity. The following existing concepts used to classify industries, their weaknesses and their influence on technological prowess, are tabled by them:

- Intensity of R & D as a measure of technological prowess;
- Innovation as technological prowess; and
- Technology use as technological prowess.

Baldwin & Gellatly (in Oakey et al 1999:190) propose a firm-based approach versus an industry approach as a more accurate classification scheme. Their suggestion is to measure the following firm specific competencies:

- Innovation competencies;
- Technological competencies; and
- Human capital development.

2.1.6.2 Technological innovation

Peter Drucker (2001:27) defines innovation as follows: *'Innovation is the act that endows resources with a new capacity to create wealth'.* Technological innovation was defined by the first OECD study in 1971 as (OECD 1997:24): *'…the first application of science and technology in a new way, with commercial success'.*

Although the definition is somewhat restrictive, the focus in later literature has shifted to the 'process of innovation' and 'innovation activities' and these terms indicate that traditional separations between discovery, invention, innovation and diffusion may be of limited relevance. The report also suggested (OECD 1997:30): *'The innovation process involves the use, application and the transformation of scientific and technical knowledge in the solution of practical problems'.*

Innovation is described in the South African Innovation Survey 2001 (Oerlemans et al 2003:11) as follows: '*Innovation – the introduction of new and/or improved products, services and production processes – is the driving force behind a nation's economic development and the improvement of the competitiveness of its firms'.*

Knowledge as a resource has become increasingly important in the modern business world. Gibbons et al (1994:57) stress the reliance on knowledge itself as a creator of prosperity with the reference: '*Increasingly, there is less and less return on the traditional resources: land, labour and (money) capital. The main producer of wealth has become information and knowledge'.*

One of the paradoxes of modern technological innovation theories, is the concept that 'big is beautiful' in the knowledge and resources era. It is commonly propagated in recent literature that large enterprises have a distinct advantage in the race for technological supremacy. Being big has been particularly regarded as a necessary attribute in knowledge production, with distinct disadvantages for the smaller firms. The view of Tedd et al (1997:247) sums up this school of thought: *'But not all firms can afford to invest in R & D: for many smaller firms the challenge*

is to find ways of using technology generated by others or to complement internally generated core technologies with a wider set drawn from outside'. But small firms have a distinct advantage in certain circumstances, according to Hakan Hakansson et al in their chapter 'The greatness of being small in business networks' (in Okay et al 1999:6). They air the view that there may be many situations where High Technology Small Firms (HTSF's) operate in heterogeneous and multifaceted structures where different actors are bound together in a special way. These HTSF's have unique advantages over their larger counterparts. The viability of the typical HTSF depends on its innovative ability in the short term, and on the development and commercialisation of new products or processes in the medium term. Nathalie Chaillou in Oakey et al (1999:52) sees the typical characteristics and environment of HTSF's as *'… small size, the rapid pace of technological evolution, a lack of management and financial skills, and restricted marketing and distribution resources…'.*

A leading journal in the USA presents an overview of the research published on technological innovation, product development and entrepreneurship over the past fifty years. The authors, Shane and Ulrich (2004:134), decompose the broader subject of innovation into 12 subjects. These subjects are:

- The role of the individual;
- Organizational design;
- Basic research and advancement development;
- Technology strategy;
- Knowledge transfer;
- Product planning and portfolios;
- Development process management;
- Concept development;
- Product design;
- Adoption and diffusion of innovations;
- Public policy; and
- Entrepreneurship.

Eric von Hippel (2005) propagates the *democratization* of innovation in modern day industries, especially in software and information products, as well as in

physical products. At the root of this concept is user-centred innovation processes versus manufacturer-centred innovation development systems, which have been the mainstay of commerce for hundreds of years. Von Hippel (2005:1) proposes the main advantage as follows: *'Users that innovate can develop exactly what they want, rather than relying on manufacturers to act as their (often very imperfect) agents. Moreover, individual users do not have to develop everything they need on their own: they can benefit from innovations developed and freely shared by others'.* He cites examples such as the development of high-performance windsurfing techniques and equipment in Hawaii, library information services and other outdoor consumer products such as mountain biking equipment, abseiling (rappelling) and snowboarding.

2.1.6.3 Technology and the economy

Schumpeter (1936) proposed the premise that economic growth and performance are dependent on the creation of new technology, diffusion of technology and efforts reacted to the economic exploitation of innovation and diffusion. Technological competence is an important determinant of international competitiveness and the differential growth rates of firms (Tolentino 1993:121).

The notion economic growth as it has relevance to this research topic, can be described as *'…a sustained expansion of the productive potential of the economy which – in the long run – converges with the growth of aggregate output'* (OECD 1997:168).

Economists have acknowledged the important role of investment in the economic growth process, not only in physical capital, but also referring to human capital, for several decades. The so-called 'new growth theories' developed by pioneers such as Romer (1987), Lucas (1988), Scott (1989) and Baldwin (1989) (in OECD 1997) have focussed on the economy *'…as being composed of two distinct economic activities: first, the production of goods using capital and labour, as in the standard model: and second, the production of knowledge (i.e. R & D), also using capital and labour'* (OECD 1997:173).

The effect of investment on the productivity growth of a country has also been researched extensively and applied by policy makers, as well as the relationships between technology and the environment, technology and globalisation, technology and competitiveness and of significance to this research, the impact of technology on emerging regions. In this regard, emerging regions are increasingly lagging in the increasingly competitive global markets, due to structural constraints, weaker physical infrastructure and most important of all, underdeveloped human resources.

The work of Romer (1986), in which an equilibrium growth model of endogenous technological change was proposed, suggests that growth is driven primarily by accumulating knowledge. It also reinforces the central role of human resources in the economic development process.

2.1.6.4 Technology transfer

The technological diffusion process follows the technological innovation process, which is part of the transfer of technology from the original developer to other users and applications. The 1992 OECD report of (OECD 1997:48) sees the diffusion process to: *'…include adoption by other users as well as more extensive use by the original innovator'.* The report goes further to propose that (OECD 1997:48): *'…every act of adoption involves certain transformations and is thus an act of incremental innovation in itself'.*

Distinction in the literature is made between disembodied and equipment-embodied technology diffusion (OECD 1997:48). Disembodied diffusion is the process whereby technology and know-how is spread through channels other than being embodied in machinery. Equipment-embodied diffusion on the other hand describes the process in which innovation is spread in the economy through the purchase of technologically intensive machinery and components.

In the disembodied technology diffusion process, where knowledge is spread, two terms are worth mentioning according to Cohen & Levinthal (1989:571). The first is the research spillovers, which is defined as *'..any original, valuable knowledge generated in the research process which becomes publicly accessible, whether it be knowledge fully characterising an innovation, or knowledge of a more intermediate sort'.* Secondly, the actions of receiving firms and industries determine to what extent innovations developed elsewhere are actually adopted into production processes. This is referred to as the absorptive capacity of the recipients (OECD 1997:51).

Ronald Dore in his chapter on Technological Self-reliance (Fransman & King 1984:65) defines the transfer of technology to developing countries in a pragmatic manner: '*..getting knowledge that is only in some foreigners' head into the heads of one's own nationals'.*

The transfer of technologies from developed countries to the lesser-developed world has contributed significantly towards the development of the technological competencies of these emerging countries. The primary vehicle, through which this transfer occurred in the early stages, is through direct foreign investment (DFI). This culminated in the countries developing their own technological competence and it also stimulated the growth of local technical and entrepreneurial capabilities, which provided major sources of innovation during the more advanced stages of technological development. This led to the development of outwards investments capabilities in these countries, also in terms of physical and human capital, as well as technology.

Various methods are used to transfer skills and technology. Methods include joint ventures, licensing agreements, turnkey plants, technical assistance, subcontracting, patent arrangements and other forms of non-equity investments.

In their article 'Technology Transfer – Entrepreneurship and the University', Trune and Goslin (1997:905) highlighted the history of the universities in the USA as an agent for technology transfer. Prior to 1980, there were no incentives for universities to claim commercial rights on technologies developed through their

efforts. Legislation changed in 1980 through the Dole-Bayh Act, which gave patent rights to universities and thus expanded technology transfer from the university to commercial entities. The result was that technology transfer generated $265 million in royalties for USA universities in 1994. This affirmed the important role of universities as both research institution and the incubator for these technological innovations which brought products and services to full commercial exploitation. The possibility of income generation has caused many university administrations to openly encourage entrepreneurship activities within the academic environment.

Deeply rooted in the transfer of technology process, is the influence of the previous organization on the transfer process itself and on the new innovation. Moorman and Miner (1997:91) explore the impact of organizational memory on new product performance and creativity. They (Moorman et al 1997:93) define organizational memory as *'…collective beliefs, behavioural routines, or physical artefacts that vary in their content, level, dispersion, and accessibility'.* They further propose four dimensions of organizational memory and explore the interrelationships between them. These four dimensions are:

- Organizational memory level;
- Organizational memory dispersion;
- New product short-term financial performance; and
- New product creativity.

They conclude as follows (Moorman et al 1997:91): *'These findings provide some initial evidence that knowledge is not an unconditionally positive asset and suggest that developing and sustaining valuable organizational memory may require attention not only to the appropriate levels of memory but also to managing subtle aspects of memory dispersion and deployment'.*

2.1.7 Technological entrepreneurship

2.1.7.1 Developed world

The history of technological entrepreneurship in the developed world can be traced to a symposium on Technical Entrepreneurship that was held at Purdue

University in the USA between 7 and 8 October 1970. The proceedings described the symposium as *'…the first time that those doing research on the founding of high-technology firms had gathered together to exchange findings and observations"* (Cooper et al 1972).

In research findings presented at the symposium in 1970, Susbauer (1972) presented the profile of the technical entrepreneur in Austin, Texas as follows: *'The technical entrepreneur, at least in this university spin-off environment, is likely to be relatively young, have gained a wide degree of experience in several companies, including marketing and contract administration. He has moderate to high education, and he probably had close relatives with entrepreneurial experience. He is more likely to form his company today in combination with a group whose talents compliment his own, and he probably views company formation as relatively riskless'.*

Shapero (1970) at the same symposium described the technical formation process in terms of the following elements:

- The technical entrepreneur;
- Source of technical entrepreneurs;
- The triggering event or situation;
- Phases and factors;
- The first phase – the company formation;
- The second phase – accumulation and incubation period;
- The third phase – sustained growth;
- Sequence and mix of industries;
- Differentials in rates of formation;
- Company growth; and
- Community factors.

It is interesting to note that several of these elements identified by Shapero in the early seventies, still occupy later theoretical models.

The most significant contribution to the present understanding of technological entrepreneurship is the research work done by Edward B. Roberts in his book entitled 'Entrepreneurs in High Technology: Lessons from MIT and Beyond' (1991).

In the book, his research findings of nearly thirty years on the formation of technology-based companies in the Greater Boston area and in particular Route 128, Massachusetts, USA are presented. The research includes studies of spin-off companies founded by MIT staff as well as independent companies, studies of personal characteristics of technological entrepreneurs and studies of high-technology financing. The work on the entrepreneurial profile and development of technological entrepreneurship is of particular importance to this research project, as it forms a major part of the theoretical basis of the research objectives. *In essence, the work of Roberts (1991) in identifying a typical profile for technological entrepreneurs in developed regions will form the benchmark against which the research findings of this study will be tested.* The model developed by Roberts for the development of technical entrepreneurship, which is discussed in depth in Chapter 3, is also one of the key building blocks of the proposed model for this study. It is therefore appropriate to mention the following extracts of Robert's (1991:27) most significant research findings:

- Entrepreneurs are very likely to have had self-employed fathers;
- First-born sons are not more likely than their siblings to become high-technology entrepreneurs;
- Entrepreneurs are not all alike; they display wide ranges of personalities, motivations, and goals for starting new enterprises;
- Initial capitalization is typically very small and provided from the entrepreneurs' personal savings;
- Widespread deficiencies in business plans and in team composition hurt the new enterprise's ability to raise 'outside' capital;
- Family background has no impact on entrepreneurial success: Successful entrepreneurs are made, not born!
- Prior supervisory, managerial, and especially sales experience by founders contributes to successful enterprises;
- Entrepreneurs with a high need for achievement are more likely to succeed;
- Multifounder teams generally perform far better than single founders;
- The more technology transferred initially from the entrepreneurs' 'source' organisation, the greater the eventual success;
- 'Founder's diseases' are widespread; and

- The future for high-technology entrepreneurship in the USA and the world is very promising.

The Canadian Academy of Engineering (1998) broadly defines technological entrepreneurship as *'…new enterprise formation based on innovative technology in response to clearly identified market needs'"*. Interesting to note, is the prerequisite of 'innovative' technology versus technology per se. This sentiment is not found in all the definitions of technological or technical entrepreneurship.

Drucker (2001:238) refers to 'high-tech entrepreneurs' and compares their importance in the job creation hierarchy to that of the lesser technologically based sectors. His remark is particularly significant to create an understanding of the inter-dependence of high-technology entrepreneurship with the other categories. Drucker says that *'…to have high-tech entrepreneurship alone without its being embedded in a broad entrepreneurial economy of 'no-tech', 'low-tech', and 'middle-tech', is like having a mountain-top without the mountain'.*

Drucker (2001:239) also refers to high-tech entrepreneurship as being the leading edge, but emphasises that there cannot be an edge without a knife. In other words, there cannot be a viable high-tech sector by itself and it is most unlikely for a country to be innovative and entrepreneurial in high-tech without an entrepreneurial economy.

Apart from the contribution that Roberts (1991) made in his work on the background and profile of technological entrepreneurs in the developed world, he also researched the various sources for early stage seed capital and venture capital funding for the technology based enterprise (Roberts 1990). His later publication (Roberts 1991) explored venture capital decision-making in the technological domain from various perspectives. More recent contributions came from Thomas Astebro (2004:314) whose research findings on key success factors for the assessment of R & D projects of technological entrepreneurs are presented in the form of a success prediction model with four main characteristics namely:

- Expected profitability;
- Technological opportunity;

- Development risk; and
- Appropriability conditions.

Contributions to the specific literature on technological entrepreneurship have also been made by the following authors, both in developed and developing regions:

- Astebro (1998) explores the success rates and profits for independent investors in technology-based ventures in Canada;
- Burke et al (1998) describe the development experience of technological entrepreneurship in China;
- Carayannis et al (1997) investigate early seed financing strategies for technological entrepreneurs in the south western USA; and
- Liu (1997) presents findings of research on technological entrepreneurship in Taiwan's industrial development.

Although these contributions enhance the body of knowledge on technological entrepreneurship, no benchmarking with Roberts' (1991) model which he developed for the MIT case study, could be found. Specific aspects of Roberts' research are addressed by other authors such as the financing of early-seed technological ventures (Astebro 1998, Carayannis 1997), while the technological entrepreneurship environment of particular countries is explored by Burke et al (1998) and Lui (1997). No other empirical studies could be found that significantly modify the model of Roberts as far as environmental influences on the technological enterprise or the technological entrepreneur's family background and education are concerned. The argument whether Roberts' model will apply to emerging regions is therefore a valid basis for the research questions asked at the outset of this research project.

2.1.7.2 Emerging world

Studies have shown that firms from emerging countries with high levels of indigenous technological capabilities have demonstrated their ability to absorb rapidly the more advanced technology generated in the developed world and to catch up in the dynamic process of international investment (Tolentino 1993:120).

The theory of technological competence as seen by Cantwell (1991) suggests that the impact of foreign technology on local development is dependent upon the level of domestic technological competence. The indigenous technological capabilities of a nation are therefore of particular relevance to this study, as it is a fundamental building block of the technological entrepreneurial capability of a nation or country.

The body of knowledge on technological entrepreneurship in the emerging world is not well developed. Research studies have been recorded for only a handful of countries, and there are often general studies which have little reference to the entrepreneurial profile of the technological entrepreneur. Furthermore, few empirical studies have been done on the training and education of technological entrepreneurs in the developing world.

In China, studies were done on the influence of economic policy on the fostering of technological entrepreneurship, as well as the effect of technological entrepreneurship on job creation (Burke, Boylan & Walsh 1998). Their research has highlighted the exceptional difficulty of finding available financing commercialising technologies and the inherent proclivity of the Chinese people for capitalism and entrepreneurial activity.

Similar studies by Koekemoer & Kachieng'a (2002) on financing technology-based enterprises in South Africa emphasise the importance of venture capital as a critical success factor in the technological enterprise formation process. The critical role of government regulation and participation in the creation of a conducive environment for technological innovation, plus the commercialisation thereof, is highlighted.

The issue of technology transfer in developing countries is addressed by Ahmadi & Qassemzadeh (1997) in their paper presented at the PICMET 1997 Conference where they suggest that there is not a single policy option that can be prescribed to all developing countries for the technology transfer process. They argue that *'…several factors contribute to effective policy implementation, which include proper balance between the capital, and work force along with socio-cultural infrastructure and work habits of the recipient country'*. Perhaps the most

significant relevance of their paper lies in their remark that we cannot explain the differences of regions or societies in technological innovative capabilities '*…by tendencies which have their roots in socio-cultural infrastructure, religion, race, or geographical locations etc.'.* They argue that, while certain research results show innovation and the 'spirit of entrepreneurship' lies at the root of technological innovation and economic development, the conditions leading to such innovations in a given society are not fully known. This argument is of paramount importance to this research study as one of the main research objectives of this project is indeed to get a *better understanding of the socio-cultural influences on the process of technological entrepreneurship in developing regions.*

Plenert (1997) at the same 1997 PICMET Conference, explored whether ethical considerations are culturally specific in international technology transfer processes. He came to the conclusion that ethics are definitely cultural specific and that there are many ethical systems in the world, each having their own strong and weak points. The key to being successful in a cultural-ethical integrated model is compromise. This underlines the fundamental and influential role that socio-cultural influences play in the technological domain.

2.1.7.3 Technology incubators

The science parks phenomenon, which is the forerunner of business incubators, has its roots in the USA according to Kung (1995). Dating back to the 1950's, science parks were established to meet the needs of entrepreneurial-minded academics. The Stanford Research Park in California, established in 1951, is often regarded as the genesis of the science park movement. By 1960, there were six science parks in the world, of which five were in the USA and one in the former Soviet Union. Denmark, Australia, Canada, France and Israel followed in the 1960's, with Sweden and the UK to establish their first in the 1970's (Oakey et al 1999:246). In the past two decades, science parks were also established in Belgium, Japan, Korea and Taiwan and by the 1990's this had resulted in a total of 50 projects in 13 countries (Kung 1995). Most of the European and other parks

were based on the American model, and later adapted to local conditions and requirements.

Originating from the science park model, a need by entrepreneurial USA Universities to play a more direct role in supporting new business development activities emerged. One mechanism to meet this need was the establishment of business incubators, where the emphasis has shifted to the further development of the innovations into commercially viable entities (Main 1994). Kung (1995) identified as many as 188 Innovation Centres, 57 Business Incubators and 103 Science parks world-wide in the early 1990's.

If research studies on the subject are analysed, five different terms are used to describe the various forms of science parks or business incubators – business parks, innovation centres, research parks, science parks and technology parks (Oakey et al 1999:246). The term business incubator is equivalent to the innovation centre and was formalised by Smilor & Gill (1991).

Dahlstrand in Oakey et al (1999:247) classifies the study subject into the following four categories:

- Research Parks, which are closely linked to Universities;
- University Science Parks;
- University and Industrial Incubators; and
- Business (or commercial) Parks.

Cooper and Folta (2000) explore the formation of high-technology clusters and the reasons why they start where they do. They define clusters as *'groups of firms within one industry based in one geographical area'* or alternatively as *'geographic concentrations of interconnected companies and institutions in a particular field'* (Cooper et al 2000:348). They argue that location does seem to make a difference, both in influencing the formation of new firms and in their subsequent performance. They conclude that it is ironic that geography has re-emerged as important at a time when instantaneous global communication is possible. A number of unanswered questions remain, which need to be addressed to add to

the present understanding of clusters and their role in the formation and development of new firms.

2.1.8 Technology in emerging economies

2.1.8.1 Technological capabilities of emerging countries

The post-war European experience, where countries were reconstructed primarily by importing foreign capital and capital goods, enabled these countries to rebuild their shattered economies in relatively short periods of time. The experience in developing countries however, was less encouraging. The mere import of foreign capital was not sufficient to achieve the same results and even with abundant natural resources and suitable labour, the emphasis was shifted in development drives to export technology, or 'know-how', to these countries.

The disparity between the technological capabilities of the richer and poorer countries became more evident as technological development progressed. As many of the major innovations in Western technology have emerged in the capital goods sector of the economy, underdeveloped countries with little or no organised domestic capital goods sectors simply have not had the opportunity to make capital-saving innovations because they have not had the capital goods industry necessary for them. Such countries have typically imported the capital goods and they have not developed the technological base of skills, knowledge, facilities and organisation upon which further technical progress largely depends (Rosenberg 1976:146).

Fransman et al (1984) also argue that the focus of study in the technology transfer process prior to the 1970's was on the problems associated with the technology transfer between countries. These problems related typically to cost, suitability and effectiveness of the technology transferred. In addition, the technology itself was often not suitable for local resources, conditions and objectives and it often operated in an inefficient way in the recipient country.

Inherent in the policies of the time, but which was seldom stated openly, was the assumption that the process was driven by the extremely poor technological capabilities of the recipient countries. It was only in the late 1970's that the assumption about the weak technological capabilities of the emerging world was being challenged. The focus of attention shifted to the examination of technological processes and change in these countries. Researchers became increasingly interested in what happens to the technologies once they were imported and assimilated. A lot of energy was directed to the processes involved in the mastering and adaptation of this technology in the recipient countries. It was increasingly realised '..that technology was implicit, in the sense that the seller always possessed more information about its use than could be embodied in blueprints, training etc. transferred to the buyer and that its transfer accordingly involved a significant degree of uncertainty' (Fransman et al 1984:5). Fransman et al (1984:9) define technology as follows: *'..technology is defined broadly so as to encompass everything pertaining to the transforming of inputs into outputs. Technological change involves change, however minor, in the way in which inputs are transformed into outputs, including changes in the quality of the output'.*

Frances Stewart in his paper 'Facilitating Indigenous Technical Changes in Third World Countries' (Fransman et al 1984:81) identifies the three areas that have the most significant effects on the indigenous technological capabilities at national level. These three areas are:

- *National policies* including:
- Trade policies towards the import of goods and services and the import of technologies;
- Industrial policies to enhance local and international competition;
- Economy wide policies to encourage incentives for local technical change, to introduce mechanisms for technology transfers from abroad, to set-up local linkages, to develop macroeconomic policies and to address the issue of monopolies/oligopolies versus competition;
- Institutional policy in the relationship between R & D institutions and the productive sector;
- Training and education;

- *The political economy of creating local technology;*
- *Alternative theoretical approaches to technical change* such as:
- Empirical case studies at micro-level;
- Neoclassical approach;
- Political economy approach; and
- Institutional explanations.

One of the key issues that any emerging country's government faces in determining policies to develop indigenous technological capacity, is the balance between the promotion of indigenous enterprises and the induction of the best technologies from abroad. India's experience in this regard for the period 1950's to 1980's is described by Sanjaya Lall in Fransman et al (1984:225). Lall argues that the 'highly interventionist regime' that characterised the Indian economy in this period, ignored the careful balance required for policies to enable growth and investment by innovative enterprises. The consequence was overprotected technologies and industries, with a resultant inability to sustain moderate rates of economical growth.

The South Korean experience in the 1980's is also worth mentioning. In this example the international economic term 'Direct Foreign Investment' (DFI) was seen as not an important source of investment finance in South Korea (Fransman et al 1984:279). Instead, the level of DFI was promoted as an effective means of transferring technology from industrial countries. However, Korea's industrialisation has been structured around export-led policies, with a strategy to obtain competence through indigenous efforts and 'learning-by-doing'. The purchase of technology through licensing has been of modest significance as the initial source of technology. Instead, more emphasis was placed on machinery imports and turnkey projects, with a significant amount of know-how that entered the country as Koreans returned from study or work abroad. Koreans have been extremely successful in their efforts to assimilate technological know-how and the phenomenal success of this strategy is well documented.

Another emerging country, Brazil, relied heavily on inflows of technology in the form of direct foreign investments, disembodied technology (patents, licenses and

technical services) and capital goods says Fransman et al (1984:317). The Brazilian government counteracted the heavy dependence on foreign technology by the Brazilian economy by giving explicit attention to the role of technology in economic development and to the stimulation of technological development through government policy.

2.1.8.2 The role of science and technology in emerging countries

The importance of technology and science in any country's economic growth has been recognised by governments of emerging countries for many decades. As early as 1961, the African ministers of education met in Addis Ababa and published a powerful pledge for investment in education. Twenty-one years later in 1982, the same African Governments issued the Harare Declaration where they confirmed the importance of scientific and technological capacity via education. The following statement reflects the sentiments of the Harare conference (Fransman et al 1984:44): '*Science and technology form the basis of industrialisation; the fact that they can be used as such effective instruments and vehicles of development means that the entire population must be associated with scientific and technological advance, that they must be given pride of place in education..'.*

Kenneth King in Fransman et al (1984:31) investigates the role of science, technology and education in the development of the 'Indigenous Technological Capability' (ITC) of what is referred to as the 'Third World' in the paper. Case studies in Africa, Latin America and Asia are tabled where the interaction between learning and technology and the concept of ITC within the third world are explored. The inter-relationship is investigated in the following four modes of education:

- Informal education, local knowledge systems and non-cognitive aspects;
- Formal primary, secondary and tertiary education;
- Formal off-the-job training; and
- Learning on-the-job.

Particular emphasis is placed in the paper on the entrepreneurial activity. King's remark (in Fransman et al 1984:42) is relevant to illustrate the interrelationship between entrepreneurship and technological capacity: *'Whatever the skills imbedded in the local knowledge systems, and whatever the environment, there is apparently another element operating on technological capacity – entrepreneurial activity. Like the search for 'the effective teacher', the analysis of successful entrepreneurship has proved immensely problematic, and yet it looks as if family and community cohesion is a vital non-cognitive aspect of the ITC'.*

2.1.8.3 Technological colonies

The concept of technological colonies was discussed by De Wet (1995) in the working paper *'Emerging from the Technology Colony: A view from the South'*. The notion that, even though many developing countries gained political independence after World War 2, they still remained 'technological colonies' due to their dependence on foreign technologies, imported innovations and technical expertise. Despite the fact that manufacturing of relatively high-tech products were transferred to developing countries, either as part of foreign direct investment programs or due to low-cost factors such as labour and natural resources, most of these products were made under licence agreements or protected by patents. This resulted in limited stimulation of indigenous technological capabilities such as R & D programs and the development of local technological entrepreneurship. It is estimated that in the case of South Africa, more than 80% of the value in industrial business (for the 1990 period) was done under foreign licence. The drive in several of these emerging countries have been primarily focused on obtaining technological independence and De Wet suggests five strategies for the naturally rich 'colonies':

- Backwards integration through the product development life cycle;
- Beneficiation, which is the increased value-adding to raw materials before they are exported;
- Solving local infrastructure problems;
- Clustering of industries and services; and

- White space initiatives, where the drive is to establish new industries and ventures where none existed in the country before.

The South African Innovation Survey 2001 (Oerlemans et al 2003:11) also confirms that South Africa can be characterised as a type of technological colony, whose industries are dependent on foreign technology for the improvement of its products and processes.

The paper presented by Buys (2004) at the IEEE Africon 2004 Conference explored the innovation capability of South Africa within the context of a technological colony heritage and compared it to the innovation benchmarks used in Europe.

2.1.9 Entrepreneurship in emerging economies

In order to understand the fundamental and underlying principles of entrepreneurship in emerging countries, it is necessary to review the literature of research studies available on this topic. The following countries fall in this category and the available literature on entrepreneurial development are summarised as follows:

2.1.9.1 Nigeria

Nigeria was created as a British colony between 1898 and 1914 with treaties between England and France. During the sixty years of colonial rule following the creation, the indigenous political systems within Nigeria were virtually undisturbed, but the economy became more capitalistic and much more productive with increased trade in crops and cattle between the north and south (Odusina 1973:5). It was however, in the social system of this country that many far-reaching changes were affected during the period of colonial rule. Christianity and Western education were introduced in the southern part of the country and the inherent work ethic of sweating from ‘sun-up to sun-down’ gave way to the leisurely, white-collar manner of life as the mark of success. Monogamy was part of the

Christianity package and literacy was seen as a measure of civilisation, although technical education was not encouraged at all (Odusina 1973:6). In the northern part of the country, the social systems were left virtually untouched. The Islamic culture remained dominant and the practice of quadrigamy and wives in 'purdah' almost completely eliminated women from the nation's economic production activities.

At the beginning of Nigeria's independence in 1960, the social class consisted mainly of graduates in the liberal arts and human sciences, with a limited number of engineers, doctors, scientists and technologists. There were few productive industrial establishments and most of the commercial banks, marketing and wholesale business activities of industrial goods were under the control of foreigners. The agricultural sector was controlled by quasi-government agencies and was mainly stimulated by export of crops like cocoa and peanuts to the lucrative world markets. The developing nation of 80 million people (1973 Nigerian National Census) was characterised by a lack of creativity, managerial and technological expertise. The Nigerian government introduced a National Development Plan from 1970-74 with as principal objective to *'…establish Nigeria firmly as: a united, strong and self-reliant nation; a great dynamic economy; a just and egalitarian society; a land of bright and full opportunities for all citizens; and a free and democratic society'* (Odusina 1973:10).

The training model proposed by Odusina (1973) was titled TIPS and GEM – 'Training for Increased Profits' and 'Greater Efficiency in Management' – and it was tailored to the needs of the small entrepreneur in Nigeria. The model further used the term 'course-aids' rather than 'curriculum' and the model was based on the following three approaches:

- *The Concept Approach* where *"…course-aids are selected on the basis of promoting learning through concepts; where the broad ideas constitute internalisation through mental imagery; where a concept is a summariser of experience; an invention of the mind to explain and classify perception – shape, colour, size etc."* (Odusina 1973:79).
- *The Process Approach* refers to the construction or selection of course-aids to specifically achieve the learning of fundamental skills needed in scientific activities. The philosophy of the approach is *'..that such skills should be*

separately learned as curriculum essentials which facilitate the understanding of most educational challenges, foster self-reliance and promote creativity' (Odusina 1973:80).

- *The Life-living Approach* that makes use of the first two approaches together in a comprehensive and tailored way. The philosophy of the approach is to use living experiences to socialise the learner and to live from the inside out, from his/her immediate environment to the world at large.

Perhaps the most significant relevance of the research done by Odusina is his characterisation of the personal attributes and habits of the average Nigerian business person (1973:130), whom Odusina describes as follows:

- He is a complacent 'conspicuous consumer';
- He is individualistic in acquisition;
- He is customarily socialistic in consumption;
- He is nepotic in environments that are far away from 'home' because of high affiliation needs;
- He is a spender on children's education at any cost;
- He entered business because his quest to become an academic failed;
- He despises agriculture and manual labour;
- He respects status, tolerates power and acknowledges high class as something to aspire towards;
- He is apathetic to political ideologies, but pragmatically sensitive to the effects of political decisions; and
- He sees married status as evidence of maturity and views parenthood as a 'mission' that must be accomplished for social respect.

Reference to this profile and the relevance thereof to the environmental influences on the development of the entrepreneur in a developing environment will be made later in this study.

Another study that contributes to the understanding of entrepreneurship in developing countries is the work of Nafziger (1977) entitled 'African Capitalism: A case study in Nigerian Entrepreneurship'. The study focuses on the footwear manufacturing industry in Nigeria, which consisted largely of indigenous firms and technology. The findings of the study are summarised as follows:

- The education level of entrepreneurs is higher than the education level of the population as a whole. It was found that the sample of entrepreneurs had completed an average of 7.1 years formal education successfully versus the 4 years of the rest of the population;
- There is a positive relationship between the entrepreneurial education and the value of output of the firms in the survey sample. Entrepreneurs in larger firms had an average of 10.5 years of formal education versus the 6.7 years formal education of entrepreneurs in smaller firms; and
- There is a significant negative relationship between entrepreneurial education and profit rate among the survey sample firms. Entrepreneurs in the low percentage profit group (-18% profit rate) had 13.5 years formal training versus the 6.0 years of the high profit group (13% or more profit rate).

The first two findings concurred with findings of other economical studies, but the latter finding was contrary to other research results and popular belief in the entrepreneurial literature. The study also concluded that the lack of previous entrepreneurial or managerial experience was a major barrier to success among entrepreneurs in large industries (Nafziger 1977:183). In conclusion, Nafziger 1977:217) proposes the following focus areas for the development of entrepreneurship in Nigeria:

- Training programs;
- Direct entrepreneurial assistance to small firms;
- Industrial extension centres;
- Industrial estates;
- Small loan agencies;
- Training in large firms;
- Management institutes and schools for large firms;
- Technical education;
- Academic education;
- Apprentice standards;
- Economic data and their utilisation;
- Research and development;
- Banks;
- Nigerianisation and foreign firms;

- Policies towards multinational corporations;
- Joint foreign-indigenous enterprises;
- The reservation of industrial sectors for Nigerians;
- Foreign managers and consultants;
- Government assistance in obtaining foreigners;
- Foreign experience;
- Tax-subsidy policies;
- Tariff policy;
- Government attitudes and capabilities;
- Entrepreneurship in government;
- Anti-monopoly measures; and
- Achievement motivation training.

2.1.9.2 Former East Germany

The transitional state of entrepreneurship education and training in the post-socialist Eastern Germany was presented at the first Annual Global Conference on Entrepreneurship Research held at Imperial College, London in February 1991 (Birley et al 1992:37). The author of the paper 'Entrepreneurship in an economy in transition: Perspectives of the situation in the ex GDR', Thomas Köllermeier, argued the appropriateness of existing models for the analysis of entrepreneurship in an economy in transition. He did so under the following main categories:

- In the historic development of East Germany after the Second World War, the Soviet Union started to nationalise private firms in accordance with the communist ideology of the ruling party at the time. The so-called VEB or state-owned companies were formed. In addition, the government started to combine some of the VEB's into large-scale enterprises called 'Kombinate', which ultimately led to a strong concentration of the structure of the economy;
- Forty-five years of different policies created a vast inherent difference between the centralised economy of the eastern part and the profit driven, decentralised free economy of the western part;

- Typical problems encountered were to estimate the number of potential entrepreneurs accurately and the distinction between entrepreneurial ventures and small businesses;
- The behavioural approach seems to be the more appropriate method to study the process of venture creation than the trait approach. The paper propagated the focus on the 'activities' of the entrepreneurs and ventures that successfully survive the time of reconstruction and started to grow, versus the search for the 'ideal' entrepreneur under these circumstances;
- The framework suggested for the research design of entrepreneurship in a transitional environment comprises a model of four dimensions as indicated in Figure 2.3. These dimensions focus on activities, but also refer to historic facts. They stem predominantly from the behavioural approach, but also represent a few concepts from the trait approach; and

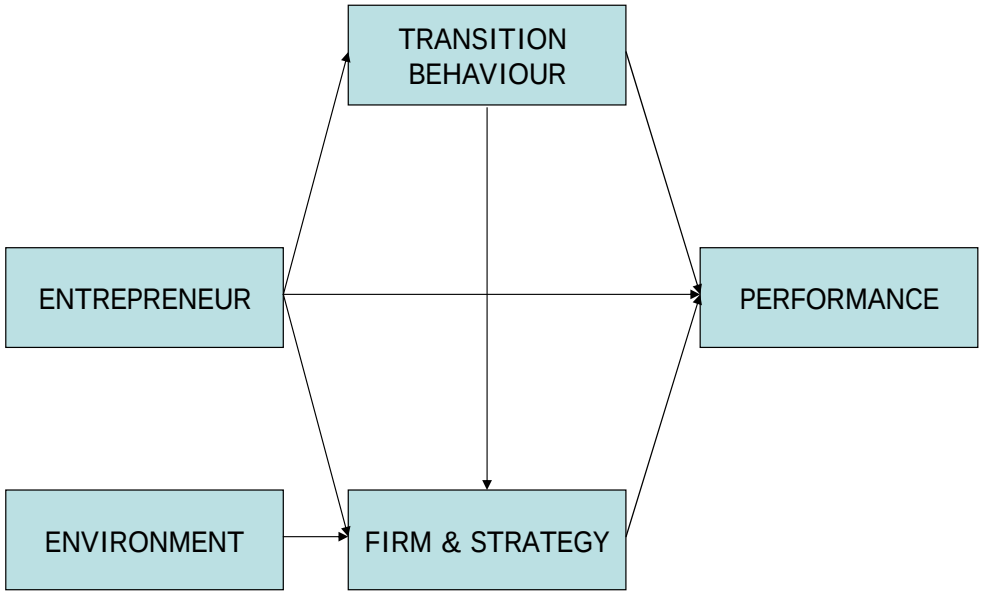


Figure 2.3: Interrelation of Venture Dimensions and Performance

Source: Birley et al (1992:51).

- The traditional theories of entrepreneurship and small business management are predominantly based on relatively stable environments with abundant resources and role models. They fail however, to capture specific aspects of entrepreneurs who operate in an economic environment that is in transition, or entrepreneurs who operate in a difficult environment with minimal resources.

In summary, the paper proposes a customised model for the research of entrepreneurship in transitional economies such as the former East Germany. This model has been significant in terms of theory building in the study of entrepreneurship in emerging economies, which can also be categorised as economies-in-transition.

2.1.9.3 Singapore

The Malay community in Singapore is one ethnic group that is lagging behind other groups, particularly the Chinese and Indians, in terms of economic development in Singapore today (Birley et al 1992:89). Since becoming independent in 1965, Singapore has made great strides in economic development. According to the 1980 census, the population of Singapore is made up of 76.9% Chinese, 14.7% Malays and 6.4% Indians. But the distribution of opportunities and economic rewards show that Malay participation is lagging behind those of the Chinese and Indians. In analysing the reasons for this phenomenon, Chong Li Choy and Abdul Jalil Ismail (Birley et al 1992:90) conclude that the Malays in Singapore are caught between present day Singapore and their traditional socio-cultural system. While this may be true for all communities within Singapore, the contrast between modernity and traditions of the Malay group is stark in comparison to the other groups. The Malay community has remained rooted in their past traditions and did not adapt to the modern urban, industrial and commercial society at the same tempo as the Chinese and Indians. In their research, Choy & Ismail (Birley et al 1992:97) proposed the following reasons for the lack of entrepreneurial activities within the Malay community:

- The influence of Islam in the daily activities of Malay Singaporeans is dominant; wealth is not considered to be essential for salvation, nor is wealth

proof of social or moral worth. Achievement in economic terms and in particular in entrepreneurial activities is unacceptable within the dominant Malay social structures;

- Lack of incentives to save or gather financial collateral within the Malay culture is a further stumbling block in the attainment of capital for new ventures;
- Lack of expertise due to the poor educational system and the lack of entrepreneurial tradition in the Malay culture; and
- Lack of opportunities created for Malay business development, is one perception of Malay entrepreneurs.

In summary, the lack of cultural tradition and a value system that supports an entrepreneurial ideology are evidently the underlying reasons for the problem of Malay participation in entrepreneurial activities in modern Singapore. A community-based entrepreneurial development approach is proposed to address the problem, with emphasis on improved education, perceptions within the family unit, the social status of entrepreneurs in the community and the creation of role models.

2.1.9.4 Vietnam

In a study of the importance of entrepreneurship in the economic development of the Republic of Vietnam (commonly referred to as South Vietnam) and the effect of public policy on the rate of flow of entrepreneurial talent into the economy, Tran (1975:96) came to the following conclusions:

- Entrepreneurs from ‘outside’ (Chinese and North Vietnam) are more successful than local or indigenous entrepreneurs;
- Entrepreneurs from Christian beliefs, in proportion to their numbers, account for as many as four times the entrepreneurs as from Buddhist beliefs;
- Secondary education (Baccalaureate degree) is associated with the most successful entrepreneurs;
- The profile group of entrepreneurs are between twenty-four and fifty-two years of age; they have been relatively successful in employment; they have been

highly mobile in terms of their occupational background and they come from a variety of trade or skill backgrounds;

- A high economic status of the father is a major factor related to a high degree of entry into entrepreneurial activity by the children;
- Pecuniary motives are the overwhelming reasons for entering business, followed with family traditions and the need to be independent;
- Lack of working capital was given as the greatest difficulty of entrepreneurs, followed by the lack of confidence and the mistrust of the suppliers and customers; and
- Entrepreneurs look first to their relatives for help, counsel, initial capital, partnership formation and employment.

The research findings of Tran also addressed the important issue of public policy and its effect on entrepreneurial response. He tables the following key findings in this regard (Tran 1975:142):

- The importance of political factors in the economic structure of Vietnam and the identification of two types of entrepreneur-politicians: first the individuals who were successful entrepreneurs prior to entering politics and secondly those who entered politics from non-entrepreneurial backgrounds. Both these groups used politics to further their own pecuniary motives;
- The majority of manufacturing entrepreneurs rely on their own experience and knowledge to choose their product, but prefer to rely on foreign technicians to choose the technology to be used. They rely very little on governmental assistance in their choice of technology;
- Entrepreneurs indicated that they would only enter the export field if the government provides the motivation, incentives, and assistance;
- Entrepreneurs blame the government for lack of economic growth due to its alleged corruption, favouritism, lack of continuity and uniformity in public policy, lack of adequate support to industries, inability to prevent inflation and monetary instability and for capital flight as well as the negative role of state enterprises;
- Entrepreneurs are favourable towards foreign investment, as long as it is not ‘exploitative’ or ‘colonialist’; and

- Opportunities are characterised by low investment and entrepreneurs favour endeavours with simple technological requirements.

2.1.9.5 Soviet Union

The Soviet Union has experienced significant difficulties in their post-1990 drive to move away from bureaucratic dominance in the economy and to decentralise the ownership of businesses. In a case study on the management of transition by a Soviet State firm in the publishing industry, which is viewed as typical of the Soviet situation, three important issues of global entrepreneurship are raised by Birley et al (1992:104):

- Conceptualisation of firms as entrepreneurial;
- Introduction of environmental variations to entrepreneurial firms; and
- The structure and composition of stakeholders.

Similar research questions to those raised in the analysis of the former East German transitional economy are posed in this case study. Fundamental to this issue, is the question: *To what extent is the Western model appropriate for understanding entrepreneurship in countries that have moved from centralised economic planning to that of a free market?*

2.1.9.6 India

India has done significant ground-breaking work on the implementation of Entrepreneurship Development Programmes (EDP's), which began as an experiment by Gujarat State Industrial Corporation and which gained momentum at national level in the early seventies (Awasthi et al 1996:14). This led to the creation of Centres for Entrepreneurship Development (CED) in 1979 and a national resource organisation, the Entrepreneurship Development Institute of India (EDI-I) in 1983. At present a large number (about 686) of institutions and organisations are engaged in conducting a variety of training and research activities which are directed towards developing entrepreneurship in India. If the

fact that the strategy of training potential entrepreneurs through EDP's constitutes an important policy instrument and that a substantial amount of funds is annually committed to train potential entrepreneurs, a need was felt to undertake a systematic and comprehensive evaluation of the programmes. The study of Awasthi et al (1996:22) based its approach to the assessment of the EDP's on a combination of two approaches. The first approach is to view it as an enterprise-building activity and the other approach is to treat it as a human resource development strategy. Both the approaches are geared towards creating an overall environment where entrepreneurship germinates and grows. Their research results measured the costs incurred in the training activities and the benefits accrued at national level. This is a useful example for other countries to follow.

The EDP's in India can be regarded as a process of 'grooming' entrepreneurs and can be divided into three distinct phases:

- Pre-training phase;
- Training phase; and
- Follow-up phase.

The pre-training phase consists of activities such as centre selection, promotional campaigns, and the identification and selection of potential entrepreneurs for the programme. The training itself mostly consists of a six-week course with three primary focus areas: Firstly the entrepreneur (behavioural traits), secondly the enterprise establishment (decision-making process to set up a new venture) and thirdly the enterprise management (successful and profitable operation of the enterprise). The two most critical training inputs besides behavioural and information inputs are on the issues of opportunity identification and guidance and managerial skills (Awasthi et al 1996:119).

Another significant perspective proposed by Kris Murthy (1997) is the notion of 'autopoiesis', which is the Greek word for 'self-production'. It is referred to as the new paradigm of self-organisation and spontaneous phenomena in physical, biological and social systems. It is defined by Murthy (1997:67) as *'a process for the production of order according to some plan'.* India as an emerging economy

suffers from symptoms such as a lack of global perspective/vision, inferior quality products, the myth that India is a low-cost centre and the lack of a level playing field. Murthy proposes that India, as well as other emerging countries adopt a change in strategic outlook by applying the principles of autopoiesis.

2.1.9.7 South Africa

The general state of entrepreneurial activities in South Africa was discussed briefly in Chapter 1 against the findings of the Global Entrepreneurship Monitor (GEM 2002, 2003 and 2004) program. The most significant contribution of these studies, apart from providing guidance to policy makers in development strategies, is the relative position that South Africa was ranked compared to the position of other developing or emerging countries. South Africa was rated last after five other countries in this category for 2003 (Brazil, Chile, Argentina, Venezuela and Uganda) and was rated last again after the six other developing countries in 2002 (Thailand, India, Chile, Argentina, Brazil and Mexico). South Africa was also last of the four countries in the 2001 GEM report. Earlier studies of the entrepreneurial activities in South Africa can be found in the work of Falkena (1980) in 'The South African State and its Entrepreneurs', as well as Van Daalen (1989) in 'Individual Characteristics and Third World Entrepreneurial Success'. The latter work researched the personality traits of indigenous black entrepreneurs in the former Ciskei region on the southeastern coastal belt of South Africa. Other work mentioned by Van Daalen (1989) included research done by Redelinghuys (1969) on several ethnic groups of entrepreneurs and in particular the Tswana ethnic group, by Hart (1972) also on entrepreneurship in the Transkei and urban areas, by Van der Merwe (1976) on the Xhosa ethnic group, by Churr (1978), by Maasdorp (1978), by Davies (1987), by Booyens (1987), Boshoff & Van Vuuren (1992), by Marx (1992), by Bagshaw (1996), by Nieuwenhuizen & Van Niekerk (1997) and others. Although most of this research data is outdated and bears little relevance to this study, there are some conclusions that are universally true for the country and its historical development. Such is the conclusion of Hart (1972:204) in her remark: *'..the fundamental irrationality of the present legislative framework…; the system represents an attempt to stimulate enterprise in areas*

where a number of major obstacles exist in the economic environment, while prohibiting or placing extremely stringent restrictions on African entrepreneurship in areas which have been shown to be inherently favourable for development'.

The conclusion reached by Van Daalen (1989:104) is '*..that the African entrepreneur in South Africa not only has to contend with the usual problems common to most developing economies, but also with the 'labyrinth of restrictive legislation' that regulates the status of the African in designated white areas to that of a temporary immigrant*". This conclusion underpins the inherent cultural heritage of the modern day indigenous entrepreneur in South Africa. The prohibiting legislative and political structures referred to by the authors, are no longer in existence in South Africa since 1994. However, this cultural heritage will have to be addressed in the research design of this study to make the findings representative of a society with this specific historical background.

Significant contributions to the understanding of entrepreneurship in Southern Africa were made by Boshoff, Bennett & Owuso (1992), and Boshoff & Van Vuuren (1992) in their paper 'Towards understanding the entrepreneurial personality – A South African study' which was delivered at IntEnt 92. Their research investigated two questions:

- Do successful and less successful entrepreneurs differ from each other in terms of biographical variables, personality traits and interests?
- Do entrepreneurs differ from individuals in other occupational groupings, i.e. state employment and banking, in terms of biographical variables, personality traits and interests?

The research sample included three groups, i.e. central government employees, bank officials and entrepreneurs from the private sector. The most important findings of their research can be summarised as follows (Klandt et al 1993:385): *'The more successful entrepreneurs and less successful entrepreneurs differ significantly in only one out of the sixteen personality variables measured i.e. superego strength and on none of the fields of interest; In terms of biographical variables like age, marital status, religious affiliation, education and family*

background, no correlation or profile for the successful entrepreneurs could be found'.

Where entrepreneurs were compared with bankers and government employees, entrepreneurs differed significantly from the other groups. The dominant biographical profile of the entrepreneurs emerged as:

- English-speaking;
- Older;
- More likely to be born outside South Africa;
- Male rather than female;
- White;
- Married;
- Not formally affiliated to a religious denomination;
- Less likely to have had tertiary education; and
- Had fathers who were themselves in business or did managerial work.

Although the research findings are not of a generic nature, it is significant both from a comparative and contextual point of view. Their contribution relative to this research study is relevant from two perspectives:

- No other findings on typical entrepreneurial traits in the South African context could be found which did not represent a particular population group only;
- The biographical variables in particular, provide a control model to which research results of this study can be compared with to obtain some level of credibility within the study framework.

Another recent study that is relevant to this research is the work of McKenzie & Turner (2003). Their research focuses on identifying the traits and factors that contribute to entrepreneurs' success within the South African context. They collected data from 26 past finalists of the Ernst & Young Entrepreneur of the Year competition for the past six years and conclude as follows (2003:55):

- Entrepreneurs with the ability to work hard, who had a positive attitude and were prepared to take risks, are more likely to succeed;

- It is unlikely to make an informed decision with regards to what enabled this group of South African entrepreneurs to succeed, based solely on their personalities and traits;
- Formal tertiary education, or the lack thereof, did not play a significant role in determining entrepreneurial success;
- Two thirds of the entrepreneurs indicated that they acted largely on their own in running the business for a number of years after they become profitable;
- When selecting a support team, almost all the entrepreneurs opted for staff who would complement their own strengths and weaknesses;
- Most of the entrepreneurs suggested that their past business failures were valuable learning experiences and did not view them as an indication of personal weaknesses. They did indicate however, that the South African society should develop a more positive view with regards to business failures;
- The majority of entrepreneurs used their own funds, or those of family, to finance their businesses. The raising of funds through traditional lending sectors in South Africa such as the banking sector was seen as a problem for prospective entrepreneurs.

Perhaps the most significant result of this study is the key factors that were identified which hindered the development of entrepreneurial firms in South Africa. These key factors are:

- Lack of the education system to expose school leavers to sufficient business knowledge;
- Gearing of the education system towards developing corporate skills rather than entrepreneurial skills;
- Poor access to experienced and knowledgeable people by start-up firms as most of the government and non-government (NGO) organisations that were set up to offer assistance are staffed by individuals who do not have the necessary business experience or skills to offer practical, effective advise; and
- Government legislation and excessive bureaucratic red tape such as onerous labour law and tax provisions were highlighted as major stumbling blocks in the development of start-up firms.

The entrepreneurs surveyed were involved in all types of businesses operating in all the economic sectors and did not provide specific information on technology-based enterprises or entrepreneurs.

2.1.9.8 Other emerging countries

Other research findings on entrepreneurship in emerging countries that are of significance to this study are the following:

- In the research findings of the study of industrial development and structural adaptation in Taiwan, Liu (1998:338) concludes: *'…that learning capability and human capital will determine the endurance of Taiwan's industrial success, and that entrepreneurship must be learned by the state, as well as by private firms'.*
- The findings of Xu, Chen & Guo (1998) on the evolutionary process of technological innovation and technology management in China.
- The illustration of Taiwan's technological development model of government-guided and knowledge-linked industrial networks (Liu 1997).
- Development of technological entrepreneurship in China, with specific reference to role of SME's and the creation of Economic Development Areas (Burke et al 1998).
- The exploration of the 'new generation of African entrepreneurs' and their networking capabilities in changing the entrepreneurial landscape of Africa (McDade and Spring 2005).
- The fundamental differences in venture capital practices between emerging and developed economies, as researched by Ahlstrom and Bruton (2006).

2.2 CURRENT THEORIES

2.2.1 Primary theories

The main body of applicable theory underlying the study subject can be summarised in the following four primary categories:

2.2.1.1 The generic entrepreneurship theory, as proposed by Bolton et al (2000) in their work, 'Entrepreneurship: Talent, Temperament, Technique';

2.2.1.2 The profile of technological entrepreneurs in developed regions, as proposed by Roberts (1991) in his book 'Entrepreneurs in High Technology: Lessons from MIT and Beyond';

2.2.1.3 The development of technological entrepreneurship, as proposed by Roberts (1991) in the same book mentioned above;

2.2.1.4 The environments for entrepreneurial development, as proposed by Gnyawali et al (1994).

2.2.2 Secondary theories

There are several secondary or supplementary theories that are relevant to the subject. The following is a summary of the most significant theories:

2.2.2.1 Knowledge of *technology,* with emphasis on:

- Technological base;
- Technological innovation;
- Technology and economical growth;
- Technology transfer;
- The commercialisation of technology.

2.2.2.2 Knowledge of *entrepreneurs and economic growth,* with emphasis on:

- Small, medium and micro enterprises;
- Intrapreneurship;
- Roles of government policies, private sector initiatives and education and training.

2.2.2.3 Knowledge of *technology in emerging regions,* with emphasis on:

- The role of science and technology;
- Technological colonies.

2.2.2.4 Knowledge of *entrepreneurship in emerging regions,* with emphasis on:

- The experience of several countries classified as emerging, such as the former East Germany, Nigeria, South Africa, Taiwan, and China etc.

2.3 THE NEED FOR NEW THEORY

2.3.1 Theory categories included

The existing theory as reviewed in Chapter 2 is categorised broadly into the following two categories:

- Entrepreneurship Education and Training; and
- Technological Entrepreneurship in Emerging Regions.

The theory gap in these two categories is identified against the background of the research topic.

2.3.2 The theory gap

As previously mentioned, this research is classified as *theory-based empirical research.* According to international research guidelines, research studies of this nature review available literature, explore the existing body of knowledge and identify gaps in the theory. The theory gap in this research field identified from the two theory categories listed above is that of *entrepreneurship education* and *technological entrepreneurship in emerging regions.*

2.3.2.1 Entrepreneurship education

There is a definite need for hypothesis-testing research in entrepreneurship education research as indicated in various literature references (Klandt et al 1993:6). In particular, there is a need to develop research methodologies to measure entrepreneurship education. There is a further need for more substantial, reliable and valid research results than case studies, with control groups measuring those who have received entrepreneurship training versus those who have not. Klandt et al (1993) also suggest that attempts should be made to control all extraneous variables and those studies should contain pre- and post-measurements.

Brockhaus summarises the theory gap in entrepreneurship education as follows (in Klandt et al 1993:7): *'There are many challenges for us as entrepreneurship educators if we truly want to do the best job that we can in educating entrepreneurs. Hopefully, we could improve what we do if we took the effort to*

conduct entrepreneurship education research. Entrepreneurship is more of interest today than probably at any other time. And yet, there is very little known about entrepreneurship education from a research perspective. There are theories of education and learning that other fields have developed for us that we can utilise in our own efforts. We must combine the knowledge that we have about entrepreneurship with the learning theories in education. With the need for improved entrepreneurship education to meet the high demands of entrepreneurship education around the world, this is an exciting time for all of us. The opportunity to focus our attention on entrepreneurship education must not be missed'.

This was the predominant view at IntEnt 92. Ten years later however, the educational needs have increased, without the accompanying growth in appropriate knowledge in the field. The specific gap in entrepreneurship education theory is that *little is known about the efficiency of entrepreneurship training and education in emerging regions, especially in the technological disciplines.*

2.3.2.2 Technological entrepreneurship in emerging regions

The key subject in the research, the technological entrepreneur, is well researched in developed regions, but little is known on the characteristics of this group of entrepreneurs operating in developing regions with emerging economies. The following specific gap in the existing theory of technological entrepreneurship is that:

- *There is not a representative model for the technological entrepreneurship domain in emerging regions which consists of specific entities and their inter-relationships;*
- *Little is known about the profile of the technological entrepreneur in emerging regions, with specific references to the family background, personality traits, educational profile and work experience and how it compares with profiles in developed regions.*

2.3.3. Conclusion

In closing the chapter on the literature survey that identified the need for new theory, the original research problem is revisited. The research problem states that: *Limited theory and models are available on technological entrepreneurship in emerging regions.*

The preceding review of current literature on the broad field of entrepreneurship research, as well as specific overviews of sub-categories of related fields such as technology and innovation, revealed that a substantial body of knowledge has been accumulated over the past decades. The knowledge is extensive for developed societies and industrialized regions, and to a lesser extent for emerging economies. Specific knowledge on the field of technological entrepreneurship in emerging regions is insignificant compared to that of other regions and forms of entrepreneurship. The review highlights the status on contemporary issues such as the born-or-made debate, influence of policy strategies and decisions on new venture creation and the human influence on the entrepreneurial process. These generic issues are complex in itself and even more so if studied in a specific environment with its own added dynamics. Such an environment is technology-based business formation in regions that have a strong economic growth profile.

Indications are that the research questions posed in Chapter 1 are not addressed adequately in existing knowledge on the subjects. This leads to the logical question: Can the existing knowledge base for generic entrepreneurship in developed societies be applied to societies that differ substantially in terms of demographic composition and economic characteristics? The following expectations are created at this stage of the research project:

- There are elements of models and principles in existing theory that should be applicable to the entrepreneurial process in a different environment;
- Some of these models or elements are more appropriate than others;
- The existing theory provides sufficient grounds for the notion that individual traits are equally important in the technological entrepreneurship process, both in single cultural developed regions and multi-cultural economically emerging regions;

- This is equally applicable to the family background, educational development and experience profile of the technological entrepreneur;
- The process of new venture creation and the development to a mature enterprise thereafter, will be influenced by generic environmental influences such as government policies, macro-economic drivers and major technology improvements in both domains;
- The environmental influences such as socio-economic factors, cultural and demographic composition, educational framework and policies at micro or regional level are not necessarily generic in its effects on the entrepreneurship process or the entrepreneur in both domains; and
- An approach to research multiple aspects of the study population over a broad spectrum, rather than lesser topics in more depth, is the most appropriate strategy to follow in the research planning.

These expectations provide a platform for the next phase in the research design. Specific models that are most applicable to the identified environment of technological entrepreneurship in multi-cultural emerging regions will be reviewed. The proposition of a new or modified model framework to address this potential gap in theory should follow. Field research is then necessary to provide the required theoretical data base from which such a model can be substantiated. This will serve to enhance the understanding of said technological entrepreneurship.

2.4 SUMMARY

In Chapter 1, the introduction to this research project was formulated. Chapter 2 contains the theory and research survey or overview, which is a crucial ingredient of any theory-based empirical research project. Due to the magnitude and span width of the research topic, care was exercised in selecting the most relevant theory. After a general overview is given, the chapter continues to present the most significant contributions by researchers using the following framework:

Firstly, the theory and research review is discussed under:

- General entrepreneurship theory;

- The development of entrepreneurship as a subject;
- Technology as a body of knowledge;
- Technological entrepreneurship;
- Technology in emerging regions; and
- Entrepreneurship in emerging regions

Secondly, current theories are reviewed:

- Primary theories; and
- Secondary theories.

Lastly, the need for new theory is presented:

- Theory categories; and
- The theory gap.

Chapter 2 contains the primary body of theory on the research subject, from which the desired new theory is developed in Chapter 3, as well as setting the propositions for the research.

CHAPTER THREE

MODEL FRAMEWORK

CHAPTER THREE

MODEL FRAMEWORK

> *'In the beginner's mind there are many possibilities; in the expert's mind there are few'.*
>
> Shunryu Suzuki, Zen philosopher (De Necker 1997:157).

3.1 MODELS USED IN THIS STUDY

3.1.1 General

This project is classified as *theory-based empirical research.* More specifically, the research is termed *theory- or model building research,* where new theory is proposed and presented in the form of a *model.* The model is a manner of representing reality. According to Buys (2004) the model has certain limitations and can at best be representative approximately 70% of reality. This research project utilised retroductive reasoning instead of deductive reasoning to derive at the final research findings. The steps in the retroductive reasoning process are the following:

3.1.1.1 Statement of the research problem (Chapter 1);
3.1.1.2 Review of past research and current theories and models (Chapter 2);
3.1.1.3 Statement of the 'theory gap' (Chapter 2);
3.1.1.4 Description of current theory and model framework (Chapter 3);
3.1.1.5 Data gathering and analysis (Chapters 4 & 5);
3.1.1.6 Inference of new hypotheses (Chapter 5);
3.1.1.7 Induction of new theory and model (Chapter 6).

The first step in this Chapter is to describe the current theory and models which is followed by formulating propositions to describe the proposed model framework.

The empirical research endeavours to prove the interdependence and quantify the relationships between the elements of the model. The method followed to prove this is discussed in Chapter 4. This Chapter explores the existing models that are relevant to the study subject, as well as those models that form the body of knowledge of the study subject. The three models in particular which are explored and used throughout the study, are the following:

- The model of Bolton & Thompson (2000) which describes the *entrepreneur* (person);
- The model of *entrepreneurial environment* by Gnyawali & Fogel (1994); and
- The model of Roberts (1991), which describes the *technological entrepreneur development* process.

Other models that contain elements of relevance are also briefly discussed. This Chapter explains the theory-base of the research, which is derived from the research and theory survey conducted in Chapter 2.

3.1.2 Entrepreneur

It is common belief that entrepreneurs create and build the future and that they are found in every walk of life. The belief is also extended to postulate *'…that every community group, every public organization and every private corporation has within it an entrepreneurial potential waiting to be released*' (Bolton et al 2000:1). Many entrepreneurial talents lie unrecognised, unused and undeveloped. It is these people and their talent that are needed to challenge and change the business world of the day to ensure optimum benefits for mankind.

It is also recognised in theory that entrepreneurial talent, like any talent, has to be discovered before it can be developed (Bolton et al 2000:4). Inherently modern societies however, tend to inhibit rather than promote the development of entrepreneurial talent through embedded constraints such as cultural and educational systems. This phenomenon is illustrated by the recorded research results that 10-15% of engineering students at Cambridge University in the 1980's

were potential entrepreneurs, while the real number of entrepreneurs was estimated to be only 1% (Bolton 1986:15). Other studies in the USA have quoted the number of potential entrepreneurs as more than 40% (Bygrave 1998:61). The large difference between the potential and real entrepreneurs raises the question as to why the potential entrepreneurial talent is not nourished by modern society to its full capacity. This discrepancy forms the basis for the model proposed by Bolton & Thompson in their publication 'Entrepreneurs: Talent, Temperament, Technique' (2000). See Figure 3.1.

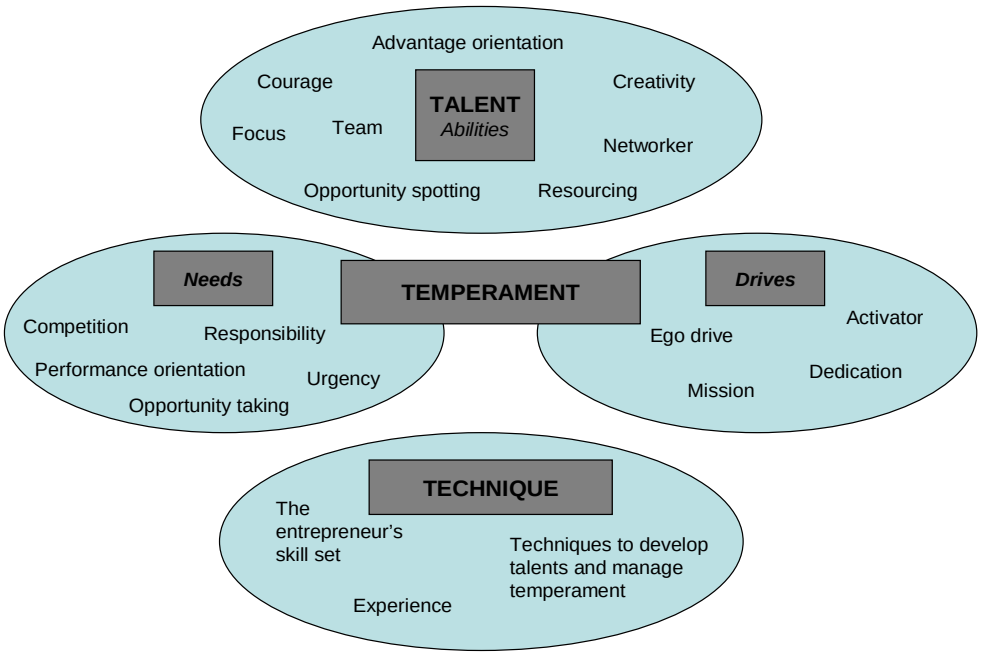


Figure 3.1 The Entrepreneur: Talent, Temperament and Technique

Source: Bolton & Thompson (2000).

3.1.3 Entrepreneurial environment

The model of Gnyawali & Fogel (1994) presents a suitable framework to describe the environment of technological entrepreneurs. The model has the following key role players:

- Government policies and procedures;
- Socio-economic conditions;
- Entrepreneurial and business skills;
- Financial assistance; and
- Non-financial assistance.

The model also identifies the following key elements:

- Opportunity;
- Propensity to enterprise;
- Ability to enterprise.

The model describes the relationships that link the elements and the effect of each related element on the other. This model is presented in Figure 3.2.

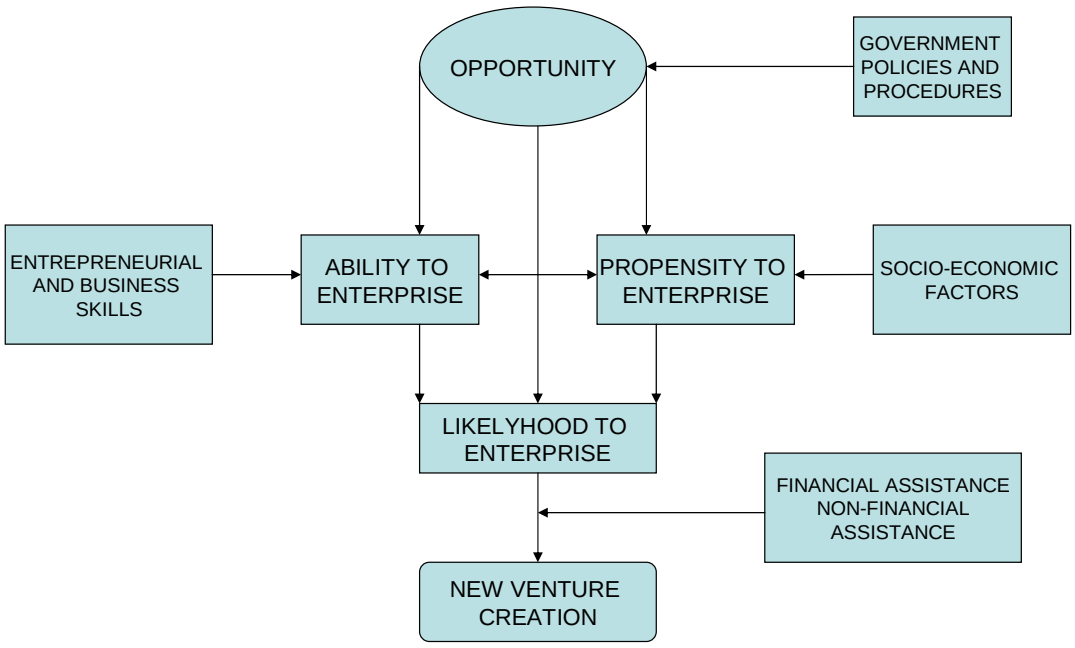


Figure 3.2 An Integrative Model of Entrepreneurial Environments

Source: Gnyawali & Fogel (1994).

3.1.4 Entrepreneur development

Roberts developed a four-factor model of the technical entrepreneur in his work (1991:52). He identified the following influences on technical entrepreneurship:

- Family background;
- Personal development, including goal orientation, personality and motivation;
- 'Growing up', including educational attainment and age; and
- Work experience.

Again, as with the other models, the links between the elements form relationships with individual characteristics. The reaction of elements depends on the variables and the specific configuration in which these elements are captured. Roberts documented the results of his studies on technological entrepreneurs in a typical profile format, which will be used as a control for the results obtained in this study. The four-factor model is presented in Figure 3.3.

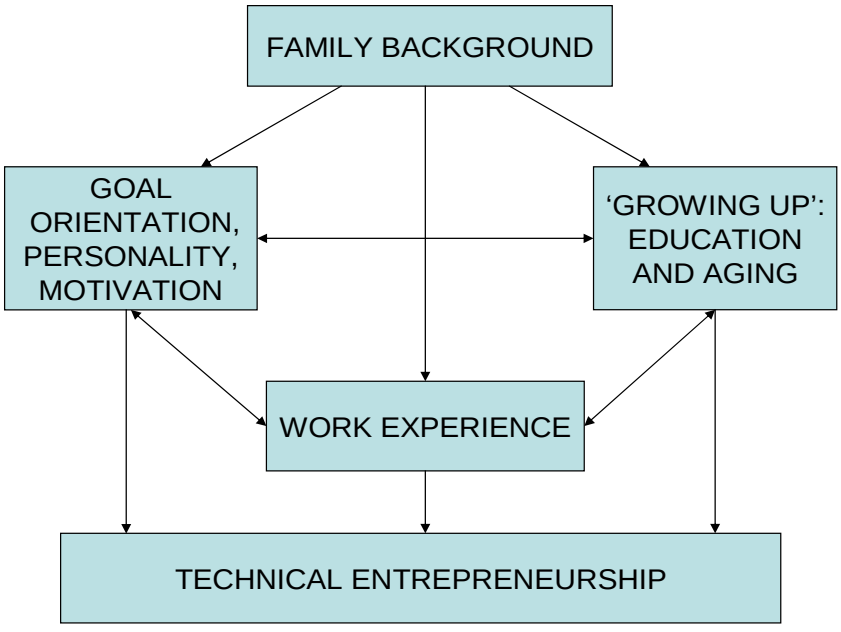


Figure 3.3 A Model of Entrepreneur Development

Source: Roberts (1991).

3.1.5 Other models

Other models that contribute to the understanding of entrepreneurship in the context of this study are the following:

3.1.5.1 Model of economic development

The Technology and Development Institute of the East-West Center in Honolulu, Hawaii (1973) developed the following model that consists of four concepts of economic development:

- *Goal:* The promotion of economic development through the increase of employment level, as well as those levels of domestic output and exports;
- *Means:* The promotion of economic growth involving technology adapted to local conditions, given a particular stage of socio-economic development;
- *Agents of change: entrepreneurs:* The critical link in the process of technology adaptation and employment creation; and

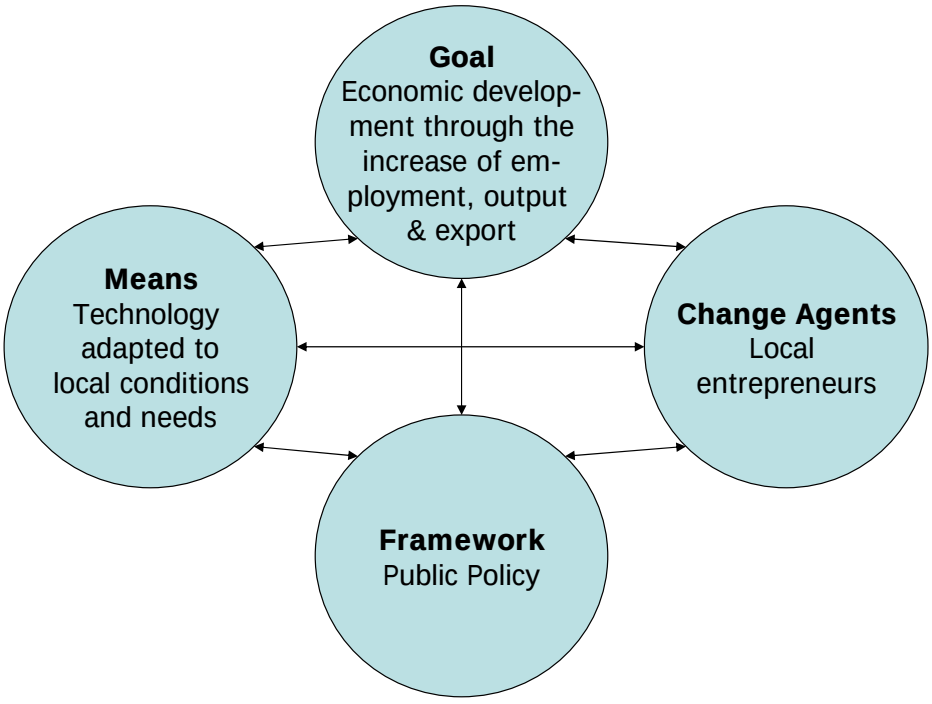


Figure 3.4 Model of Economic Development

Source: Entrepreneurship Workshop II (1973) as cited by Tran (1975).

- *Framework: public policy:* The institutional framework used to accelerate the flow of entrepreneurial talent to use technology and to expand exports.

The interrelationships between the four concepts of economic development are given in Figure 3.4 (Entrepreneurship Workshop II 1973:25 as cited by Tran 1975).

3.1.5.2 General theory framework of entrepreneurship education

Klandt et al (1993) developed a general framework for entrepreneurship research, which was represented by Schubert (Klandt et al 1993:162) in the paper on educational requirements of entrepreneurship. The model is given in Figure 3.5.

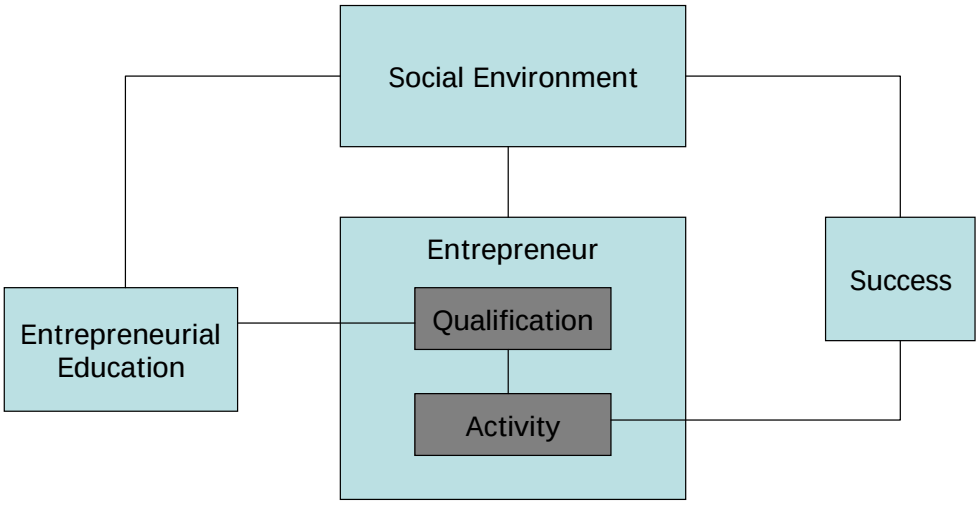


Figure 3.5 Theoretical model for studying training objectives (Schubert)

Source: Klandt et al (1993).

Here the entrepreneur and his/her social environment are pointed out as independent elements that determine business activities and business success. The model of Schubert (Klandt et al 1993:162) has certain similarities with the five categories proposed by Bull et al (1995) for the theoretical framework for

entrepreneurship research. These similarities include the identification of entities such as the entrepreneur and the social environment as key elements in the entrepreneurial process, which eventually lead to business success. The additional element introduced in the Schubert model is entrepreneurial training as a key ingredient in the development of the entrepreneur and his/her qualifications. Schubert (Klandt et al 1993) uses this model to derive training objectives for entrepreneurship education and training programs.

3.1.5.3 Entrepreneurial training model at The University of Tulsa (Oklahoma, USA)

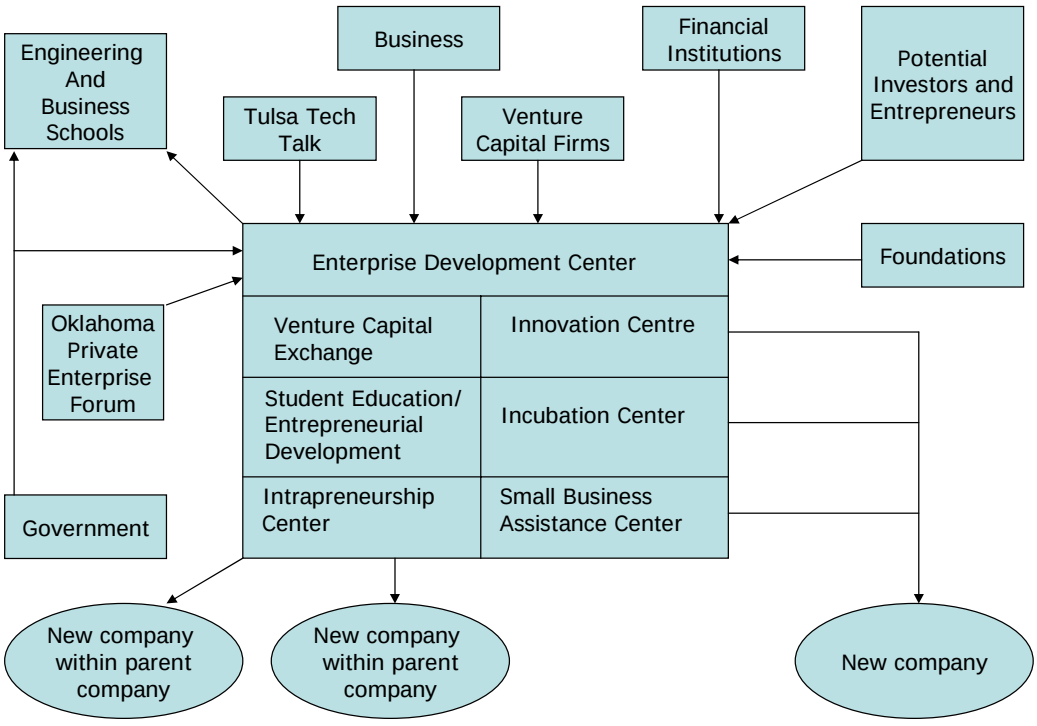


Figure 3.6 Model of practical aspects of entrepreneurial education at The University of Tulsa (USA)

Source: Klandt et al (1993).

One model which has particular relevance in the creation of a national framework for entrepreneurship education and training, is the Enterprise Development Centre model used by the University of Tulsa in the USA in the early 1990's (Klandt et al

1993:32). The model focuses in particular on the practical aspects of entrepreneurship education at a tertiary educational institute and brings together the public sector (federal, state, and city governments), the university sector (engineering and business schools), the private sector (businesses, venture capital firms, financial institutions, potential investors, and entrepreneurs), and foundations. The model is illustrated in Figure 3.6.

3.1.5.4 Structures of industrial development and government roles

The proposed model of Liu (1998), which analyses the structural development and industrial adaptation in Taiwan, is based on the following elements:

- Product market demands;
- Factor market supplies;
- Competitive strategy;
- Government leadership; and

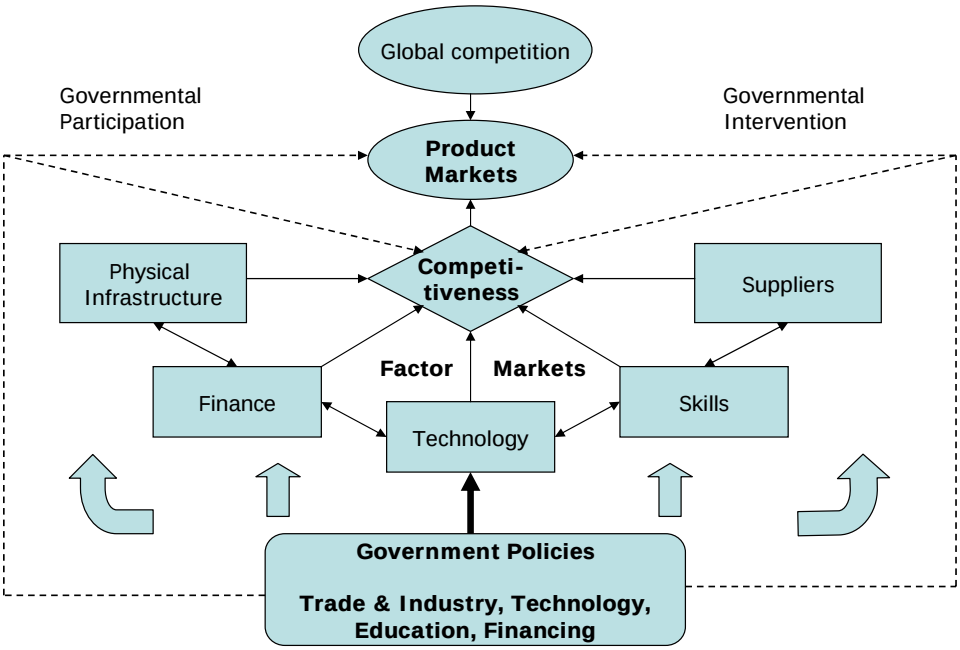


Figure 3.7 Structures of industrial development and government roles

Source: Liu (1998).

- Dynamic contingency of industrial systems.

The model is presented schematically in Figure 3.7. Although the model is of significance in its totality, it is the influences of governmental policies and their inter-relationships with the other elements that have significance to this research. The notion that distinction is made between governmental intervention and governmental participation can be incorporated into the proposed model of this research where the government's role as a key role player in the entrepreneurial environment is formulated.

3.1.6 Existing model overview

No suitable model could be found in the existing literature that is applicable to the study domain of technological entrepreneurship in the emerging landscape. The closest model identified is that of Roberts (1991), which focuses on the person and the influences on his or her development. The model of Roberts has four entities only and does not address the prominent environmental drivers. It also excludes elements of the new venture creation process such as assistance during start-up, opportunity recognition and other socio-economic influences on the process. The model of Bolton et al (2000) addresses some of the same issues more in detail, but is generic by nature and not specific to the technological domain. Another aspect not addressed in any of the models is the further growth from inception to maturity.

Subsequent literature to Roberts' research indicates that elements of his model variables serve as useful predictors of performance. These include (with specific variables in brackets):

- Jones-Evans (1995) and his work on typology of technology-based entrepreneurs and their occupational background in the UK (work experience);
- Whittaker (2001) on the engineers, their education and inclination and the commercialization of technology in Canada (technical training);
- Capaldo and Fontes (2001) with their study of graduate entrepreneurs in new technology-based firms of southern Europe. They provide empirical research on the strengths and weaknesses that are associated with their age, limited credibility, particular set of competencies and skills, the resources that they have

access to and the relationships that they are able to establish. Of particular relevance is the 'formal' assistance rendered by dedicated institutions and the 'informal' support provided by the network of interpersonal relationships (educational level, background and assistance during start-up);

- Politis (2005) on the process of entrepreneurial learning through career experience, transformation and entrepreneurial knowledge (experience and education); and
- Cooper and Folta (2000) with their views on the importance of geography on the new business formation and subsequent performance when they explore entrepreneurship and high-technology clusters (location and technology).

The model of Gnyawali et al (1994) is the best fit of the available models that address the environmental influences on the new venture creation process. Its focus is away from the entrepreneur. When combined with the model of Roberts, a broad frame that is fit-for-purpose can be created for the research parameters. The environmental influences expected to be present in the proposed model framework for this project are: 1) government policies and procedures; 2) socio-economic environment (especially the cultural aspect); and 3) financial and non-financial assistance during start-up. The fourth influence of the Gnyawali model i.e. entrepreneurship and business skill set overlaps that of Roberts.

Kropp et al (2005) also support the importance of government policies as a variable in determining venture performance in both developed countries (USA, Sweden and Australia) and developing countries (Malaysia) through Small Business and Innovation Programs (SBIP). Other models discussed enhance the formation of the model framework with variables such as entrepreneurship training, access to venture capital, small business and innovation centre assistance, as well as the influence of local conditions and needs.

In conclusion, the existing theory gap could not be satisfied with available model comparisons, insofar as both elements (the representative profile of the technological entrepreneur in an emerging environment, as well as a suitable model demonstrating the new venture creation process) are concerned. Although the model of Roberts (1991) was found to be the most appropriate template, it has to be

supplemented with several elements borrowed from other models such as that of Gnyawali et al (1994). In an effort to contain the extent of the research framework, certain potential entities in the proposed model had to be omitted. The process of technological innovation, the nature and availability of venture capital and opportunity recognition are examples of these omissions.

3.2 THE PROPOSED MODEL

3.2.1 General model theory

A model can be described as a 'snapshot of reality'. Buys (2004:4) describes the model as *'a method to simulate or present reality … a tool that can be applied in practice'*. Buys also describes it as: *'A graphical, mathematical or schematic representation of a system of postulates (theory), data, and inferences'.*

3.2.2 Model framework

The model framework consists of the four key elements mentioned earlier which are inter-connected through certain relationships. These four elements or entities are:

- The *technological entrepreneur;*
- The *new venture creation process;*
- The *mature enterprise;* and
- The *environmental influences* on the three entities above*.*

Each of the elements used was 'borrowed' from one of the most appropriate models found in the relevant theory.

3.2.2.1 The technological entrepreneur

The entrepreneur (person) is one of the three main elements of entrepreneurship as defined in literature. The technological entrepreneur is therefore placed in the centre of the model and he/she is the conductor of the whole process. Bolton & Thompson

(2000) also place the entrepreneur in the centre of their proposed model with the entrepreneur as the spotter and activator of opportunities.

3.2.2.2 The new venture creation process

The new venture creation process, or start-up as it is often referred to in the literature, is the core activity of the entrepreneurial process. This is the last of the three main elements of entrepreneurship i.e. the entrepreneurial process. Models suggested by Roberts (1996), Bolton & Thompson (2000) and Gnyawali & Fogel (1994) all include start-up activity as the centre of the process, with the other elements in supportive and influential capacities. It is therefore appropriate to follow this trend in the composition of the proposed model.

3.2.2.3 The mature enterprise

One of the elements often neglected in the entrepreneurial process, is the final product established by the venture creation activity i.e. the mature or successful business. Researchers such as Schöllhammer & Kuriloff (1979), Drucker (2001), Block & MacMillan (1985) and Scott & Bruce (1987) all acknowledged the development stages of the newly formed enterprise, from incubation to full maturity. The small business management discipline is also well-documented. Although this section of the literature does not feature directly in the critical study field of this research, it was however added to the model and included in the research scope. It was deemed necessary, firstly for the sake of completeness of the entrepreneurial process and secondly, the success rate after start-up is becoming more critical in emerging countries with a high ratio of necessity entrepreneurship (GEM report 2003:10).

3.2.2.4 Environmental influences

Environmental influences, as is the case with the other two main elements of the study subject, should be seen as a group of non-homogenous role-players from a wide range of angles. The following elements are classified as environmental influences from their relative position to the person (entrepreneur), the process (start-up) and the mature business:

- Government institutions;
- Policies and legislation;
- Private sector initiatives;
- Financial institutions;
- Educational and training institutions;
- Employers;
- Society in general;
- Cultural heritage;
- Family background;
- Economic conditions;
- Political dispensation; and
- Religion.

These are the main categories and can be refined further to represent the full domain of the external environment that has an effect on the person and process. The model framework is represented schematically in Figure 3.8.

3.2.3 Three-part model

The objective was set to derive a three part model from the research framework. The proposed model consists of the three main entities (entrepreneur, new venture creation process and mature enterprise) and the relationship(s) between each of the three with any of the other entities, including the environment.

3.2.4 Verification of proposed model

The design of the field research was done to verify the nature and weight of the six identifiable inter-relationships between the four elements. This aspect is addressed in Chapters 4 and 5.

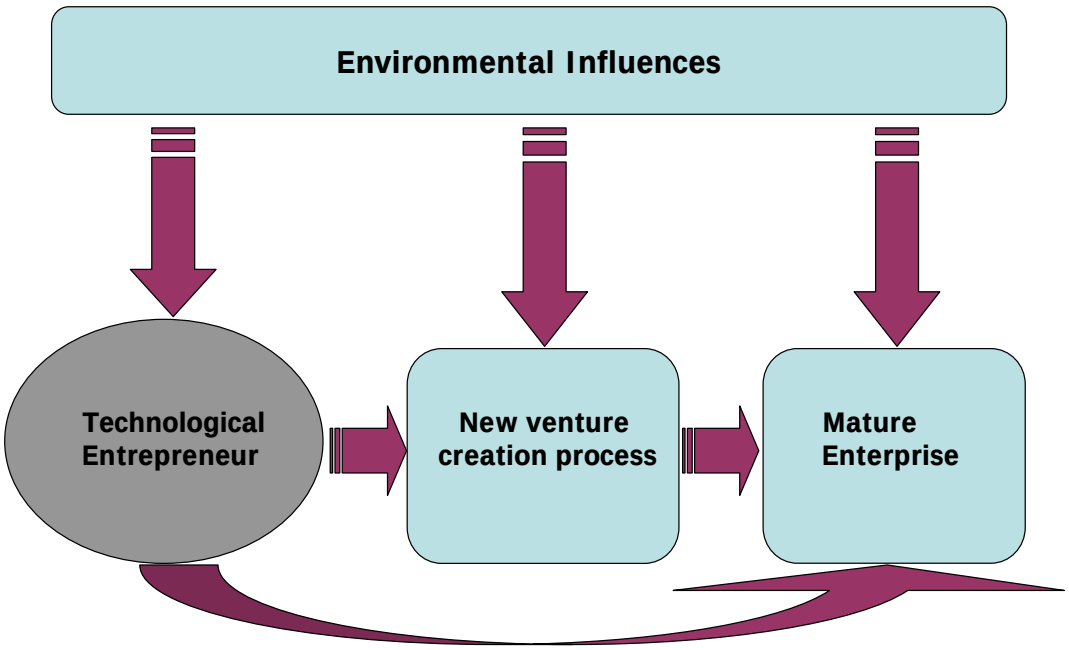


Figure 3.8 Model Framework

3.2.5 Future expansion of the model

The model can be expanded through further research to include three additional elements that are crucial to the entrepreneurial process in the technological domain. These three elements are: *Opportunities, Technological Innovation* and *Venture Capital.*

3.2.5.1 Opportunities

Most models that describe the entrepreneurial process acknowledge the core position of the opportunity in the hierarchy of events. Stevenson & Gumpert, as stated by Bolton et al (2000:50), argue that entrepreneurs are opportunity driven and that they constantly seek answers to a series of questions such as:

- Where are the opportunities?
- How do I capitalize on them?
- What resources do I need?
- How do I gain control over them?
- What structure is best?

Opportunity is recognised by both the models of Bolton et al (2000) and Gnyawali & Vogel (1994) and should be included in future model expansion projects.

3.2.5.2 Technological innovation

The question whether technological innovation should be a prerequisite for new venture creation to be classified as technological entrepreneurship, is irrelevant if a compromise is reached between the two schools of thought on the level of innovation. If it is accepted that different levels and intensities of innovation is possible and in fact occurs during the majority of new venture creations, the rigid go or no-go approach towards this qualifier is avoided. This view opens the door for new technology-based ventures to be studied even if their technological innovation component is marginal. It is within this context that the element of technological innovation is proposed for future inclusion in the model.

3.2.5.3 Venture capital

A significant gap exists in early-stage seed capital for technology-based new ventures in the United States (Carayannis, Kassicieh & Radosevich 1997). This was also reported for South Africa by Koekemoer & Kachieng'a (2002), for China by Burke, Boylan & Walsh (1998) and for Taiwan by Liu (1998). It is therefore essential to include venture capital as a key element in the entrepreneurial process for future

models due to its crucial role in the venture formation process, which is also supported by Roberts (1990 and 1991).

The GEM reports of 2002, 2003 and 2004 also highlight the important role of access to early seed capital as one of the major key success factors in the venture formation process.

3.3 PROPOSITIONS

3.3.1 Formulation of propositions

In order to develop a basis from which to predict the outcome of certain variables, it is necessary to formulate a set of propositions. Buys (2004:24) defines a proposition as *'Something offered for consideration or acceptance usually stated in sentence form near the outset'.* Three propositions were developed to form a basis from which further statistical analysis of this research project is conducted.

3.3.2 Proposition 1: Three-part model for technological entrepreneurship domain

The technological entrepreneurship domain in emerging economic regions can be presented by a three part model consisting of three primary entities which are each inter-correlated with each other, as well as environmental influences. The three primary entities are:

- *The entrepreneur (person);*
- *The new venture creation process; and*
- *The mature business.*

3.3.3 Proposition 2: Technological entrepreneurship profile comparison

The profile of technological entrepreneurs in emerging economic regions is different to that of their counterparts in developed regions, but there are also distinct similarities.

3.3.4 Proposition 3: Formal entrepreneurship training

The extent of formal entrepreneurship training in primary, secondary and tertiary educational programs in South Africa is inadequate in relation to its importance in the development process of technological entrepreneurs.

3.4 SUMMARY

Chapter 1 presents the introduction to this research project, while Chapter 2 contains the theory and research survey. In this chapter, the current theories are summarised in the different categories and the theory gap is identified. In Chapter 3 several existing models from the literature are explored from which key entities are 'borrowed' to develop a unique research framework for this study. The framework is presented in schematic format and consists of four elements:

- The *technological entrepreneur* (person);
- The *venture creation process;*
- The *mature enterprise; and*
- *Environmental influences* on the three elements above.

A three-part model is proposed from the research framework.

Three propositions are also formulated and presented as a basis to predict the outcome of certain variables Chapter 4 addresses the research design and methodology, including the research strategy and instruments.

CHAPTER FOUR

RESEARCH DESIGN AND METHODOLOGY

CHAPTER FOUR

RESEARCH DESIGN AND METHODOLOGY

'Madame, enclosed please find the novel you commissioned. It is in two volumes. If I had more time I could have written it in one'.

Voltaire (Timmons 1994:375).

4.1 RESEARCH STRATEGY

4.1.1General

This research project has previously been described as *theory building research,* or more specifically *model building research.* While the tendency in human sciences research projects is to use *qualitative* research methods*,* the natural sciences lend themselves to *quantitative* research techniques due to their very nature. The trend in management sciences is to focus on qualitative research rather than qualitative methods. In order to test the propositions formulated for the study, the suggested model and new theory was tested in the real life situation by quantitative data gathering and analysis in a format compatible with the model framework.

4.1.2The study population

The study object of this research project is the technological entrepreneur and his or her founded business. A sample of the study population was defined in order to understand:

- The environment in which the study object functions;
- The influences on his or her behaviour; and
- The circumstances under which he or she operates.

To study a representative group of entrepreneurs, the primary characteristics of this particular group are defined first to ensure sufficient focus of the research efforts. This is addressed later in this Chapter when the sample frame is discussed in detail.

4.1.3The choice of data gathering techniques

If a quantitative method is appropriate for verification of the propositions, a crucial question to be answered is what technique will be used in the data gathering process. Buys (2004:36) suggests that there are four primary techniques that can be used to collect data:

- Perusal;
- Observation;
- Questioning (consultation);
- Measurement.

The third option i.e. questioning was selected as the most appropriate technique for this type of research project.

According to De Necker (1997:139), there are four data collection methods that were originally proposed by Manzini (1998:199). These are:

- *Structured interviews,* where a prescribed sense of questions is followed, which was developed by the interviewer. Alternatively, questions provided by a diagnostic model can be used;
- *Unstructured interviews***,** where non-leading questions aimed at generating the respondent's own definition of relevant problems and issues are asked;

- *Questionnaires,* where pen and paper instruments are developed by the diagnostic team in conjunction with management, or commercial products;
- *Survey-research methods***,** involving data collection by consultants and subsequent feedback of data to management.

4.1.4Validity of the data gathering techniques

The next step in the design of the research plan was to assess whether the data gathering techniques have the desirable attributes. The following control questions were asked (Buys 2004:36):

4.1.4.1 How reliable is the data gathered through the proposed techniques?
4.1.4.2 How valid is the data?
4.1.4.3 Is the data sensitive to the issues at hand?
4.1.4.4 Is the data appropriate to solve the research problem?
4.1.4.5 How objective is the data?
4.1.4.6 Are the techniques feasible to execute?
4.1.4.7 Are the techniques ethically acceptable?

4.2 RESEARCH METHODOLOGY

4.2.1The quantitative research approach

In order to obtain a clear understanding of research domain in the various disciplines, it is appropriate to explore some theoretical perspectives by various authors.

Mouton & Marais (1990:8) define research domain in the human science as follows: *'Human science is a communal human activity, by means of which a particular phenomenon is studied objectively in reality in order to present a valid understanding of the phenomenon'.*

According to De Necker (1997:137), Mouton et al (1990) explain five dimensions of research as follows:

- The *sociological dimension,* which emphasises scientific research as a joint or collaborate activity;
- The *ontological dimension,* which states that research should be directed at an aspect or aspects of social reality;
- The *teleological dimension,* which maintains that research is intentional and goal-directed with its main aim being the understanding of phenomena;
- The *epistemological dimension,* which says that the aim of research is not merely to understand phenomena but also to provide a valid and reliable understanding of reality;
- The *methodological dimension,* which emphasises research as objective by virtue of its critical, balanced, unbiased, systematic and controllable nature.

Leedy (1989:5) argues that true research has the following characteristics:

- Research originates with a *question*;
- Research demands a clear articulation of a *goal*;
- Research requires a specific *plan* or procedure;
- Research usually divides the *principle problem* into more manageable sub-problems;
- Research is tentatively guided by constructs called *hypotheses*;
- Research will countenance only hard, *measurable data* in attempting to resolve the problem that initiated the research; and
- Research is, by nature, *circular*; or, more exactly, helical.

4.2.2Survey methods

The main research designs and methods for organisational research according to Bryman (1989:29) consist of the elements as presented in Table 4.1.

The design of this research project consisted of a D2 (survey) and the method by which data was gathered was M1 (Self-administered questionnaires).

Table 4.1: Survey designs and methods	
DESIGNS	**METHODS**
D1 – Experiment (major distinctions: laboratory and field experiments: experiments and quasi-experiments)	**M1** – Self-administered questionnaire **M2** – Structured interview
D2 – Survey (including longitudinal survey design)	**M3** – Participant observation
D3 – Qualitative research	**M4** – Unstructured interviewing
D4 – Case study	**M5** – Structured observation
D5 – Action research	**M6** – Simulation **M7** – Archival sources of data

Source: De Necker (1997:158).

4.2.3Data collection and analysis

The process of theory building research (retroductive reasoning) is categorised into the following main elements (Buys 2004:61):

- Data collection;
- Data analysis;
- Inference of new hypotheses.

The first of the processes i.e. data collection, is described in more detail in this chapter, while the analysis of the data is dealt with in the next chapter.

4.2.4Sampling

Levin and Rubin (1991:260) define a sample as *'…a portion of elements in a population chosen for direct examination or measurement'.*

Population sampling can be divided into two broad categories:

- *Random* or probability sampling, and
- *Non-random* or non-probability sampling (sometimes called judgement sampling).

Mason & Lind (1996:296) define probability sampling as follows: *'A sample selected in such a way that each item or person in the population being studied has a known (non-zero) likelihood of being included in the sample'.*

The chances with random sampling are real that an element of the population will or will not be included in the chosen sample. The way to deal with this inherent weakness is to describe the objectivity of the estimates in a mathematical manner. At least, unlike non-random sampling, each member of the population in random sampling has an equal probability of being selected. This aspect is dealt with in Chapter 5.

According to Mason et al (1996:296), four methods of random sampling exist:

- *Simple* or singular (individual) random sampling, where each item or person in the population has the same chance of being included;
- *Systematic* random sampling, where the items or individuals of the population are arranged in some way and selected in accordance with a predetermined pattern;
- *Stratified* random sampling, where a population is first divided into subgroups, called strata, and a sample is selected from each stratum, and
- *Cluster* or batch sampling, where large population groups are divided into smaller units, of which a few are selected randomly to investigate.

4.2.5Research field

After reviewing the theoretical research domain, the next step in the research design process was to develop a research framework. A research field was defined first to act as a framework for the research model. The research field is illustrated in Figure 4.1.

The research field model clearly defines the entrepreneurship process (with all its role-players) within the two main domains i.e:

4.2.5.1 Technology based enterprises; and

4.2.5.2 Emerging regions.

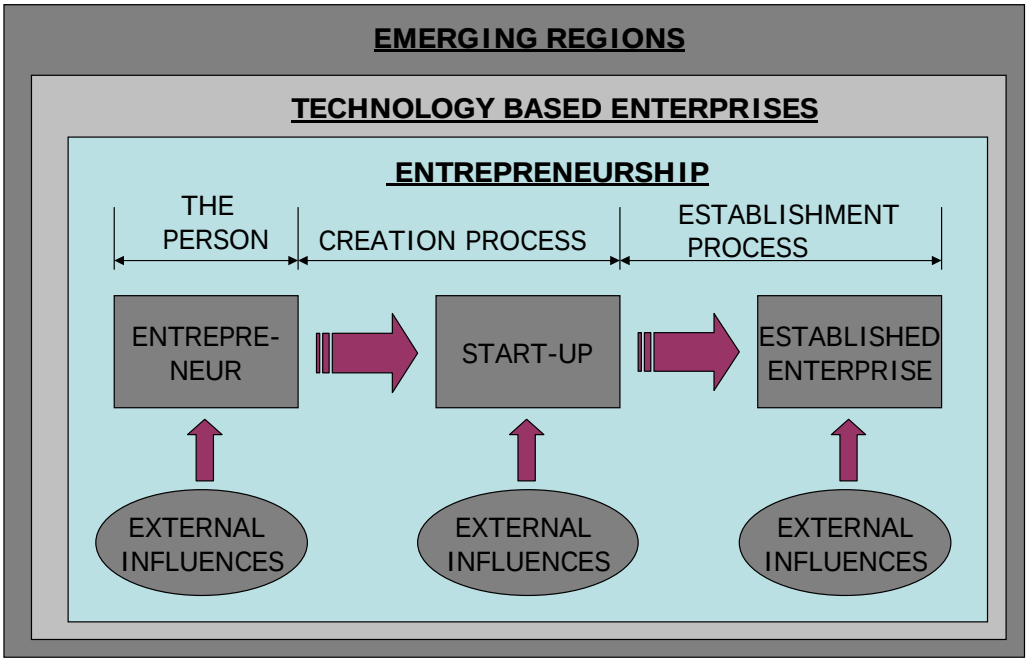


Figure 4.1 Research field

4.2.6Research framework

The research design focuses mainly around the four key entities and their inter-relationships defined in the proposed model framework as it is presented in Chapter 3. A model framework was developed to group the necessary data categories. This framework consists of four main elements with the required data grouped as follows:

4.2.6.1 The enterprise detail;

4.2.6.2 The entrepreneur;

4.2.6.3 Formation of new enterprise; and

4.2.6.4 Mature enterprise.

The research framework was used for the design of the questionnaire to entrepreneurs. The block diagram in Figure 4.2 illustrates the research framework.

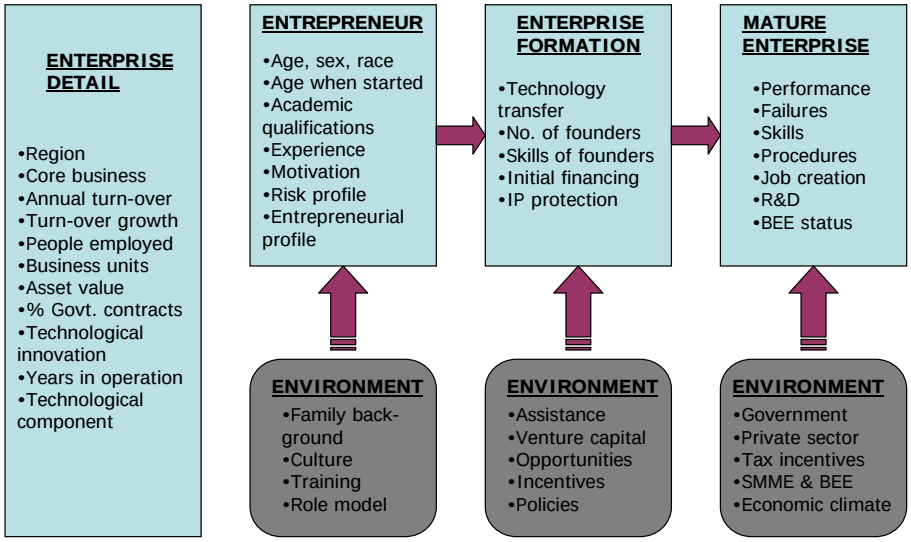


Figure 4.2 Research framework

4.2.7The sample frame

With the theoretical background reviewed, the research method chosen and the research model developed, the next step in the design process was to identify the sample frame to be studied. To retain research focus, the following definition was developed: *The study population group consists of entrepreneurs, who have founded and successfully operated a business, with a significant technological component in its final product or service, in an emerging economic region.*

The following population was excluded from the sample frame:

- Entrepreneurs in the sales, commercial or general business sectors;
- Technological entrepreneurs in developed or industrialised countries;
- Technological entrepreneurs who were not operating a business at the time of the data collection process.

4.2.8Population size

Although the research topic has narrowed the research population group down to a significantly smaller and more manageable group i.e. technological (versus all) entrepreneurs in emerging (versus all) countries, the total population is still by far too large within the constraints of the research project. The choice of sampling method and the sample frame was a critical decision, which has a significant effect on the success of the research and the validity of the results obtained (and the conclusions drawn). The population size of all technological entrepreneurs in all the developing countries could not be established in the available literature, and can at best be estimated. In any event, the figure is of academic value only, as it is not practical from a research point of view to include the total population group in the data collection process.

The choice of sampling method was another critical decision in the research design. The most appropriate and practically feasible method is that of *cluster random sampling.* The sampling method is applied to the research population group as follows:

- The Republic of South Africa is classified as an emerging country using the criteria as discussed in Chapters 1 and 2;
- The Republic of South Africa is divided into nine geographical provinces of which a typical province was selected as representative of an emerging economic region.

The province that was selected is the Province of KwaZulu-Natal as described in Chapter 1.

4.2.9Database

The most comprehensive electronic database of registered companies and their activities in KwaZulu-Natal is a commercial business telephone directory that

operates on an annual subscription basis. According to the Braby's directory (2002), there are approximately 500,000 registered businesses on their database in Southern Africa comprising South Africa, Lesotho, Swaziland, Namibia, Botswana, Mozambique, Zimbabwe, Angola, Madagascar, Seychelles, Mauritius and Zambia. It contains a comprehensive database of each company, including contact details, e-mail addresses, major activities and location of premises. The number of companies in South Africa alone totals well over 119,000.

4.2.10 Sample selection

The sample was selected from the Braby's data base to include companies with a technological service or product only. Utilising the search engine of the Braby's database for technological categories within the province of KwaZulu-Natal, South Africa, the following four categories were identified:

4.2.10.1 Manufacturers
4.2.10.2 Chemical, Industrial and Mining
4.2.10.3 Technical services
4.2.10.4 Technical general

Any duplicated firms and branches were electronically deleted and a stratified sample was selected from each of the four categories to obtain a database of multiples of 100 companies to assist research administrators.

The detail questionnaire administration process, as well as sample sizes is discussed in Chapter 5.

4.3 RESEARCH INSTRUMENTS

4.3.1 Data collection

The process of data collection was selected as follows:

4.3.1.1 Using the database of technological entrepreneurs in KwaZulu-Natal which was compiled as described earlier, Questionnaire A was forwarded to the selected entrepreneurial companies by e-mail, facsimile, personal delivery with the help of research administrators.

4.3.1.2 A follow-up exercise to ensure receipt of completed questionnaires was also done by research administrators.

4.3.1.3 A total number of 210 questionnaires were collected in this manner.

4.3.1.4 Similarly, Questionnaire B was given to 183 post-graduate students at the University of Pretoria to complete.

4.3.2 The questionnaire to technological entrepreneurs

As previously stated, the *sample frame is entrepreneurs who have successfully founded and still operate a business with a technological base in the province of KwaZulu-Natal*. It is necessary to discuss the contents of the questionnaire in order to establish the appropriateness of the information that is to be collected to achieve the research project goals. Main Questionnaire A was developed with the propositions in mind and designed to address the research questions in the most effective manner possible. The questionnaire consisted of the following main categories of information:

4.3.2.1 Part A contained personal and background information about the *entrepreneur* such as age, religion, gender, position in the family, home language, training, level of education, as well as the development of their entrepreneurial capabilities.

4.3.2.2 Part B contained the *enterprise details*, such as geographical representation, annual turnover and growth figures, asset value, government contracts as well as a quantification of the technological component of the product or service.

4.3.2.3 Part C addressed the *new venture formation process* and the circumstances under which the new business was founded. Issues such as the degree of technology transfer, details of the initial founders, contribution by founders to the initial financing, assistance obtained and major problems experienced during the initial phases were addressed.

4.3.2.4 Part D contained questions about the enterprise growth process after formation and the *new business success*. Issues such as management skills, use of formal procedures, outside consultants and factors affecting the business' success are addressed here. The respondents were also asked in this part to assess the factors that to their opinion influenced the development of technological entrepreneurship in emerging regions.

The questionnaire was developed in conjunction with the personnel who assisted with the statistical analysis of the data and contains 55 questions, 132 data figures spread over 10 pages. It took approximately 20 minutes for a respondent to complete the questionnaire. The questionnaire is attached as Appendix A.

The questionnaire was structured to assess the four key elements identified in the proposed three part model of Chapter 3 and their inter-relationships in the manner described in Table 4.2.

Table 4.2: Assessment of four key elements in proposed model and their inter-relationships

ITEM	KEY ELEMENT	SUBJECT	QUES-TION No.	ENVIRON-MENTAL INFLUENCE
1	Technological Entrepreneur (TE)	❑ Position in family	8	TE
2	❑ Family back-ground	❑ Level of income @ 18 yrs	9	TE
3		❑ Employment of parents @ 18 yrs	10	TE
4	TE	❑ Language	5	TE
5	❑ Cultural	❑ Religion	6	TE
6		❑ Race	7	TE
7		❑ Attitude of culture towards entrepreneurship	21	TE
8	TE	❑ Academic qualifications	11	TE
9	❑ Education	❑ Primary field of training	12	TE
10		❑ Formal training in entrepre-neurship	13	TE
11		❑ Years experience	14	TE
12		❑ Age when introduced to entrepreneurship	20	TE
13	TE	❑ Age	2	-
14	❑ Personal profile	❑ Gender	4	-
15	TE	❑ Risk profile	18	-
16	❑ General	❑ Entrepreneurial abilities	19	-
17	New venture creation process (NVCP)	❑ Age when starting new business	3	NVCP
18		❑ Size of previous firm	15	TE
19		❑ Factors that motivated entrepreneur	16	TE

20		❑ Role models	17	TE
21		❑ Period between idea and start-up date	33	NVCP
22		❑ No of founders	35	NVCP
23		❑ Remaining founders still owners	36	ME
24		❑ Skills of founders	37	NVCP, ME
25		❑ Assistance from institutions	40	NVCP
26		❑ Degree of intellectual property (IP) protection	41	NVCP
27		❑ Financing by founders	38	NVCP
28		❑ External financing	39	NVCP
29		❑ Availability of and access to venture capital (VC)	53 (part)	NVCP
30	Mature Enterprise (ME)	❑ Geographical area of operation	22	-
31	❑ Details	❑ Core business	23	-
32		❑ Annual turn-over	24	-
33		❑ Turn-over growth	25	-
34		❑ Number of people employed	26	-
35		❑ Number of business units/branches	27	-
36		❑ Value of assets	28	-
37		❑ Extent of government contracts	29	NVCP, ME
38		❑ Age of enterprise	31	-
39	ME	❑ Performance vs expectations	42	-
40	❑ Success	❑ Previous failures	43	-
41		❑ Imported managerial skills	44	-
42		❑ Own people management skills	45	-
43		❑ Marketing function	46	-
44		❑ Use of procedures	47	-
45		❑ Job creation	48	-
46		❑ External factors in first three years	50	NVCP, ME
47		❑ Reasons for failures	53, 54	NVCP, ME
48	ME	❑ Extent of innovation	30	NVCP, ME
49	❑ Technological Innovation	❑ Technological component	32	NVCP, ME
50		❑ Technology transfer	34	NVCP, ME
51		❑ R & D department	49	NVCP, ME
52		❑ Causes for lack of technological innovation	51	NVCP, ME
53	Environmental Influences	❑ Improvement areas for technological entrepreneurship	55, 56	TE, NVCP, ME
54		❑ Black empowerment and affirmative action	52	TE, NVCP, ME

The number of data points is a further analysis of the questionnaire and is indicated in Table 4.3.

Table 4.3: Analysis of data points in main questionnaire to the entrepreneur

QUESTION NUMBER	QUESTION SUBJECT	NO OF DATA POINTS	PROPO-SITION
1	Respondent's number	1	-
2	**Part A: Entrepreneur** Age	1	P1, P2
3	Age when starting new business	1	P1, P2
4	Gender	1	P1, P2
5	Home language	1	P1, P2
6	Religion	1	P1, P2
7	Race group	1	P1, P2
8	Position in family	1	P1, P2
9	Family income	1	P1, P2
10	Employment status of parents	4	P1, P2
11	Qualifications	10	P1, P2, P3
12	Field of training	1	P1, P2
13	Training in entrepreneurship	1	P1, P2, P3
14	Working experience	5	P1, P2
15	Previous firm	1	P1, P2
16	Motivation to start own business	1	P1, P2
17	Role model	1	P1, P2
18	Risk profile	1	P1, P2
19	Entrepreneurial characteristics	10	P1, P2, P3
20	Age when introduced to entrepreneurship	1	P1, P2
21	Attitude of culture towards entrepreneurship	1	P1, P2
-	**Subtotal A**	45	-
22	**Part B: Enterprise details** Geographical areas	1	P1
23	Core business	1	P1
24	Annual turnover	1	P1
25	Annual turnover growth	1	P1
26	Number of employees	1	P1
27	Business units or branches	1	P1
28	Value of assets	1	P1
29	Percentage of government contracts	2	P1
30	Technological innovation	1	P1
31	Years in operation	1	P1
32	Technological component	1	P1
-	**Subtotal B**	12	-
33	**Part C: Formation of new enterprise** Time between idea and start-up	1	P1
34	Degree of technology transfer	1	P1
35	Number of initial founders	1	P1
36	Original founders still owners	1	P1
37	Compliment of founder's skills	1	P1
38	Ratio of initial financing	1	P1
39	Institutions assisting with initial financing	8	P1
40	Institutions assisting with initial start-up	7	P1
41	Intellectual property protection	1	P1
-	**Subtotal C**	22	-
42	**Part D: New enterprise success** Enterprise performance against expectations	3	P1
43	Previous business failures	3	P1
44	Managerial skills	1	P1
45	Personnel management skills	1	P1

46	Marketing function	1	P1
47	Written procedures	1	P1
48	Job creation	1	P1
49	Research and development	1	P1
50	External influences on success	10	P1
51	Causes for lack of technological innovation	5	P1
52	Black owned status	1	P1
53	Causes for new technological business failures	10	P1, P2
54	Other causes for failures	5	P1
55	Measures to improve technological entrepreneurship	5	P1, P2
56	Other measures to improve TE	5	P1
-	**Subtotal D**	53	-
-	**Total**	133	-

List of abbreviations used:

a. P1 - P3 = Proposition 1 to 3
b. TI = Technological Innovation
c. TE = Technological Entrepreneur
d. ME = Mature Enterprise
e. VC = Venture Capital
f. NVCP = New Venture Creation Process.

4.3.3 The Questionnaire to MOT/MEM/MPM students at the University of Pretoria

One of the research goals is to assess the importance of training and formal education in entrepreneurship in the entrepreneur's development. This issue was addressed in the main questionnaire, but as a data controlling mechanism, a second sample frame was identified for this purpose. A second Questionnaire B that specifically addresses this issue was developed and given to post graduate students in Engineering and Technology Management courses at the University of Pretoria (Yearbook 2004). These students were all enrolled for one of the following degrees:

- Masters degree in Maintenance Management (MEM);
- Masters degree in Project Management (MPM);
- Honours or masters degree in Technology Management (MOT).

The significance of this sample frame and the data acquired in this way is the following:

- All the students attended the subject 'New ventures and Entrepreneurship' as part of their honours or masters degree program;
- The subject was an elective subject, which implies that the primary reason for attending the course was the need to learn more about entrepreneurship and new venture formation;
- Although the students were not all entrepreneurs at the time of completing the questionnaires, the improvement to their entrepreneurial knowledge and affinity for entrepreneurship was assessed in the questionnaire;
- The sample frame was fairly homogenous as potential entrepreneurs and the accuracy and reliability of the data is regarded as relatively high.

The questionnaire addressed the following main issues:

- Limited personal and background information;
- Training and educational profile, especially in the subject of entrepreneurship;
- The respondent's assessment of the importance of training and education in entrepreneurship.

The questionnaire contained 14 questions, 16 data figures over 2 pages and takes less than five minutes to complete. The questionnaire was submitted to groups of postgraduate students in 2002 and 2003 and a 93% response or 170 of the total student population of 183 was achieved.

The questionnaire is attached as Appendix B.

The questionnaire was structured mainly to evaluate Proposition 3. The analysis of the questionnaire is given in Table 4.4.

Table 4.4: Analysis of data points of questionnaire to students			
QUESTION NUMBER	**QUESTION DESCRIPTION**	**NO OF DATA POINTS**	**PROPOSITION**
1	Respondent number	1	-
2	Age	1	-
3	Entrepreneurial history	1	-
4	Entrepreneurial history	1	-
5	Race	1	-
6	Secondary education	1	P3
7	Tertiary education	1	P3
8	Tertiary education	1	P3
9	Tertiary education	1	P3
10	Formal entrepreneurial training	3	P3
11	Formal entrepreneurial education	1	P3
12	Entrepreneurial future	1	-
13	Formal entrepreneurial training	1	P3
14	Gender	1	-
-	**Total**	**16**	**-**

4.3.4Correlation of the data with the propositions

4.3.4.1 Proposition 1

The technological entrepreneurship domain in emerging economic regions can be presented by a three part model consisting of three primary entities which are each inter-correlated with each other, as well as environmental influences. The three primary entities are:

- *The entrepreneur (person);*
- *The new venture creation process; and*
- *The mature business.*

Proposition 1 was addressed by the main research questionnaire to entrepreneurs (Questionnaire A) as the questionnaire collects 132 data points through 55 questions. It was further supported by Questionnaire B to the master's degree students by 15 data points through 13 questions.

4.3.4.2 Proposition 2

The profile of technological entrepreneurs in emerging regions is different to that of their counterparts in developed regions, but there are also distinct similarities.

Proposition 2 was addressed by main Questionnaire A with 44 data points through 20 questions and by Questionnaire B to students with 15 data points through 13 questions.

4.3.4.3 Proposition 3

The extent of formal entrepreneurship training in primary, secondary and tertiary educational programs in South Africa is inadequate in relation to its importance in the development process of technological entrepreneurs.

Proposition 3 was addressed by main questionnaire A with 36 data points through 5 questions and by Questionnaire B to students with 9 data points through 7 questions.

The analysis summary of the data points versus proposition testing is given in Table 4.5.

Table 4.5: Summary analysis of data points versus proposition testing

ITEM	PROPOSITION	NO OF QUESTIONS	NO OF DATA POINTS
1	P1 Questionnaire to entrepreneurs	55	132
2	P1 Questionnaire to students (control)	13	15
3	P2 Questionnaire to entrepreneurs	20	44
4	P2 Questionnaire to students (control)	13	15
5	P3 Questionnaire to entrepreneurs	5	36
6	P3 Questionnaire to students	7	9
7	**Total**	**113**	**251**

4.3.4.4 The validation of the proposed model.

The four elements and five inter-relationships of the proposed three part model were verified with all the data in the main Questionnaire A to entrepreneurs i.e. 132 data points and 55 questions.

4.3.5Administration of the questionnaires

The questionnaires were submitted to and collected from the respondents by research administrators in one of the following ways:

4.3.5.1 By hand or through personal contact;

4.3.5.2 By e-mail; or

4.3.5.3 By facsimile.

After collection, the questionnaires were handed to the statistical personnel for the detail analyses, which are explored in detail in Chapter 5. This applies to both sets of questionnaires.

4.3.6Quantitative analyses

Statistics are defined by Mason & Lind (1996:3) as follows: *'The science of collecting, organising, presenting, analysing, and interpreting numerical data for the purpose of assisting in making a more effective decision'.*

The statistical analyses of the quantitative data are described in more detail in the next Chapter. Statistical analysis is the core of any quantitative research project and forms the primary interpretation mechanism of the research findings.

4.3.7Controlling of the data

Apart from the normal quality control of statistical data, which forms part of the statistical analysis process, it provides greater significance and status to the results

of any research project if the results are tested against known benchmarks or against comparable previous research results. In order to obtain the maximum benefit from this approach, it is important to keep these benchmarks in mind during the research design. Two such data controlling mechanisms were included in this research design:

4.3.7.1 The control of one of the primary research goals i.e. to asses the effect of training and formal education in the development of entrepreneurship, through a second questionnaire, sample frame and subsequent results;

4.3.7.2 The control of the results with previous comparable research results obtained from technological entrepreneurs in developed regions. The work of Roberts (1991) on technological entrepreneurs in the Boston area, Massachusetts, United States of America, is of particular significance in testing the validity of the research. The main questionnaire and data composition in particular, were designed to reveal the same data structure for this purpose.

4.4 SUMMARY

After the introduction and general research background in Chapter 1, the theory and research review followed in Chapter 2, where the existing knowledge and theory on the research subject was given. In Chapter 3 three propositions and a new model to enhance the theory were proposed. This Chapter addresses the methodology through which the proposed model will be tested in practice through the field research. Aspects such as the research strategy, where the question of qualitative versus quantitative research is addressed, are covered. This is followed by a discussion of the complete research design and more specifically, the research methodology. Various methods and data collection techniques are discussed, as well as the selection of the most appropriate methods and techniques for this project. The concept of sampling and various sampling types are briefly reviewed, but the core of the Chapter is devoted to the identification and discussion of the specific study population and the selection of an appropriate sample frame.

The actual data collection through self-administered questionnaires is presented in detail, as well as the specific two questionnaires that were developed for this research project. Their main focus areas are highlighted to present the necessary aspects for proposition verification. Controlling of the research data with other comparable research results is also discussed.

The analysis of the statistical data as part of the interpretation process is briefly mentioned, which is addressed in more detail in Chapter 5.

CHAPTER FIVE

RESULTS:

DATA COLLECTION

AND ANALYSIS

CHAPTER FIVE

RESULTS: DATA COLLECTION AND ANALYSIS

'Successful entrepreneurs are made, not born'.

Edward B. Roberts (1991:28).

5.1 DATA COLLECTION PROCESS

5.1.1 Questionnaire to technological entrepreneurs

5.1.1.1 Data base

The database employed for this research project's main data gathering process was the Braby's company directory (Braby's 2002), which is a commercial database of well over 500,000 company entries for Southern Africa and over 119,000 company entries for South Africa alone. The data base is described in detail in Chapter 4.

5.1.1.2 Data selection process

The research data was selected from the Braby's data base by selecting companies with a technological service or product only. The search engine of the database was prompted for technological categories within the province of KwaZulu-Natal, South Africa. These search categories were:

- **Manufacturers**

  All types of manufacturers.
- **Industrial and Mining**

  Chemicals;

  Industrial and related;

  Mining and related;

  Control instruments and systems etc.
- **Technical services**

  Technical and scientific services;

  Professional, design and consulting services;

  Information technology services;

  Non-destructive testing services etc.
- **Technical general**

  Irrigation systems and equipment;

  Audio equipment;

  Fire protection systems;

  Security systems;

  Communication equipment;

  Computer networking systems etc.

The following data composition was obtained from the search:

Table 5.1: Technology categories including duplications

ITEM	CATAGORY	NUMBER
1	Manufacturing	1238 companies
2	Chemical, industrial and mining	464 companies
3	Technical services	539 companies
4	Technical general	609 companies
5	Total search population	2850 companies

Any duplicated firms and firm branches were electronically omitted from the data base. After this process was completed, 2687 companies remained in the data base, with the following distribution:

Table 5.2: Technology categories excluding duplications			
ITEM	**CATAGORY**	**NUMBER**	**PERCENTAGE**
1	Manufacturing	1172 companies	43.62%
2	Chemical, industrial and mining	444 companies	16.52%
3	Technical services	521 companies	19.39%
4	Technical general	550 companies	20.47%
5	Total search population	2687 companies	100%

5.1.1.3 Sampling

A stratified sample was selected from each of the four categories to obtain a database consisting of multiples of 100 companies. The purpose of the sampling process was to prepare batches of 100 companies with a representative composition of the four industry categories (manufacturing, chemical/industrial/mining, technical services and technical general) as well as the geographical location (metropolitan and towns/rural). These batches of 100 companies served as starting points for the research questionnaire administrators. The sample was selected by the department of statistics at the University of Pretoria with appropriate software and the sample configuration consisted of the following (only batches of 500 are shown):

Table 5.3: Stratified sample: multiple of 500 companies (Manufacturing and technical general)				
SAMPLE QUANTITY	**MANU-FACTURING RURAL**	**MANU-FACTURING METRO**	**TECHNICAL GENERAL RURAL**	**TECHNICAL GENERAL METRO**
500	76	143	36	67
1000	152	285	72	133
1500	228	427	108	200
2000	304	569	144	266
2687	408	764	193	357

Table 5.4: Stratified sample: multiple of 500 companies (Chemical and technical services)				
SAMPLE QUANTITY	**CHEMICAL INDUSTRIAL MINING RURAL**	**CHEMICAL INDUSTRIAL MINING METRO**	**TECHNICAL SERVICES RURAL**	**TECHNICAL SERVICES METRO**
500	32	52	35	63
1000	63	104	69	126
1500	94	155	104	188
2000	125	207	138	251
2687	167	277	185	336

The overall geographical profile was the following:

Table 5.5: Geographical profile

LOCATION	NUMBER	PERCENTAGE
Metropolitan area	1734	64.5%
Non-metropolitan area (rural, towns)	953	35.5%

5.1.1.4 Screening process

The data base was given to three research administrators assigned to the project to refine the sample frame to entrepreneurial firms. They ascertained telephonically (or by e-mail) that the businesses listed were in fact entrepreneurial by asking the following question to a senior company official:

'Was the company you work for, started by an entrepreneur whom you know the name of?'

If the answer was 'yes', the next step was to obtain the name of the entrepreneur.
If the answer was 'no', the company would be removed from the database.
If the answer was 'I do not know', then another company official would be approached until a definite 'yes' or 'no' answer was obtained.

5.1.1.5 Completion of questionnaires

The initial data collection process comprised of the delivering of questionnaires to the companies' founding entrepreneurs by one of the following means:

- By hand for completion and collection later;
- By hand for completion during an appointment;
- By facsimile for completion and returning by facsimile; or
- By e-mail for completion by e-mail or facsimile.

During this initial process it was found that the response from e-mails, telephone calls and facsimiles was less than expected. It was subsequently decided to change the methodology of questionnaire collection as follows:

- Each administrator identified the potential companies from the data base within a geographical area;
- He then made appointments with the founders of these companies;
- He visited the selected companies in the geographical area for a number of consecutive days, conducted personal interviews and collected the completed questionnaires;
- After completion of one area he continued on to the next identified geographical area and followed the same procedure.

The second collection method yielded a more satisfactory return rate. A total of 210 completed questionnaires were collected over a period of approximately six weeks. The spread of respondents over the industry category and geographical location is given in Appendix D.

The first less successful process of remote collection from the 2687 companies (Braby's data base) can be referred to as a 'self-selected accidental sample'. The response rate based on this number was 7.82%. The second more successful process can be classified as a 'stratified random sample'. Although the exact number of businesses visited in this manner was not recorded, it is estimated that the response rate was in excess of 70%. The survey sample (n=210) can therefore be regarded as representative.

5.1.2 Questionnaire to MEM / MPM / MOT students

5.1.2.1 Data base

The data base for this research aspect was compiled from registered students who were enrolled for one of the following post graduate degrees at the University of Pretoria, South Africa:

- Masters degree in Maintenance Management (MEM);
- Masters degree in Project Management (MPM);
- Honours or Masters Degree in Technology Management (MOT).

The sample frame consisted of postgraduate students attending these three courses over a period of two years i.e. 2002 and 2003.

5.1.2.2 Completion of questionnaires

A total of 183 students formed the sample frame. Questionnaires were handed to them for completion during contact class sessions. A total of 167 completed questionnaires were received and analysed, which represents a response rate of 91% of the total population.

5.2 DATA COLLECTED

5.2.1 General measurement issues

In order to determine the characteristics and nature of research variables, it is important to define the scales of such variables. A scale can be defined as *'…a set of measures where some level of value or intensity or characteristics is conveyed by a position, usually a number, on the scale'* (Page & Meyer 2000:72). Several scales have been used in the compilation of the questionnaires as follows:

5.2.1.1 Nominal variable scales

In a nominal scale, *'…numbers stand for a particular characteristic, but that number cannot convey any sense of order or value in the measure'* (Page et al 2000:72). Nominal scales have been used to categorise respondents into e.g. males/females, religion, race groups, home language etc. Further examples of simple nominal scales that were used are the dichotomous scale where there is only one of two options in answering the question i.e. yes/no.

5.2.1.2 Ordinal variable scales

Ordinal scales *'…provide some order to the intensity/values/levels of the variable being measured'* (Page et al 2000:73). This scale assigns a rating to the possible answer, which is categorised into degrees of assessment e.g. a three-category scale of non-existent/average/high, a four-category scale of direct/partial/vague/not at all or a five-category scale of non-existent/poor/average/good/excellent. As this method of scaling is based on perceptions and has limitations in mathematical analysis, it was used to a lesser degree in the two questionnaires. Only seven of the total sixty-seven questions in both questionnaires fall into this category. Furthermore, the Likert scaling method was not used at all in any questionnaire, where respondents are asked to what extent they agree/disagree with a certain statement.

5.2.1.3 Interval variable scales

The third scale used in the questionnaires is the interval scale, which '*…measures variables in such a manner that the measurement units are equidistant, but there is not necessarily a defining beginning point to the measure-no true zero point on which to anchor numerical calculations'* (Page et al 2000:74). This scaling method, as well as the special interval scale i.e. the ratio scale, was used significantly in both the questionnaires. Such questions where annual income, growth or number of employees was requested are examples of interval and ratio scales.

5.2.2 Questionnaire to technological entrepreneurs

The main questionnaire to technological entrepreneurs consisted of four information categories, with the following relating questions:

5.2.2.1 Entrepreneurs

- **Basic profile**

  Age of respondent;

  Age when starting first business;

  Gender;

Home language;

Religion;

Race group.

- **Family background**

  Position as child in family;

  Level of income at age of 18;

  Employment status of parents.

- **Growing-up experiences, education, ageing**

  Academic qualifications;

  Primary field of training;

  Formal entrepreneurship training;

  Age when introduced to entrepreneurship;

  Cultural attitude towards entrepreneurship.

- **Working experience**

  Years experience;

  Size of previous firm.

- **Goal orientation, personality, motivation**

  Motivating factors;

  Role models;

  Risk profile;

  Entrepreneurial characteristics.

5.2.2.2 Enterprise detail

- Geographical area of operation;
- Core business;
- Annual turnover;
- Annual turnover growth;
- Number of people employed;
- Number of branches/units;
- Value of business assets;
- Percentage of Government contracts;
- Degree of technological innovation;
- Period in operation;

- Technological component.

5.2.2.3 Formation of new enterprise

- Period between need and establishment;
- Degree of technology transfer;
- Number of initial founders;
- Original founders still owners;
- Skills complements of founders;
- Founders' financing ratio;
- Contributors of foreign capital;
- Assistance during start-up;
- Degree of intellectual property protection.

5.2.2.4 New enterprise success

- Performance against projections;
- Past failures;
- Additional management skills employed;
- Own management skills;
- Marketing responsibility;
- Use of formal procedures;
- Number of permanent jobs created;
- Research and development department in firm;
- External factors affecting new business success;
- Causes for lack of technological innovation in SA firms;
- Black economic empowerment status;
- Causes for technological business failures;
- Rating of measures to improve technological entrepreneurship.

Refer to Appendix A for a copy of the questionnaire.

5.2.3 Questionnaire to MEM / MPM / MOT students

The second questionnaire to post graduate students consisted of the following information categories, with relating questions:

5.2.3.1 Limited personal information

- Age of respondent;
- Entrepreneurship history;
- Established business technological nature;
- Race group;
- Gender.

5.2.3.2 Basic training and educational profile

- Primary and secondary schooling history;
- Highest tertiary qualification;
- Tertiary qualification grouping;
- Tertiary qualification institution;
- Formal training history in entrepreneurship.

5.2.3.3 Assessment of importance of training and education in entrepreneurship

- Extent of prior formal training in entrepreneurship;
- Aspirations to become an entrepreneur;
- Contribution of specific subject in entrepreneurship.

Refer to Appendix B for a copy of the questionnaire.

5.3 DATA ANALYSIS

5.3.1 Analysis assistance

Analysis of the data was done by the Department of Statistics, University of Pretoria who uses SAS statistical analysis software. Over 25,000 research data points were entered into the data base that was used to perform the various regression analysis techniques.

5.3.2. Analysis framework

5.3.2.1 Frequencies

The first technique used to analyse the data was to determine the frequency distribution. Lind et al (2002:22) defines frequency distribution as: *'A grouping of data into mutually exclusive classes showing the number of observations in each'.*

The first step in this procedure was to tally the data into a table that showed the classes (categories) and the number of observations in each category. A table for each of the questions of each questionnaire was therefore drawn up with a set of categories in the vertical plain and the number of observations in the horizontal plain. The frequencies were given in:

- absolute values,
- as a percentage of the total number of observations,
- as cumulative frequencies; and
- as cumulative percentages.

These tables are displayed in the Appendices. Graphic presentations of each of the frequency distributions are displayed and discussed in Appendices C and D.

5.3.2.2 Correlation analysis

The second technique used in the analysis of data in this research project was correlation analysis, which is the study of the relationship between variables. Lind et al (2002:458) defines correlation analysis as follows: *'A group of techniques to measure the strength of the association between two variables'.*

The two variables used in the analysis were categorised as follows (Lind et al 2002:459):

- The independent variable: A variable that provides the basis for estimation. It is the predictor variable.
- The dependent variable: The variable that is being predicted or estimated.

The correlation coefficient describes the strength of the relationship between two variables and is defined by Lind et al (2002:461) as *'A measure of the strength of the linear relationship between two variables'.*

Most of the statistical data followed the normal distribution function and therefore the most appropriate statistical analysis tool used was the regression analysis, which is a technique to express the linear (straight line) relationship between two variables. In this technique, the regression equation is defined as *'An equation that defines the linear relationship between two variables'* (Lind et al 2002:470).

The linear regression equation is given as:

$$Y' = a + bX \qquad [5 - 1]$$

Where:

Y' read *Y* prime, is the predicted value of the *Y* variable for a selected *X* value

a is the *Y*-intercept. It is the estimated value of *Y* when X = 0

b is the slope of the line, or the average change in *Y'* for each change of one unit (either increase or decrease) in the independent variable *X*

X is any value of the independent variable that is selected.

Another mathematical method which was used in the regression analysis is the least square principle, which Lind et al (2002:471) defines as *'Determining a regression equation by minimizing the sum of the squares of the vertical distances between the actual Y values and the predicted values of Y'.* Furthermore, the standard error of estimate, which is *'A measure of the scatter, or dispersion, of the observed values around the line of regression'* (Lind et al 2002:477) was used to describe the accuracy of certain analysed data.

As the entities in the proposed model (dependent variables) were influenced by more than one independent variable or predictor, simple regression analysis techniques did not suffice. Multiple regression analysis techniques were therefore used to determine the relationships between several predictor variables and the predicted variable.

The equation for multiple regression with k independent variables is:

$$Y' = a + b_1X_1 + b_2X_2 + b_3X_3 + \text{-------} + b_kX_k \qquad [5 - 2]$$

A dummy variable had to be created in cases where a qualitative variable had to be entered as a variable in the regression analysis. It is defined as (Lind et al 2002:520) *'A variable in which there are only two possible outcomes. For analysis, one of the outcomes is coded a 1 and the other a 0'.*

In cases where the shape of the research population did not necessarily follow a normal distribution pattern, a non-parametric test was used to compare the observed set of frequencies to an expected set of frequencies. The specific test that was used in the statistical analysis is the goodness of fit test using chi-square distribution (Lind et al 2002:551).

Where single relationships were tested for level of significance using this test, the following parameters were applied:

- A low value of chi-square, with a high probability index (higher than 0.05 or 5%) indicates that there is no statistical evidence for a relationship between the variables:
- A high value of chi-square, with a low probability index (lower than 0.05 or 5%) indicates that there is statistical evidence for a relationship between the variables.

Where stepwise regression techniques were used for model building, the following parameter was applied:

- All variables with a high value of chi-square, with a low probability index (lower than 0.20 or 20%) were entered into the model.

5.4 RESULTS: TECHNOLOGICAL ENTREPRENEURS

5.4.1 Frequency distributions

The frequency distribution results that were obtained from the analysis are displayed in graphical format in Appendix D. A summary of the frequency distribution results of the various entities in the proposed model is described in the section hereafter.

5.4.1.1 Entrepreneur

The profile of the sample entrepreneur is:

'He is predominantly male (90%), average aged 46.5 years, started his business at the age of 32.2 years, is predominantly English speaking (86.1%) with a Christian religion (45.4%) and a racial distribution of Indian (54.8%), white (39.5%) and black/coloured/other (5.7%). He was the eldest or second eldest child in the family (53.3%), either his father or mother was self-employed (34.8%) and had an income of less than R5000.00 per annum (77.5%) when he was 18 years old.

His primary qualification profile is school (grade 1-12/other) (36.7%), technical (artisan/technical certificate/Technikon diploma or degree) (47.1%) and University degrees (bachelors, masters and doctoral) (16.2%). He has been trained primarily in the technical field (53.4%), had received no formal training in entrepreneurship (59.5%), with most experience in the technical field (average 10.1 years) in a medium sized firm of 6-50 employees (45.3%).

Independence (38.5%) is his primary motivating factor to start his own business and he did not have a role model (60%) in his early entrepreneurial years. He is primarily a risk taker (44%) or risk manager (44.4%), he rates his strongest entrepreneurial characteristic as dedication (90.5%) and his weakest tolerance of risk (54.9%). He was only introduced to entrepreneurship for the first time at an average age of 24.8 years and he regards his cultural group as mainly neutral (44.5%) and conducive to entrepreneurship (39.5%)'.

5.4.1.2 Enterprise details

The typical enterprise profile of the survey sample is the following:

'It is predominantly based in the metropolitan areas (57.8%), with 42.2% in towns and in the rural areas. It operates primarily in the manufacturing (45.4%) and technical services sectors (30%), has an average annual turn-over of between R250,000 and R1,000,000 (33.2%), turn-over growth of between 0 and 10% over the last three years (51%), employs between 6 and 50 people (63.6%), has only one branch (72.9%) and reports a value of operational assets of between R100,000 and R1,000,000 (39.2%).

The typical enterprise also received less than 20% government contracts at starting (95.5%) and at present (85.2%), rates itself as technologically innovative (good/average) (79.4%), has been in operation for an average of 11.9 years with an average technological component in its products or services (51.4%)'.

5.4.1.3 Enterprise formation

The enterprise formation profile of the survey sample is the following:

'The enterprise was formed after an average period of 3.3 years after the need was first felt, technology transfer was direct/partial (58.8%), mainly one founder (54.6%) with 66.2% of the original founders (only one) still owners at present. Of the group which had more than one founder, 46.9% reported that the founders' skills complimented each other. The majority of founders (61.7%) had to finance the initial enterprise with more than 80% of their own capital, while those who reported external financing received financing from family (38.1%) and commercial banks (37.1%).

When asked to select from a list of possible institutions that assisted them during start-up, the private sector was the highest (15.2%), while 42.4% of founders

reported no assistance from any of the listed institutions. The majority of enterprises had not registered a South African or international patent (78.9%)'.

5.4.1.4 New enterprise success

The following characterises the survey sample's new enterprise success:

'The new enterprise performed on average as expected on annual turn-over (57.9%), as expected on growth (54.9%) and as expected on profitability (53.8%). Only 11.9% of entrepreneurs reported any previous business failures. The majority of entrepreneurs (54.8%) do not employ additional managerial skills to their own, the majority rated their own personnel management skill as good (55.8%) and reported that the owner is primarily responsible for the marketing function in the business (63.2%). The majority of firms use formal written procedures (75.2%), have created an average of 14.4 jobs over the past 5 years, do not have a research and development department (80%) and are primarily 100% black owned businesses (50%)'.

A list of possible external factors which influenced the business success was presented to the respondents and the following ratings were received:

- *Not at all:* Central government initiatives (81.6%), central government policies and programs (77.9%), non-government organisations initiatives (77.1%), provincial government initiatives (77%), local government initiatives (72.5%), development initiatives for SME's (69.9%), tax incentives (69.7%), black empowerment policies (58.7%), private sector initiatives (52%) and healthy climate for business opportunities (39.8%).
- *Negatively:* Black empowerment policies (16.3%), local government initiatives (9.7%) and central government policies and programs (9.5%).
- *Positively:* Healthy climate for business opportunities (56.1%), private sector initiatives (43.5%) and development initiatives for SME's (26%).

The entrepreneurs ranked the factors as causes for lack of technological innovation as follows:

1. Lack of resources (time, money, staff)

2. Insufficient assistance and initiatives from government
3. Poor or no return on efforts to improve own technological innovation abilities
4. Lack of skills and knowledge to innovate
5. Easy and cheap access to existing technologies.

The following ranking was given to factors as causes for new technological business failures:

1. Insufficient assistance and initiative from government
2. Insufficient training in entrepreneurial skills
3. Availability of and access to venture capital
4. Insufficient assistance and initiatives from the private sector
5. Insufficient training in business management skills
6. Non-sympathetic culture and upbringing towards entrepreneurship
7. Availability of and access to mentorship programs
8. Insufficient tax incentives
9. Racial and sexual discrimination
10. Other.

The following additional (other) causes for technological business failures were given by respondents (not in any order):

1. Migration of skills
2. Lack of business strategy to promote technological entrepreneurship
3. Currency fluctuation
4. Lack of education of employees
5. Insufficient self motivation of people
6. Cultural constraints
7. Market size
8. Difficult to change mindset
9. Suitable premises
10. Security
11. Taxation
12. Employees
13. Exposure of technology to the general public

14. Technological education to the generation that missed out on the technological revolution
15. Lack of training
16. Cost of equipment software
17. Development courses
18. Poor management
19. Financial incentive
20. Black empowerment policies
21. Corruption
22. Registering of patents – too much red tape
23. Lack of assistance from banks to black owned business – especially SME's
24. Government incentive
25. Decentralization benefits
26. Unions
27. Archaic socialist laws governing business
28. Commitment from labour force very low
29. Greed of general South African society to make money
30. Noise factors introduced by incompetent market contenders driven by greed/survival
31. Insufficient single source information centres for small business
32. Everything you want will cost you something
33. Market research
34. Comparatively small local market to explore.

The last ranking of measures to improve the development of technological entrepreneurship was given as follows:

1. Improve the development of technological entrepreneurship skills during primary, secondary and tertiary education
2. Improve efforts to positively influence society's perception towards entrepreneurship in general
3. Increase efforts by the central/provincial/local government
4. Increase efforts by the private sector
5. Other.

The following additional (other) measures to improve the development of technological entrepreneurship were given by respondents (not in any particular order):

1. Provide incentive
2. Tax breaks
3. Incentive-free funding for development of technology
4. Opportunities in business
5. Practical training
6. No assistance from private sector
7. Introductory seminars to update employees on current modern technology
8. Increase financial incentive
9. Do away with racism
10. Scrap black empowerment and affirmative policies
11. Government to increase funding for skills development
12. Privatization to proceed with stronger effect
13. Seed out corruption
14. Starting up loans must be available early. Banks are not receptive.
15. Micro-economies must be proven to be a sustainable form of household income
16. A culture of holding each other down still exists in mainly black communities
17. A general culture of a 'get rich quick' exists, which might be due to entrepreneurship being perceived incorrectly
18. Sustainability is not seen as important
19. Technical skills development
20. Access to markets
21. Stable currency.

5.4.2 Correlation analysis results

5.4.2.1 General

The process that was followed in the multiple linear regression analysis was to develop a model from several independent variables which showed a significant correlation with the dependent variable. A significance level of 0.2000 was used as entry into the model. Furthermore, the parameter in the results is the gradient of the linear regression line if represented graphically, where the dependent (predicted) variable is presented on the Y-axis and the independent (predictor) variable is presented on the X-axis. The intercept is the value on the Y-axis where the line intercepts the y-axis.

Where the predicted variable did not follow a normal distribution pattern, the logistic procedure was followed which is a non-parametric test, using a model building technique with the goodness of fit test together with a chi-square distribution.

Both the multiple linear regression and the logistic chi-square procedures utilised stepwise regression techniques, which is described in detail by Draper & Smith (1981).

*It shall be noted that all correlations listed in the stepwise regression model have probability values of less than 0.2000 or 20%, while the correlations marked with * has probability values of less than 0 0500 or 5%.*

Several hypotheses were derived from the correlation analyses, which are given in sentence form in the tables of each category (Tables 5.5 to 5.27). *It shall also be noted that these derived hypotheses are to be viewed in context with the model building process, where the individual correlation values are determined by multiple regression techniques. Only the stronger correlations (where P < 0.0500) can be classified as hypotheses of any significance. Those correlations with extremely low probabilities (P < 0.0001) can be classified as significant hypotheses.*

5.4.2.2 Correlations A: Entrepreneur

A number of dependent variables (to be predicted) of the entrepreneur as one of the main entities in the proposed model were identified. As many independent (predictor) variables as possible which could influence these dependent variables

were then identified and grouped in a table format (See Appendix E). The table is presented in graphical format in Figure 5.1.

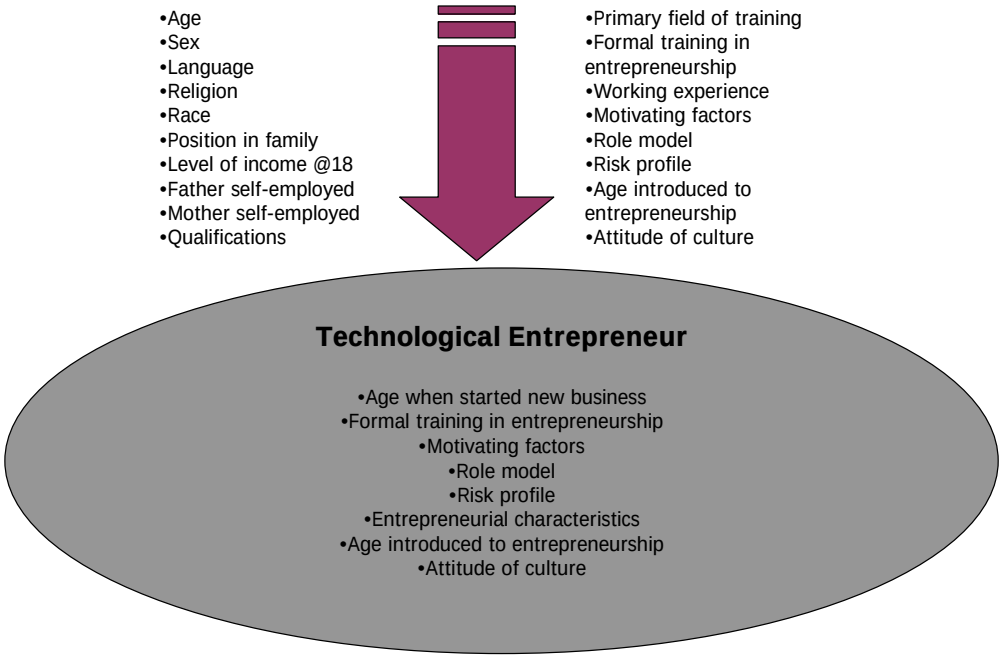


Figure 5.1 Comprehensive model elements with most predictor and selected predicted variables: Technological Entrepreneur

The correlation tests as described earlier in this chapter were conducted on the entrepreneur and the results are given in detail in Appendix D. A graphical summary of the results are given in Figures 5.2 to 5.8 with explanations on the correlations between the variables attached after each diagram. Each section is concluded with the mathematical formula for each dependent variable.

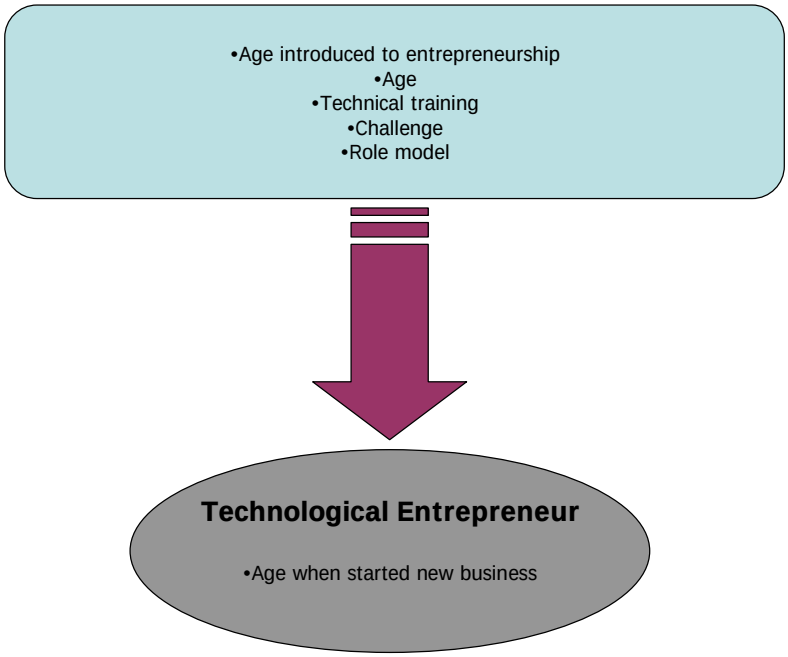


Figure 5.2 Correlations with age when started new business

The correlations with *age when started a new business* are as follows:

Table 5.6: Age when started new business	
1	*Entrepreneurs who were introduced to entrepreneurship at a younger age tend to start their business earlier than those who were introduced later. *Parameter = 0.49; Probability = 0.0001*
2	*Younger entrepreneurs tend to start their new businesses earlier than their older counterparts. *Parameter = 0.24; Probability = 0.0001*
3	*Entrepreneurs with other than technical training, tend to start their businesses earlier than those with technical training. *Parameter = 2.42; Probability = 0.0081*
4	*Entrepreneurs who listed primary motivators other than challenge to start their own businesses tend to start their businesses earlier than those who listed challenge. *Parameter = 2.55; Probability = 0.0412*
5	Entrepreneurs who have a role model tend to start their businesses earlier than those without a role model. *Parameter = -1.37; Probability = 0.1679*

The mathematical equation for the *age when new business was started* is the following:

$$Y'em = Aem + Bem_1Xem_1 + \ldots\ldots\ldots + Bem_5Xem_5 \qquad [5-3]$$

Where:

Y'em	Age when new business was started
Aem	Y-intercept = 7.25
Bem$_1$ – *Bem*$_5$	Parameters in Table 5.6
Xem$_1$	Age when introduced to entrepreneurship
Xem$_2$	Age
Xem$_3$	Technical field of training
Xem$_4$	Challenge as motivating factor
Xem$_5$	Role model

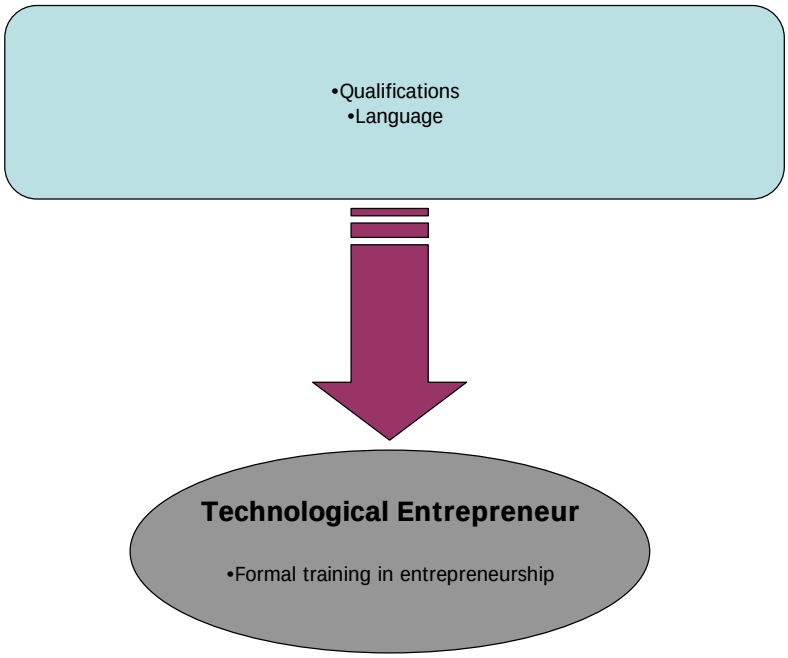


Figure 5.3 Correlations with formal training in entrepreneurship

The correlations with *formal training in entrepreneurship* are as follows:

Table 5.7: Formal training in entrepreneurship	
1	*Entrepreneurs with lower qualifications (school) tend to receive more formal training in entrepreneurship than those with higher qualifications (Technical or University degree). *Chi-square = 6.20; Parameter = 0.54; Probability = 0.0128*
2	English speaking entrepreneurs tend to receive more formal training in entrepreneurship than those speaking other languages such as Zulu, Xhosa or Afrikaans. *Chi-square = 2.92; Parameter = -0.75; Probability = 0.0875*

The mathematical equation for *formal training in entrepreneurship* is the following:

$$Y'en = Aen + Ben_1Xen_1 + Ben_2Xen_2 \qquad [5-4]$$

Where:

$Y'en$	Formal training in entrepreneurship
Aen	Y-intercept = -0.69
$Ben_1 – Ben_2$	Parameters in Table 5.7
Xen_1	Qualifications
Xen_2	English language

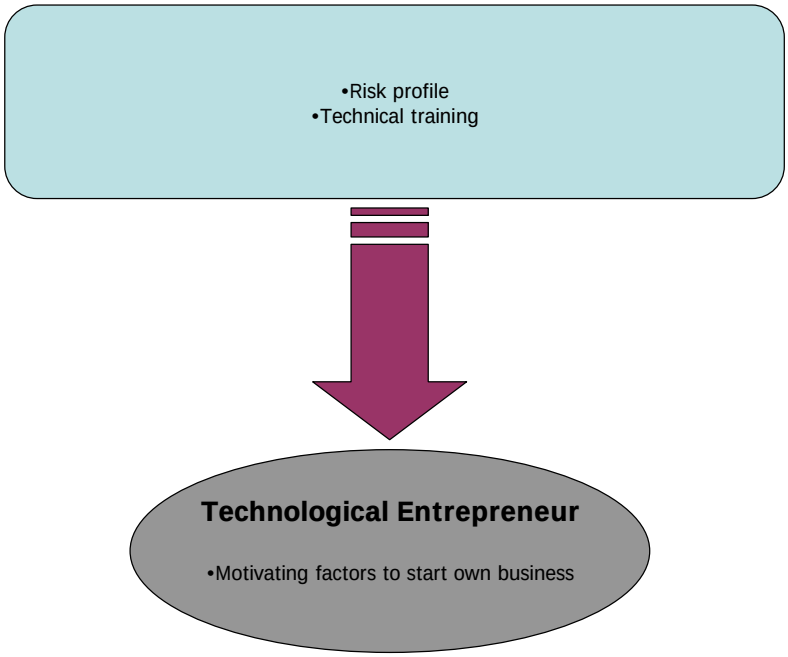


Figure 5.4 Correlations with motivating factors to start own business

The correlations with *motivating factors to start their own business* are as follows:

Table 5.8: Motivating factors to start their own business	
1	*Entrepreneurs who are strong risk averters tend to list money and challenge as their primary motivating factors while the risk takers tend to list non-employment and other as their motivating factors. Risk managers tend to list independence as their primary motivating factor. *Chi-square = 10.73; Parameter = -0.67; Probability = 0.0011*
2	Entrepreneurs with technical training tend to list money and challenge as their primary motivating factors while those with other than technical training tend to list independence, non-employment and other as their motivating factors. *Chi-square = 3.60; Parameter = -0.52; Probability = 0.0577*

The mathematical equation for the *motivating factors to start own business* is the following:

$$Y'ep = Aep + Bep_1Xep_1 + Bep_2Xep_2 \qquad [5-5]$$

Where:

Y'ep	Motivating factors to start own business
Aep	Y-intercept = 0.07
Bep1 – Bep2	Parameters in Table 5.8
Xep1	Risk profile
Xep2	Technical training

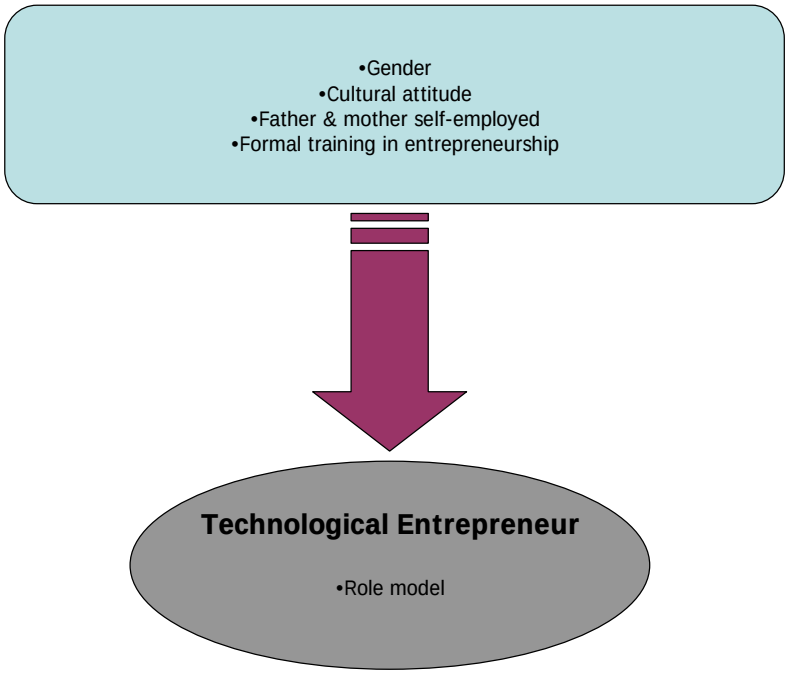


Figure 5.5 Correlations with role model

The correlations with entrepreneurs *who have role models* are as follows:

Table 5.9: Role models	
1	*Male entrepreneurs tend to have more role models than female entrepreneurs. *Chi-square = 6.54; Parameter = -1.58; Probability = 0.0105*
2	*Entrepreneurs who grew up in a culture that is conducive to entrepreneurship, tend to have more role models than those who grew up in a culture that is negative to entrepreneurship. *Chi-square = 4.72; Parameter = -0.52; Probability = 0.0299*
3	*Entrepreneurs whose father & mother were not self-employed tend to have more role models than those who come from self-employed families. *Chi-square = 4.26; Parameter = 0.74; Probability = 0.0390*
4	Those entrepreneurs with little or no formal training in entrepreneurship tend to have more role models than entrepreneurs with formal entrepreneurship training. *Chi-square = 1.83; Parameter = 0.44; Probability = 0.1766*

The mathematical equation for *role models* is the following:

$$Y'eq = Aeq + Beq_1Xeq_1 + \ldots\ldots\ldots + Beq_4Xeq_4 \qquad [5 - 6]$$

Where:

$Y'eq$	Role models
Aeq	Y-intercept = 1.55
$Beq_1 – Beq_4$	Parameters in Table 5.9
Xeq_1	Gender
Xeq_2	Attitude of culture towards entrepreneurship
Xeq_3	Self-employment status of parents
Xeq_4	Training in entrepreneurship

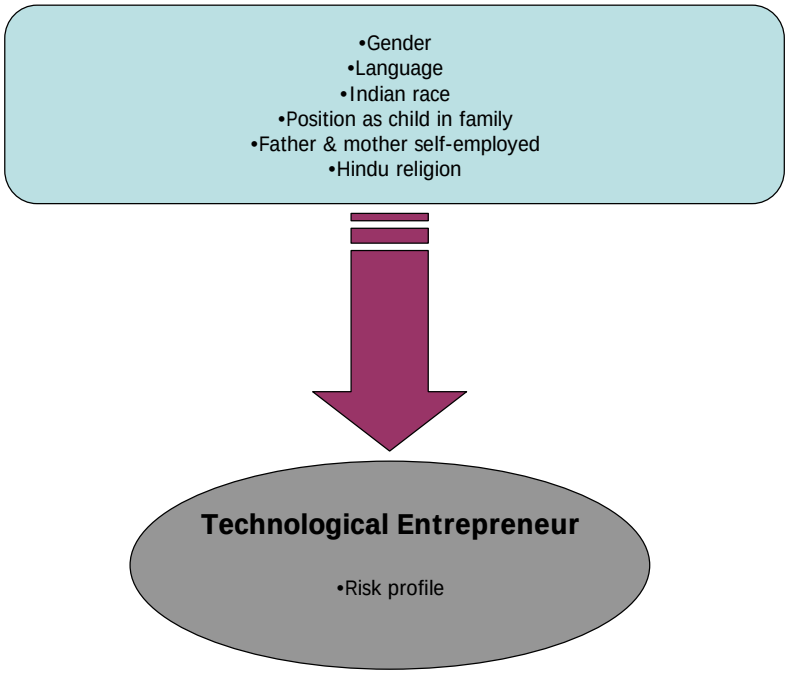


Figure 5.6 Correlations with risk profile

The correlations with entrepreneurs' *risk profile* are as follows:

Table 5.10: Risk profile	
1	Male entrepreneurs tend to be more risk takers than females who are more risk averters. *Parameter = -0.26; Probability = 0.0674*
2	Non-English speaking entrepreneurs (Afrikaans, Zulu and Xhosa) tend to be more risk takers than English speaking entrepreneurs who are more risk managers and risk averters. *Parameter = 0.34; Probability = 0.1038*
3	*Indian entrepreneurs tend to be more risk takers than entrepreneurs from other races who are more risk averters. *Parameter = -0.44; Probability = 0.0328*
4	Entrepreneurs who are the eldest child in the family tend to be more risk takers than those who are the youngest child. *Parameter = 0.06; Probability = 0.1001*
5	Entrepreneurs whose parents were not self-employed tend to be greater risk takers than those with self-employed parents. *Parameter = 0.19; Probability = 0.1450*
6	Entrepreneurs from religions other than the Hindu (e.g. Christian, Muslim, Jewish and other) tend to be greater risk-takers than entrepreneurs from the Hindu religion. *Parameter = 0.24; Probability = 0.1370*

The mathematical equation for *risk profile* is the following:

$$Y'er = Aer + Ber_1Xer_1 + \ldots\ldots\ldots + Ber_6Xer_6 \qquad [5-7]$$

Where:

$Y'er$	Risk profile
Aer	Y-intercept = 1.53
$Ber_1 – Ber_6$	Parameters in Table 5.10
Xer_1	Gender
Xer_2	English language
Xer_3	Indian race
Xer_4	Position as child in family
Xer_5	Self-employed status of parents
Xer_6	Christian religion

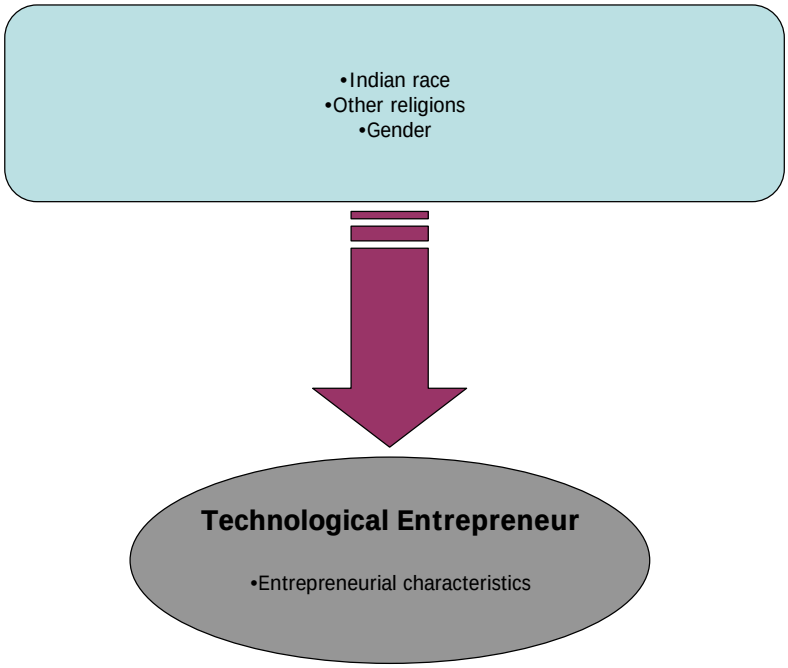


Figure 5.7 Correlations with entrepreneurial characteristics

The correlations with *entrepreneurial characteristics* are as follows:

Table 5.11: Entrepreneurial characteristics	
1	Indian entrepreneurs tend to rate their own entrepreneurial characteristics higher against the proposed profile than entrepreneurs from other races. *Parameter = 0.07; Probability = 0.1341*
2	Entrepreneurs from the Christian and Hindu religions tend to rate their entrepreneurial characteristics higher against the proposed profile than entrepreneurs from the Muslim, Jewish and other religions. *Parameter = -0.08; Probability = 0.1341*
3	Male entrepreneurs tend to rate their entrepreneurial characteristics higher against the proposed profile than females. *Parameter = 0.09; Probability = 0.1851*

The mathematical equation for *entrepreneurial characteristics* is the following:

$$Y'es = Aes + Bes_1Xes_1 + \ldots\ldots\ldots + Bes_3Xes_3 \qquad [5-8]$$

Where:

Y'es	Entrepreneurial characteristics
Aes	Y-intercept = 2.62
Bes1 – Bes3	Parameters in Table 5.11
Xes1	Indian race
Xes2	Hindu religion
Xes3	Gender

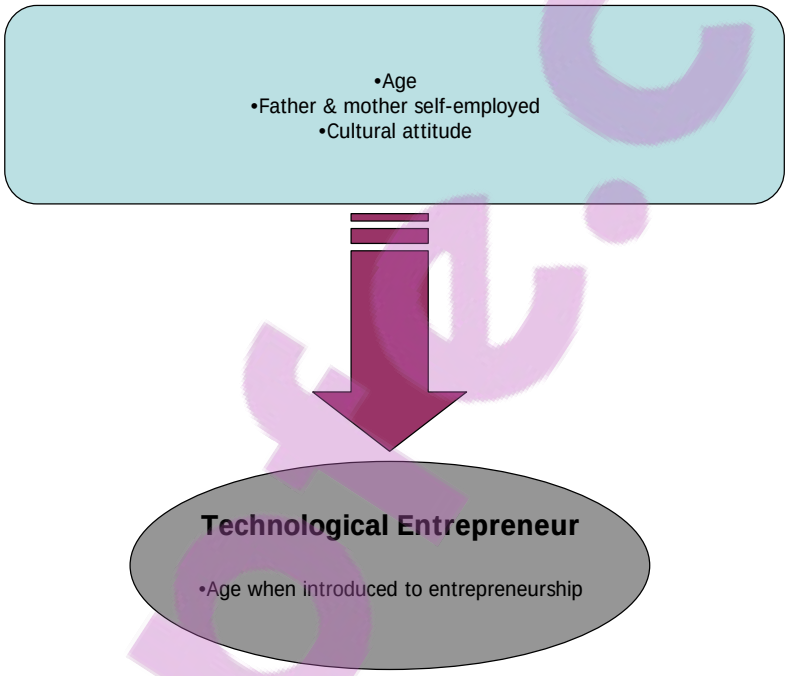


Figure 5.8 Correlations with age when introduced to entrepreneurship

The correlations with the *age when introduced to entrepreneurship* are as follows:

Table 5.12: Age when introduced to entrepreneurship	
1	*Younger entrepreneurs tend to be introduced to entrepreneurship earlier than older entrepreneurs. *Parameter = 0.25; Probability = 0.0001*
2	*Entrepreneurs whose parents were self-employed tend to be introduced to entrepreneurship at a younger age than their counterparts whose parents were not self-employed. *Parameter = -4.55; Probability = 0.0001*
3	Entrepreneurs who grew up in a culture which is conducive to entrepreneurship tend to be introduced to entrepreneurship at an earlier age than those who grew up in a negative culture towards entrepreneurship. *Parameter = 1.27; Probability = 0.0915*

The mathematical equation for the *age when introduced to entrepreneurship* is the following:

$$Y'et = Aet + Bet_1Xet_1 + \ldots\ldots\ldots + Bet_3Xet_3 \qquad [5-9]$$

Where:

Y'et	Age when introduced to entrepreneurship
Aet	Y-intercept = 11.84
$Bet_1 - Bet_3$	Parameters in Table 5.12
Xet_1	Age
Xet_2	Self-employed status of parents
Xet_3	Attitude of culture towards entrepreneurship

The final framework of all correlations with the entrepreneur shown graphically in Figure 5.9 includes all the predictors as *environmental influences* which influence the predicted *technological entrepreneur.*

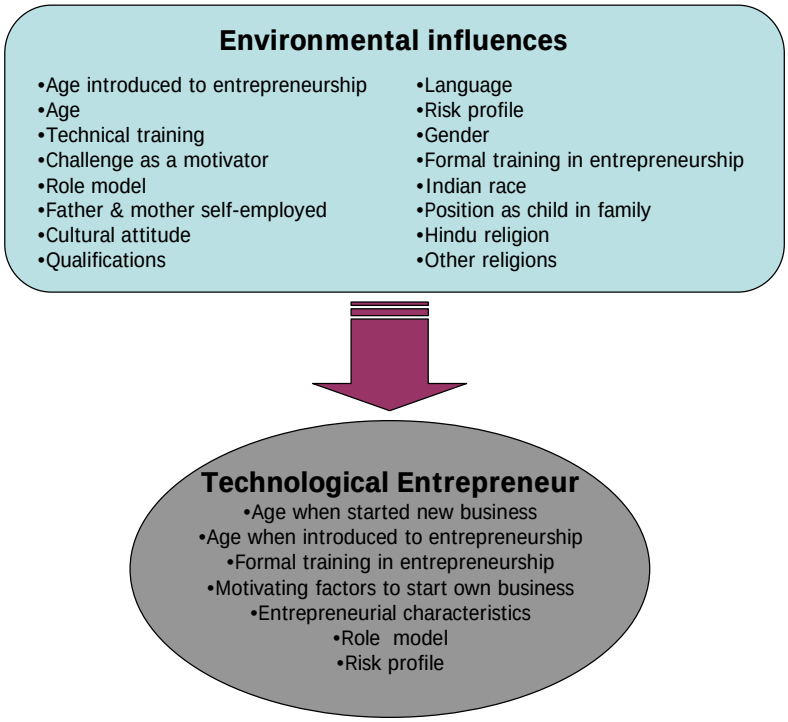


Figure 5.9 Framework of all correlations with entrepreneur

5.4.2.3 Correlations B: New venture creation

A number of dependent variables (to be predicted) of the new venture creation process as one of the main entities in the proposed model were identified. As many as possible independent (predictor) variables which could possibly influence these dependent variables were then identified and grouped in table format. See Appendix F. The table is presented in graphical format in Figure 5.10.

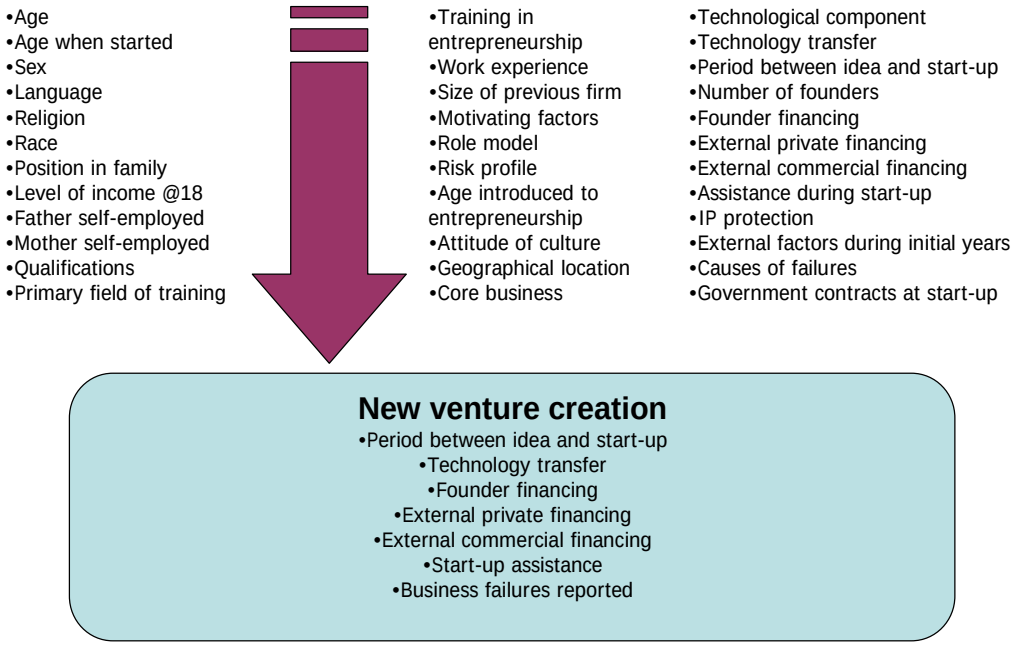


Figure 5.10 Comprehensive model elements with most predictor and selected predicted variables: New Venture Creation

The correlation tests as described earlier in this chapter were conducted on the venture creation process and the results are given in detail in Appendix D. A graphical summary of the results are given in Figures 5.11 to 5.19 with explanations on the correlations between the variables attached after each diagram.

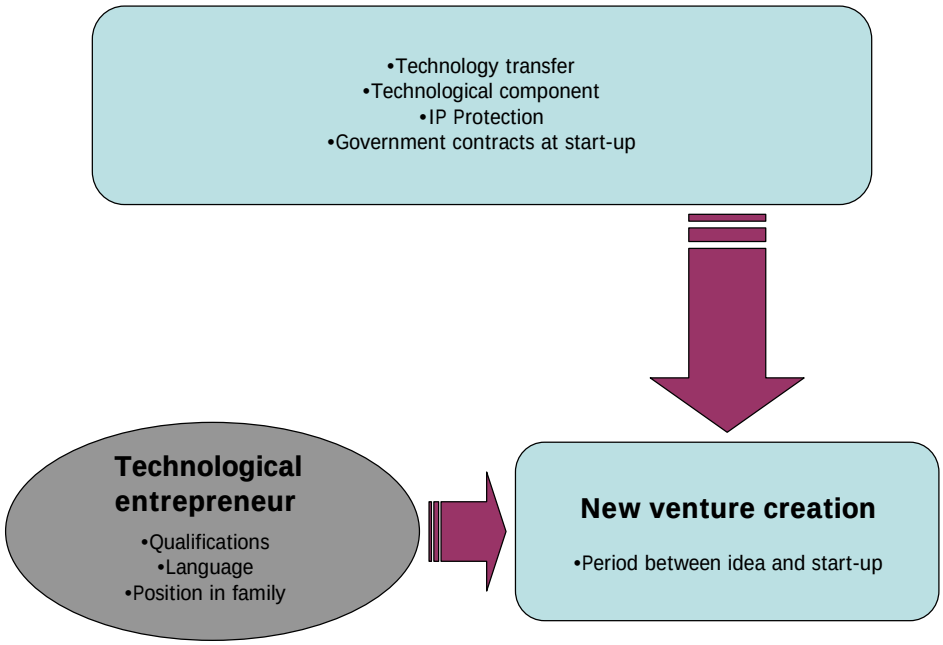


Figure 5.11 Correlations with period between idea and start-up

The correlations with *period between idea and start-up* are as follows:

Table 5.13: Period between idea and start-up	
1	*Entrepreneurs with higher tertiary education tend to take longer to start their new ventures after idea formation than those with lower (school) qualifications. *Parameter = 1.06; Probability = 0.0287*
2	*Entrepreneurs who had no or vague technology transfers during enterprise formation tend to start their new business in a shorter time after idea formation, while direct transfers tend to take a longer period to establish the business. *Parameter = -0.40; Probability = 0.0441*
3	Entrepreneurs who have protected their intellectual property with a patent tend to take longer to establish their businesses than those who did not protect their intellectual property. *Parameter = 1.34; Probability = 0.0706*
4	New ventures with a high technological component tend to take a shorter period to establish after the idea than those with a low technological component. *Parameter = -1.59; Probability = 0.0702*
5	English-speaking entrepreneurs tend to start their new businesses earlier after idea formation than non-English speaking entrepreneurs. *Parameter = -1.99; Probability = 0.0925*
6	Entrepreneurs who are the eldest child in the family tend to start their business earlier after idea formation than those who are younger family members. *Parameter = 0.34; Probability = 0.0717*
7	New ventures which had few (0 – 20%) Government contracts during start-up period tend to be started earlier after idea formation than those who had more Government contracts. *Parameter = 1.99; Probability = 0.1058*

The mathematical equation for the *period between idea and start-up* is the following:

$$Y'vm = Avm + Bvm_1Xvm_1 + \ldots\ldots\ldots + Bvm_7Xvm_7 \qquad [5 - 10]$$

Where:

Y'vm	Period between idea and start-up
Avm	Y-intercept = 3.16
$Bvm_1 - Bvm_7$	Parameters in Table 5.13
Xvm_1	Qualifications
Xvm_2	Technology transfer
Xvm_3	IP protection
Xvm_4	Technological component
Xvm_5	Language
Xvm_6	Position as child in family
Xvm_7	Government contracts at start-up

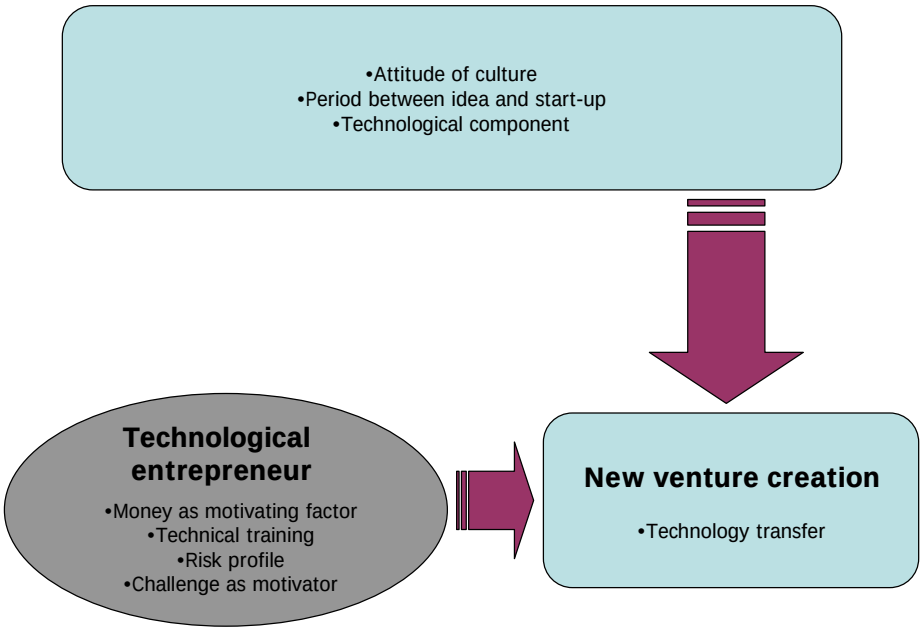


Figure 5.12 Correlations with technology transfer

The correlations with *technology transfer* are as follows:

Table 5.14: Technology transfer	
1	*Entrepreneurs with money as their primary motivator tend to establish businesses with no- or vague technology transfer during start-up. *Parameter = 0.50; Probability = 0.0002*
2	*Entrepreneurs who are trained in a technical field tend to transfer technology more directly during new venture formation than those with non-technical training. *Parameter = -0.65; Probability = 0.0020*
3	*Entrepreneurs who come from cultures that are conducive to entrepreneurship tend to transfer technology more directly than those who come from entrepreneurial negative cultures. *Parameter = 0.22; Probability = 0.0403*
4	Technology tends to be transferred more directly when the period between the idea and the actual start-up is longer. *Parameter = -0.04; Probability = 0.0526*
5	Entrepreneurs classified as risk-averters tend to transfer technology more directly than their risk-taker counterparts. *Parameter = -0.24; Probability = 0.1338*
6	Entrepreneurs with challenge as their primary motivator tend to establish businesses with direct technology transfer during start-up. *Parameter = -0.39; Probability = 0.1259*
7	Businesses with a low technological component tend to transfer technology more directly than those with a high technological component that had no or vague transfer. *Parameter = 0.31; Probability = 0.1012*

The mathematical equation for *technology transfer* is the following:

$$Y'vn = Avn + Bvn_1Xvn_1 + \ldots\ldots\ldots + Bvn_7Xvn_7 \qquad [5 - 11]$$

Where:

Y'vn	Technology transfer
Avn	Y-intercept = 2.58
Bvn1 – Bvn7	Parameters in Table 5.14
Xvn1	Money as motivator to start own business
Xvn2	Technical training
Xvn3	Attitude of culture towards entrepreneurship
Xvn4	Period between idea and start-up
Xvn5	Risk profile
Xvn6	Challenge as motivator to start business
Xvn7	Technological component

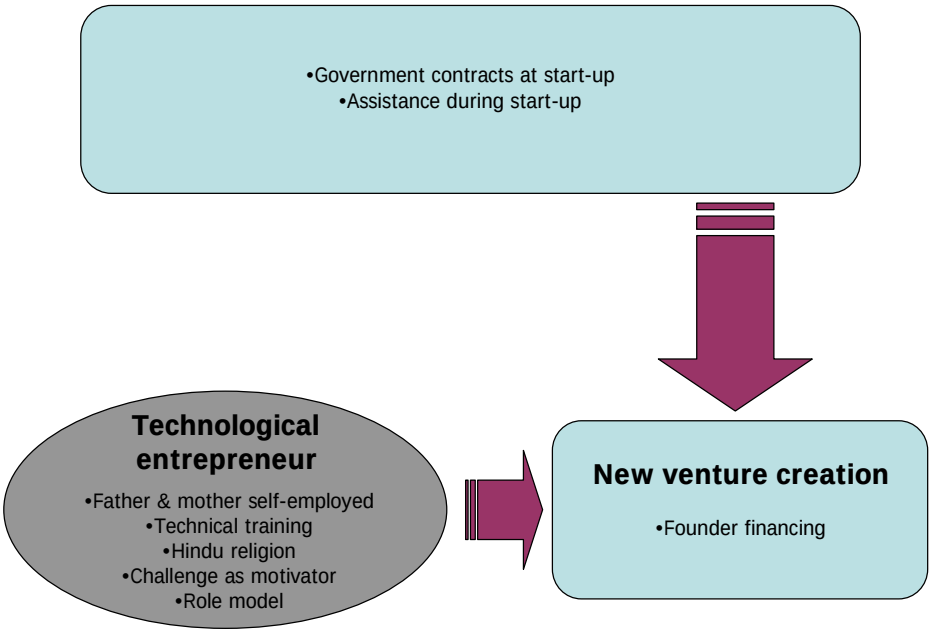


Figure 5.13 Correlations with founder financing

The correlations with *founder financing* are as follows:

Table 5.15: Founder financing	
1	Entrepreneurs who come from families where the parents were self-employed tend to finance their new ventures more using own funds than using external money. *Chi-square = 3.33; Parameter = 0.67; Probability = 0.0679*
2	*Entrepreneurs who had technical training tend to finance their new ventures with less of their own and more external funds. *Chi-square = 6.09; Parameter = -0.86; Probability = 0.0136*
3	*Entrepreneurs from other religions tend to finance their new ventures more with own funds than entrepreneurs from the Hindu religion. *Chi-square = 5.87; Parameter = -0.89; Probability = 0.0154*
4	*New ventures with low levels of Government contracts at start-up were financed with less own founders' capital than those with high levels of Government contracts. *Chi-square = 4.78; Parameter = 1.43; Probability = 0.0288*
5	*Entrepreneurs who reported assistance from any of the listed institutions during start-up tend to finance their businesses more from own capital. *Chi-square = 4.94; Parameter = 0.81; Probability = 0.0263*
6	Entrepreneurs who have role models tend to finance their businesses more from own finances than those without role models. *Chi-square = 2.69; Parameter = 0.57; Probability = 0.1011*
7	Entrepreneurs who listed challenge as a motivator to start their own business tend to have their businesses financed more with external funds than with their own capital. *Chi-square = 2.07; Parameter = -0.60; Probability = 0.1505*

The mathematical equation for *founder financing* is the following:

$$Y'vp = Avp + Bvp_1Xvp_1 + \ldots\ldots\ldots + Bvp_7Xvp_7 \qquad [5-12]$$

Where:

$Y'vp$	Founder financing
Avp	Y-intercept = -2.41
$Bvp_1 – Bvp_7$	Parameters in Table 5.15
Xvp_1	Self-employed status of parents
Xvp_2	Technical training
Xvp_3	Hindu religion
Xvp_4	Government contracts at start-up
Xvp_5	Assistance during start-up
Xvp_6	Role model
Xvp_7	Challenge as motivator to start own business

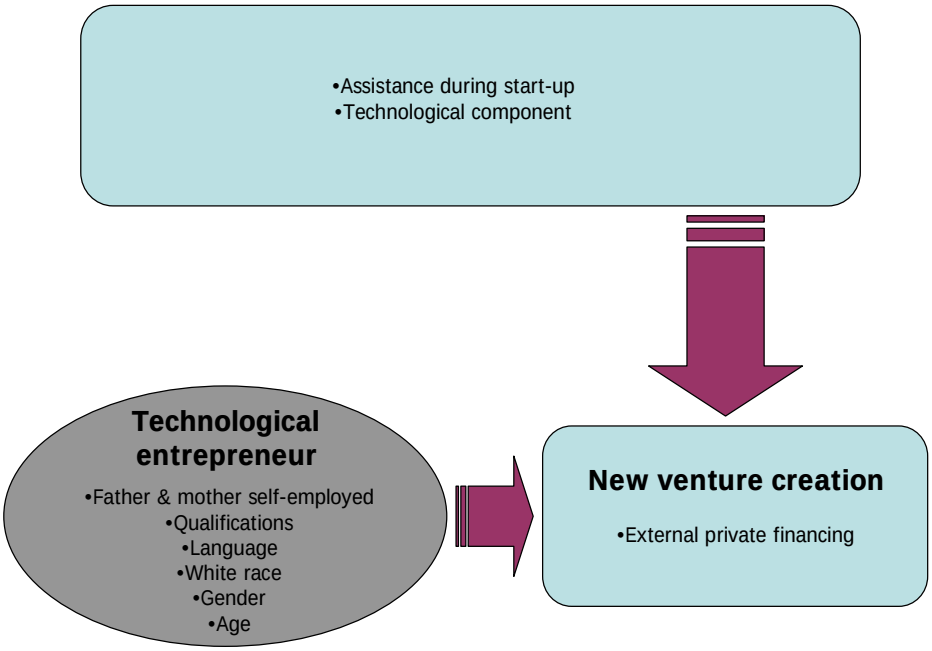


Figure 5.14 Correlations with external private financing

The correlations with *external private financing* are as follows:

Table 5.16: External private financing	
1	*When external financing is done, entrepreneurs who come from families where the parents were self-employed make less use of private funding than those whose parents were not self-employed. *Chi-square = 7.10; Parameter = 1.09; Probability = 0.0077*
2	*When external financing is done, white entrepreneurs tend to make more use of private financing than entrepreneurs from other races. *Chi-square = 5.72; Parameter = -0.92; Probability = 0.0168*
3	*When external financing is done, new businesses with a high technological component tend to make more use of private financing than their counterparts with a lower technological component. *Chi-square = 4.63; Parameter = -0.79; Probability = 0.0314*
4	*When external financing is done, English-speaking entrepreneurs tend to utilize more private funds in their start-up phase than entrepreneurs from other languages. *Chi-square = 5.04; Parameter = -1.27; Probability = 0.0248*
5	When external financing is done, female entrepreneurs tend to use more private financing than their male counterparts. *Chi-square = 3.47; Parameter = 1.26; Probability = 0.0624*
6	When external financing is done, older entrepreneurs tend to make more use of private financing than younger entrepreneurs. *Chi-square = 3.02; Parameter = -0.03; Probability = 0.0825*
7	When external financing is done, entrepreneurs with a higher qualification (i.e. University degree) tend to make more use of private financing than those with lower (i.e. school) qualifications. *Chi-square = 2.27; Parameter = -0.38; Probability = 0.1319*

8	When external financing is done, entrepreneurs who indicated no assistance from the listed institutions during start-up tend to use more private financing than those who indicated assistance. *Chi-square = 2.27; Parameter = 0.67; Probability = 0.0963*
9	When external financing is done, entrepreneurs who were trained in the technical field tend to make more use of private funds during start-up than their counterparts form other training disciplines. *Chi-square = 1.94; Parameter = -0.52; Probability = 0.1638*
10	When external financing is done, entrepreneurs with a high risk aversive profile tend to make more use of private funding than those with a high risk taker profile. *Chi-square = 1.75; Parameter = -0.35; Probability = 0.1857*

The mathematical equation for *external private financing* is the following:

$$Y'vq = Avq + Bvq_1Xvq_1 + \ldots\ldots\ldots + Bvq_{10}Xvq_{10} \qquad [5-13]$$

Where:

$Y'vq$	External private financing
Avq	Y-intercept = 3.75
$Bvq_1 – Bvq_{10}$	Parameters in Table 5.16
Xvq_1	Self-employed status of parents
Xvq_2	White race
Xvq_3	Technological component
Xvq_4	Language
Xvq_5	Gender
Xvq_6	Age
Xvq_7	Qualifications
Xvq_8	Assistance during start-up
Xvq_9	Technical training
Xvq_{10}	Risk profile

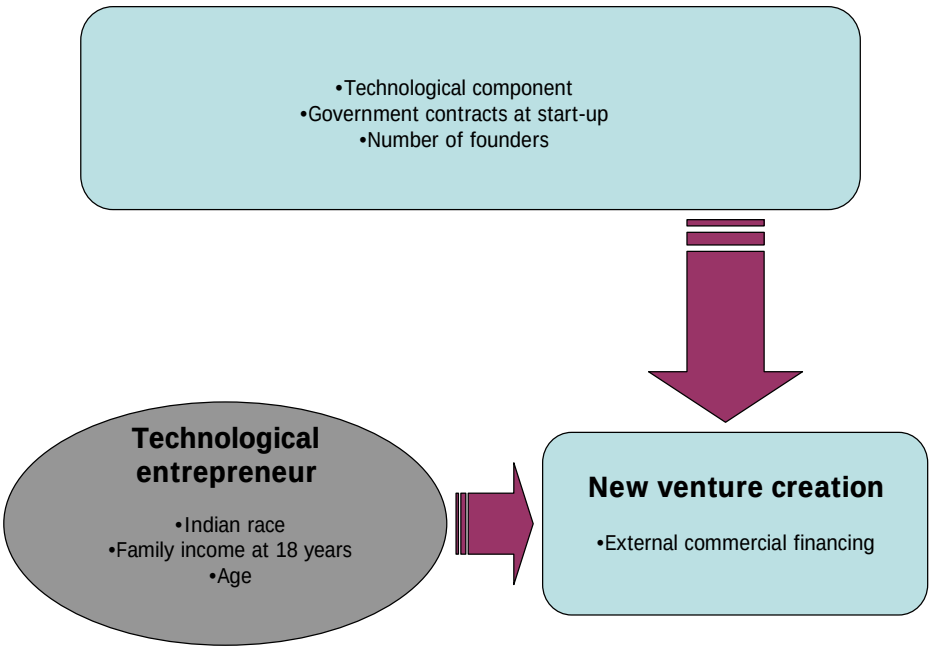


Figure 5.15 Correlations with external commercial financing

The correlations with *external commercial financing* are as follows:

Table 5.17: External commercial financing	
1	When external financing is done, Indian entrepreneurs tend to make more use of commercial financing than entrepreneurs from other races. *Chi-square = 2.97; Parameter = -0.59; Probability = 0.0850*
2	*When external financing is done, new businesses with a high technological component tend to make more use of commercial financing than those with a lower technological component. *Chi-square = 5.76; Parameter = -0.82; Probability = 0.0164*
3	When external financing is done, new businesses with one founder tend to make more use of commercial financing than those with more than one founder. *Chi-square = 3.33; Parameter = 0.46; Probability = 0.0681*
4	*When external financing is done, younger entrepreneurs tend to make more use of commercial financing than older entrepreneurs. *Chi-square = 6.20; Parameter = 0.04; Probability = 0.0128*
5	*When external financing is done, entrepreneurs who come from a family with low income at 18 years tend to make more use of commercial financing than those who come from higher income families. *Chi-square = 5.00; Parameter = 0.54; Probability = 0.0254*
6	When external financing is done, new businesses with a low percentage Government contracts at start-up tend to make more use of commercial financing than those with a higher percentage. *Chi-square = 2.37; Parameter = 1.08; Probability = 0.1240*

The mathematical equation for *external commercial financing* is the following:

$$Y'vr = Avr + Bvr_1Xvr_1 + \ldots\ldots\ldots + Bvr_6Xvr_6 \qquad [5 - 14]$$

Where:

Y'vr	External commercial financing
Avr	Y-intercept = -3.53
Bvr1 – Bvr6	Parameters in Table 5.17
Xvr1	Indian race
Xvr2	Technological component
Xvr3	Number of founders
Xvr4	Age
Xvr5	Family income at age of 18
Xvr6	Government contracts at start-up

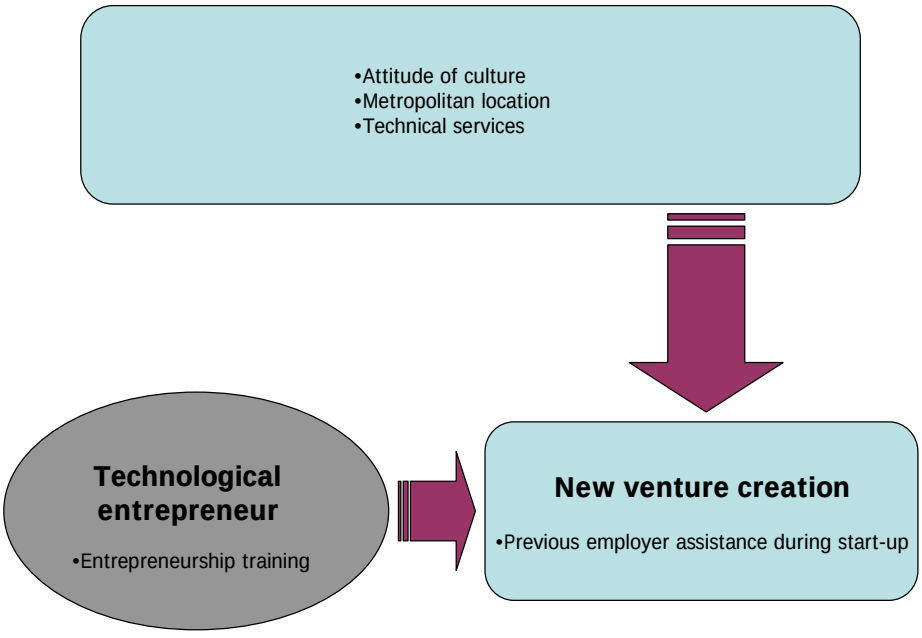


Figure 5.16 Correlations with previous employer assistance during start-up

The correlations with *previous employer assistance during start-up* are as follows:

Table 5.18: Previous employer assistance during start-up	
1	*Entrepreneurs who come from a culture that is conducive to entrepreneurship tend to receive no direct assistance from their previous employer during start-up, while those from a negative culture tend to receive direct assistance. *Chi-square = 4.45; Parameter = -1.24; Probability = 0.0349*
2	*New ventures in metropolitan areas tend to receive direct assistance from their previous employer during start-up, while their counterparts in the rural areas or towns tend to receive less direct assistance. *Chi-square = 5.49; Parameter = -2.00; Probability = 0.0191*
3	Entrepreneurs who received entrepreneurship training tend to receive direct assistance from their previous employer, while those who received no entrepreneurship training tend to receive less direct assistance. *Chi-square = 3.71; Parameter = -1.76; Probability = 0.0539*
4	New businesses in the technical services sector tend to receive no direct assistance form their previous employer, while those from other sectors tend to receive direct assistance. *Chi-square = 2.53; Parameter = 1.21; Probability = 0.1118*

The mathematical equation for *previous employer assistance during start-up* is the following:

$$Y'vs = Avs + Bvs_1Xvs_1 + \ldots\ldots\ldots + Bvs_4Xvs_4 \qquad [5-15]$$

Where:

$Y'vs$	Previous employer assistance during start-up
Avs	Y-intercept = 2.11
$Bvs_1 – Bvs_4$	Parameters in Table 5.18
Xvs_1	Attitude of culture towards entrepreneurship
Xvs_2	Metropolitan location
Xvs_3	Entrepreneurship training
Xvs_4	Technical services

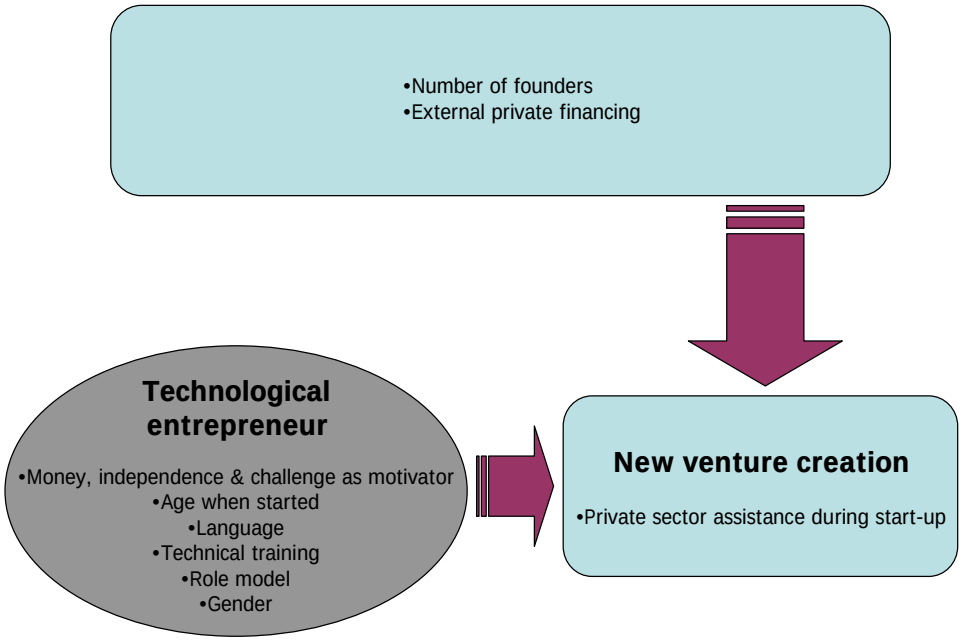


Figure 5.17 Correlations with private sector assistance during start-up

The correlations with *private sector assistance during start-up* are as follows:

Table 5.19: Private sector assistance during start-up	
1	*Entrepreneurs who were motivated by money, independence or the challenge to start a new venture tend not to be directly assisted by the private sector, while those who were motivated by other factors than those mentioned above, tend to be directly assisted. *Chi-square = 8.34; Parameter = 5.73; Probability = 0.0039*
2	Entrepreneurs who started their businesses at a younger age tend to receive direct assistance from the private sector, while those who started later tend to receive less direct assistance. *Chi-square = 3.53; Parameter = 0.11; Probability = 0.0604*
3	*Non-English speaking entrepreneurs tend to receive direct assistance from the private sector, while their English-speaking counterparts tend not to receive direct assistance. *Chi-square = 4.18; Parameter = 2.69; Probability = 0.0409*
4	New enterprises with only one founder tend to receive direct assistance from the private sector, while businesses with more founders tend to receive less assistance. *Chi-square = 3.47; Parameter = 1.18; Probability = 0.0625*
5	Entrepreneurs who used external private financing during start-up tend to be assisted directly by the private sector, while those who did not use external private financing tend not to be assisted directly. *Chi-square = 3.71; Parameter = 1.52; Probability = 0.0542*
6	Entrepreneurs who have role models tend to be directly assisted by the private sector, while those without role models tend to be less directly assisted. *Chi-square = 2.97; Parameter = -1.47; Probability = 0.0849*
7	Entrepreneurs with other than technical training tend to be directly assisted by the private sector, while those with technical training tend to be less directly assisted. *Chi-square = 3.28; Parameter = 1.60; Probability = 0.0700*

8	Male entrepreneurs tend to be more directly assisted by the private sector than female entrepreneurs. *Chi-square = 2.59; Parameter = -2.01; Probability = 0.1073*

The mathematical equation for *private sector assistance during start-up* is the following:

$$Y'vt = Avt + Bvt_1Xvt_1 + \ldots\ldots\ldots + Bvt_8Xvt_8 \qquad [5-16]$$

Where:

$Y'vt$	Private sector assistance during start-up
Avt	Y-intercept = -11.15
$Bvt_1 – Bvt_8$	Parameters in Table 5.19
Xvt_1	Money, independence or challenge as motivator to start own business
Xvt_2	Age when started new business
Xvt_3	Language
Xvt_4	Number of founders
Xvt_5	External private financing
Xvt_6	Role model
Xvt_7	Technical training
Xvt_8	Gender

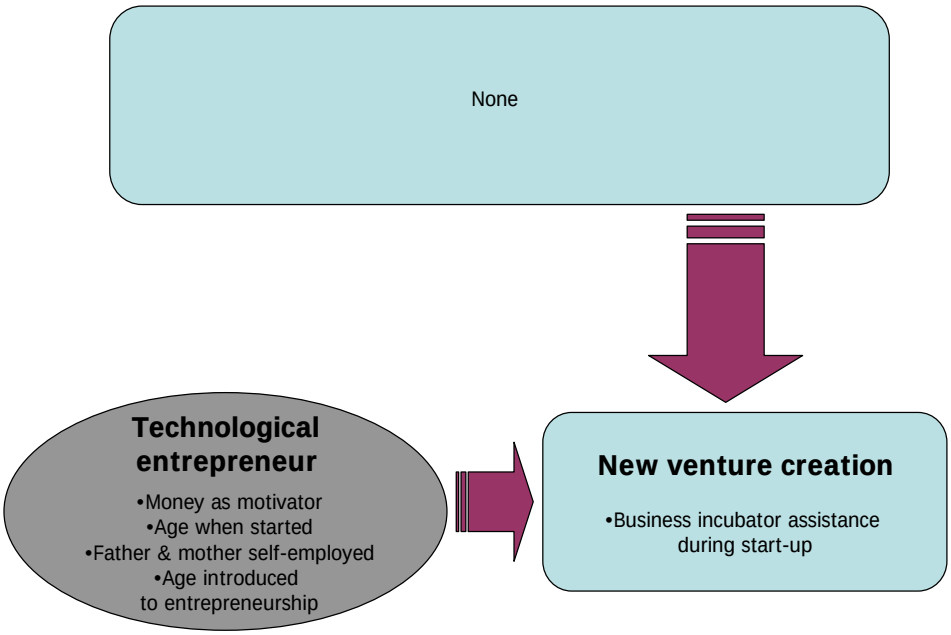


Figure 5.18 Correlations with business incubator assistance during start-up

The correlations with *business incubator assistance during start-up* are as follows:

Table 5.20: Business incubator assistance during start-up	
1	*Entrepreneurs who listed as a primary motivator to start a new business other factors than money tend to be more directly assisted by business incubators than those who listed money as a motivator. *Chi-square = 6.59; Parameter = 14.27; Probability = 0.0102*
2	*Entrepreneurs who started their businesses at a younger age tend to be directly assisted from business incubators, while those who started later tend to be less directly assisted. *Chi-square = 6.89; Parameter = 0.65; Probability = 0.0086*
3	*Entrepreneurs who come from families where the parents were self-employed tend not to be assisted directly from business incubators, while their counterparts where the parents were not self-employed tend to be more assisted. *Chi-square = 5.00; Parameter = 7.01; Probability = 0.0254*
4	Entrepreneurs who were introduced to entrepreneurship at a younger age tend not to be assisted by business incubators, while their counterparts who were introduced later tend to be directly assisted. *Chi-square = 3.19; Parameter = -0.19; Probability = 0.0739*

The mathematical equation for *business incubator assistance during start-up* is the following:

$$Y'vu = Avu + Bvu_1Xvu_1 + \ldots\ldots\ldots + Bvu_4Xvu_4 \qquad [5 - 17]$$

Where:

Y'vu	Business incubator assistance during start-up
Avu	Y-intercept = -24.49
Bvu1 – Bvu4	Parameters in Table 5.20
Xvu1	Money as motivator to start own business
Xvu2	Age when started new business
Xvu3	Self-employed status of parents
Xvu4	Age when introduced to entrepreneurship

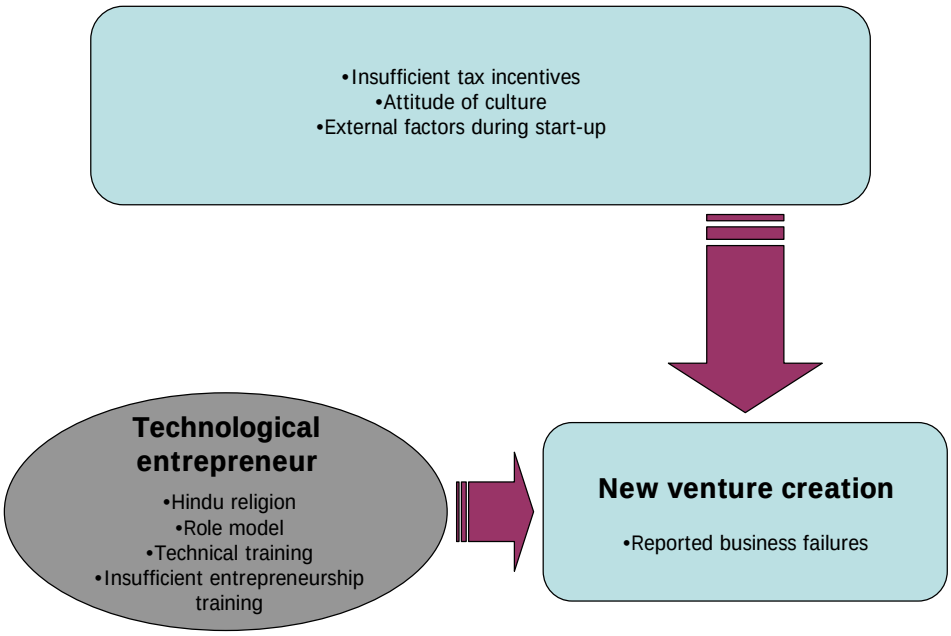


Figure 5.19 Correlations with reported business failures

The correlations with entrepreneurs who *reported business failures* are as follows:

Table 5.21: Business failures reported	
1	*Entrepreneurs who listed insufficient tax incentives as a cause for new technological business failures, tend to have more previous business failures than those who listed other causes. *Chi-square = 8.15; Parameter = -0.35; Probability = 0.0043*
2	*Entrepreneurs who come from cultures that are conducive to entrepreneurship tend to

	report more business failures than those who come from negative inclined cultures. *Chi-square = 4.08; Parameter = 0.72; Probability = 0.0434*
3	*Entrepreneurs from the Hindu religion tend to have more business failures than those from other religions. *Chi-square = 3.96; Parameter = -1.23; Probability = 0.0466*
4	*Entrepreneurs who did not have a role model tend to have more business failures than those who had a role model. *Chi-square = 4.02; Parameter = 1.09; Probability = 0.0450*
5	Entrepreneurs who rated the list of external factors that influenced the start-up phase positively tend to have more business failures than those who rated them negatively. *Chi-square = 3.08; Parameter = -1.36; Probability = 0.0794*
6	Entrepreneurs with technical training tend to have more business failures than those with non-technical training. *Chi-square = 2.58; Parameter = -0.89; Probability = 0.1081*
7	Entrepreneurs, who listed insufficient entrepreneurship training as a cause for new technological business failures, tend to have less previous business failures than those who listed other causes. *Chi-square = 2.05; Parameter = 0.17; Probability = 0.1525*

The mathematical equation for *business failures reported* is the following:

$$Y'vv = Avv + Bvv_1Xvv_1 + \ldots\ldots\ldots + Bvv_7Xvv_7 \qquad [5 - 18]$$

Where:

$Y'vv$	Business failures reported
Avv	Y-intercept = 0.97
$Bvv_1 – Bvv_7$	Parameters in Table 5.21
Xvv_1	Insufficient tax incentives
Xvv_2	Attitude of culture towards entrepreneurship
Xvv_3	Hindu religion
Xvv_4	Role model
Xvv_5	External factors during start-up
Xvv_6	Technical training
Xvv_7	Insufficient training in entrepreneurship

The final framework of correlations with the new venture creation process shown graphically in Figure 5.20 includes all the predictors as *environmental influences* and as the *technological entrepreneur* which influence the predicted *new venture creation process.*

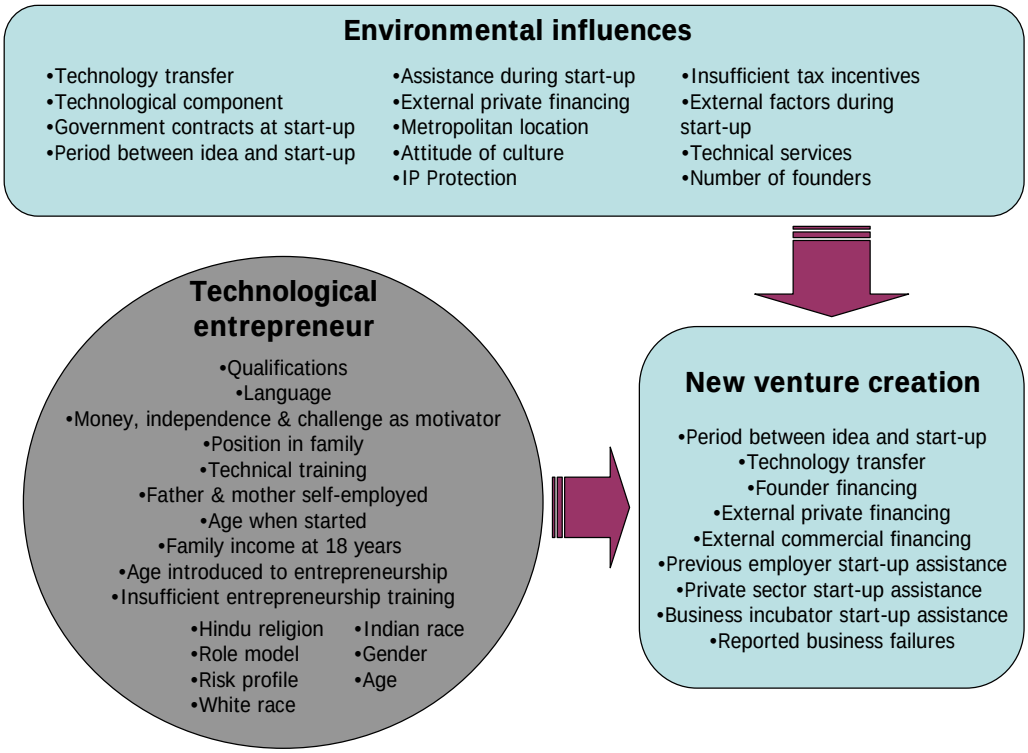


Figure 5.20 Framework of all correlations with new venture creation process

5.4.2.4 Correlations C: Mature business

A number of dependent variables (to be predicted) of the mature business as one of the main entities in the proposed model were identified. As many as possible independent (predictor) variables which could possibly influence these dependent variables were then identified and grouped in table format (See Appendix G). The table is presented in graphical format in Figure 5.21.

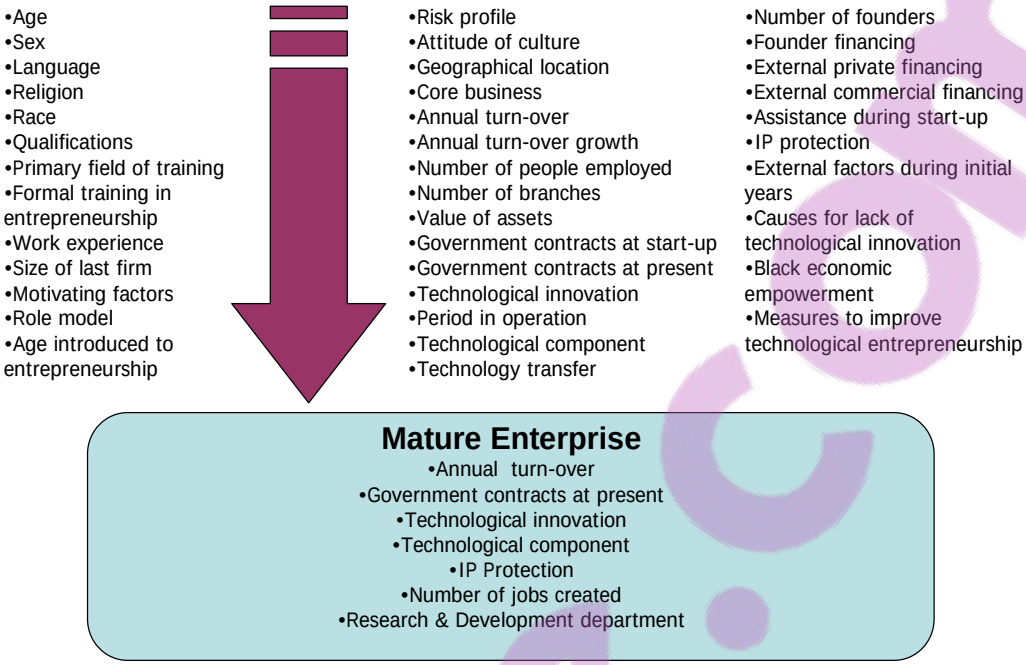


Figure 5.21 Comprehensive model elements with most predictor and selected predicted variables: Mature Enterprise

The correlation tests as described earlier in this chapter were conducted on the mature business and the results are given in detail in Appendix D. A graphical summary of the results are given in Figures 5.22 to 5.28 with explanations on the correlations between the variables attached after each diagram.

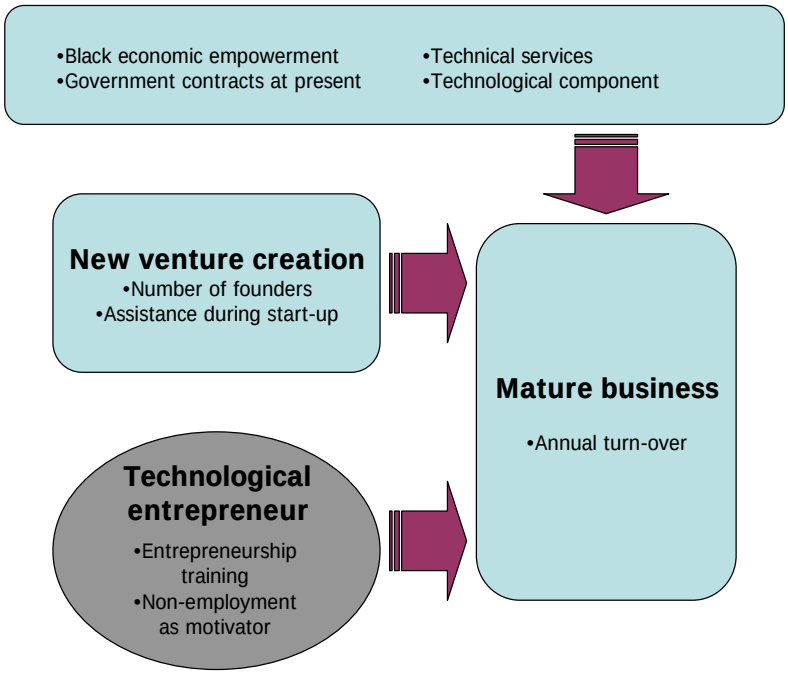


Figure 5.22 Correlations with annual turn-over

The correlations with *annual turn-over* are as follows:

Table 5.22: Annual turn-over	
1	*Mature businesses with more than one founder tend to have larger annual turn-over than those with one founder only. *Parameter = 0.27; Probability = 0.0100*
2	*Black owned businesses tend to have smaller annual turn-over than their white-owned counterparts. *Parameter = 0.22; Probability = 0.0250*
3	Mature businesses that were started by founders who had entrepreneurship training tend to have smaller annual turn-over than those that were started by un-trained entrepreneurs. *Parameter = -0.28; Probability = 0.0756*
4	Mature businesses that have a large percentage of government contracts at present tend to have larger annual turn-over than those with less government contracts. *Parameter = 0.38; Probability = 0.0518*
5	Businesses who reported direct assistance from any of the listed institutions during start-up tend to have smaller annual turn-over than those who did not report assistance. *Parameter = -0.33; Probability = 0.0664*
6	Businesses in the technical services sector tend to have smaller annual turn-over than those in the manufacturing or other sectors. *Parameter = -0.30; Probability = 0.1179*
7	Mature businesses that were founded by entrepreneurs who listed un-employment as their primary motivator tend to have smaller annual turn-over than those who listed other motivators. *Parameter = -0.33; Probability = 0.1487*
8	Mature businesses with a high degree of technological component tend to have larger annual turn-over than those with low or average technological component. *Parameter = 0.19; Probability = 0.1497*

The mathematical equation for *annual turn-over* is the following:

$$Y'mm = Amm + Bmm_1Xmm_1 + \ldots\ldots\ldots + Bmm_8Xmm_8 \qquad [5 - 19]$$

Where:

$Y'mm$	Annual turn-over
Amm	Y-intercept = 0.99
$Bmm_1 – Bmm_8$	Parameters in Table 5.22
Xmm_1	Number of founders
Xmm_2	Black economic empowerment
Xmm_3	Training in entrepreneurship
Xmm_4	Government contracts at present
Xmm_5	Assistance during start-up
Xmm_6	Technical services
Xmm_7	Non-employment as motivator to start own business
Xmm_8	Technological component

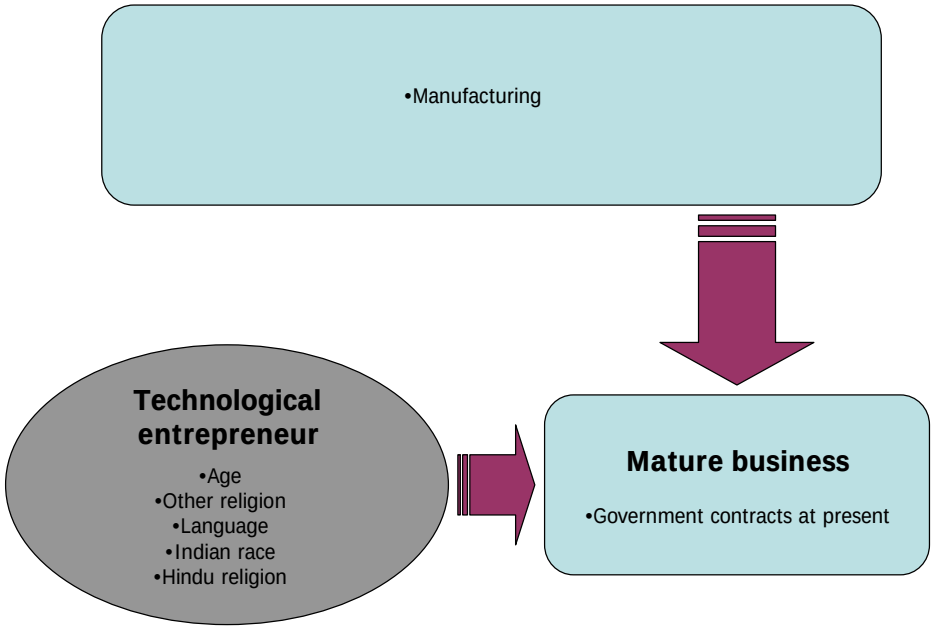


Figure 5.23 Correlations with Government contracts at present

The correlations with businesses that have *Government contracts at present* are as follows:

Table 5.23: Government contracts at present	
1	Businesses managed by older entrepreneurs tend to have a larger percentage of government contracts at present than their younger counterparts. *Chi-square = 3.42; Parameter = 0.04; Probability = 0.0641*
2	Businesses managed by entrepreneurs from Christian and Hindu religions tend to have a larger percentage of government contracts at present than those from other religions. *Chi-square = 3.62; Parameter = 2.29; Probability = 0.0571*
3	Businesses in the manufacturing sector tend to have a lower percentage government contracts than those in the technical services or other sectors. *Chi-square = 1.82; Parameter = -0.60; Probability = 0.1774*
4	Businesses managed by English-speaking entrepreneurs tend to have a larger percentage of government contracts than those managed by their non-English speaking counterparts. *Chi-square = 3.58; Parameter = 1.19; Probability = 0.0584*
5	*Businesses managed by Indian entrepreneurs tend to have a smaller percentage of government contracts than those managed by entrepreneurs from other race groups. *Chi-square = 4.74; Parameter = -1.65; Probability = 0.0294*

The mathematical equation for *government contracts at present* is the following:

$$Y'mn = Amn + Bmn_1Xmn_1 + \ldots\ldots\ldots + Bmn_5Xmn_5 \qquad [5 - 20]$$

Where:

$Y'mn$	Government contracts at present
Amn	Y-intercept = -0.34
$Bmn_1 – Bmn_5$	Parameters in Table 5.23
Xmn_1	Age
Xmn_2	Christian and Hindu religions
Xmn_3	Manufacturing
Xmn_4	Language
Xmn_5	Indian race

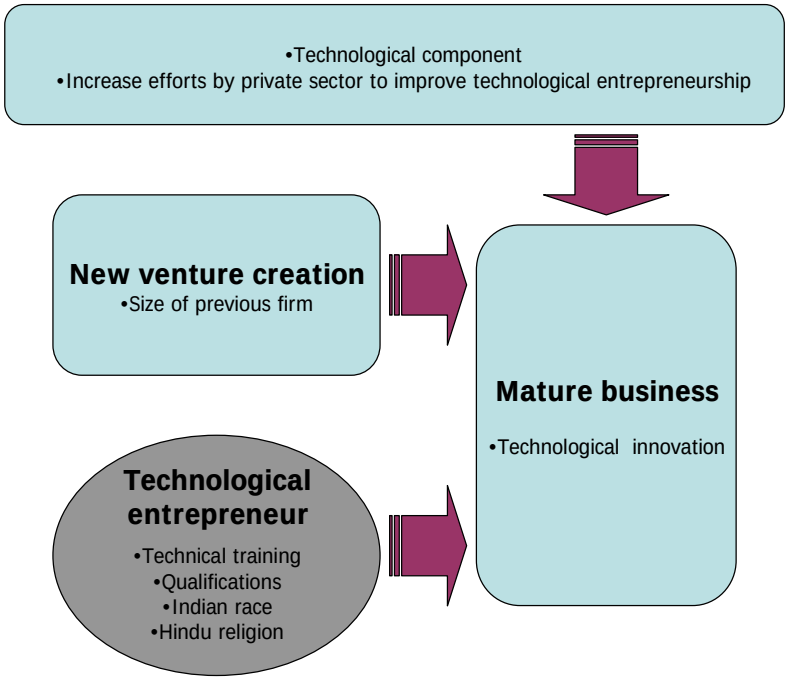


Figure 5.24 Correlations with technological innovation

The correlations with *technological innovation a*re as follows:

Table 5.24: Technological innovation	
1	*Mature enterprises with a high technological component tend to report higher levels of technological innovation in their businesses than those with an average or lower technological component. *Parameter = 13.77; Probability = 0.0001*
2	*Businesses managed by entrepreneurs who are trained in the technical field, tend to innovate more than those managed by entrepreneurs trained in other fields. *Parameter = 0.33; Probability = 0.0088*
3	*Entrepreneurs who last worked for a large business tend to report higher technological innovation levels in their own businesses than those who worked for smaller firms. *Parameter = 0.15; Probability = 0.0320*
4	*Entrepreneurs with lower qualifications (school only) tend to report higher innovation levels in their own businesses than those with higher qualifications (technical or university). *Parameter = -0.19; Probability = 0.0297*
5	Entrepreneurs who listed increased efforts by the private sector as the most important measure to increase technological entrepreneurship tend to report lower levels of innovation than those who listed any of the other measures as most important. *Parameter = -0.11; Probability = 0.1036*
6	Indian entrepreneurs tend to report higher technological innovation levels in their businesses than those from other races. *Parameter = 0.45; Probability = 0.1849*
7	*Entrepreneurs from the Hindu religion tend to report lower levels of technological innovation than those from other religions. *Parameter = -0.39; Probability = 0.0272*

The mathematical equation for *technological innovation* is the following:

$$Y'mp = Amp + Bmp_1Xmp_1 + \ldots\ldots\ldots + Bmp_7Xmp_7 \qquad [5-21]$$

Where:

Y'mp	Technological innovation
Amp	Y-intercept = 2.41
Bmp₁ – Bmp₇	Parameters in Table 5.24
Xmp₁	Technological component
Xmp₂	Technical training
Xmp₃	Size of previous firm
Xmp₄	Qualifications
Xmp₅	Increase efforts by private sector
Xmp₆	Indian race
Xmp₇	Hindu religion

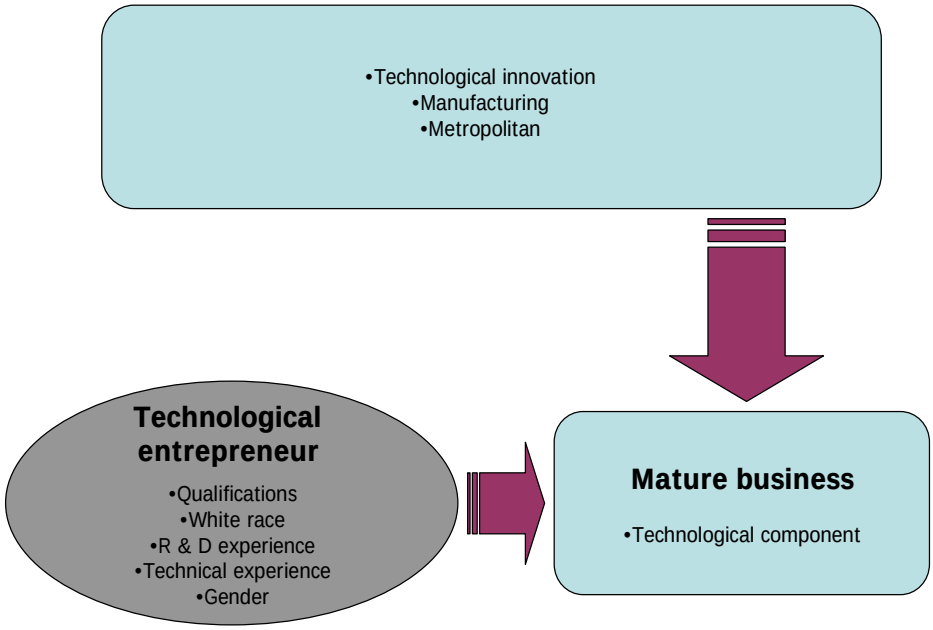


Figure 5.25 Correlations with technological component

Warning: The sample frequency of this test is only 17. The validity of the model fit is therefore questionable.

The correlations with *technological component* are as follows:

Table 5.25: Technological component	
1	*Mature businesses managed by entrepreneurs with high qualifications (University degree) tend to have a higher technological component than those managed by lower qualified entrepreneurs. *Parameter = 0.66; Probability = 0.0399*
2	*Mature businesses that reported high levels of technological innovation tend to have a high technological component in their products or services. *Parameter = 0.52; Probability = 0.0103*
3	*Mature businesses in the manufacturing sector tend to have a lower technological component than businesses in other sectors. *Parameter = -0.31; Probability = 0.0043*
4	Mature businesses located in metropolitan areas tend to have a lower technological component than those located in towns or rural areas. *Parameter = -0.20; Probability = 0.0922*
5	Mature businesses managed by white entrepreneurs tend to have a higher technological component than those managed by entrepreneurs from other races. *Parameter = 0.50; Probability = 0.1899*
6	Mature businesses managed by female entrepreneurs tend to have a higher technological component than those managed by male entrepreneurs.

	Parameter = -0.55; Probability = 0.0603
7	Mature businesses managed by entrepreneurs who had a shorter period of prior R & D experience tend to have higher technological component than those who had longer previous R & D experience. *Parameter = -0.04; Probability = 0.0659*
8	Mature businesses managed by entrepreneurs who had a longer period previous technical experience tend to have higher technological component than those who had shorter previous technical experience. *Parameter = 0.01; Probability = 0.0975*

The mathematical equation for *technological component* is the following:

$$Y'mq = Amq + Bmq_1Xmq_1 + \ldots\ldots\ldots + Bmq_8Xmq_8 \qquad [5 - 22]$$

Where:

$Y'mq$	Technical component
Amq	Y-intercept = -0.64
$Bmq_1 – Bmq_8$	Parameters in Table 5.25
Xmq_1	Qualifications
Xmq_2	Technological innovation
Xmq_3	Manufacturing
Xmq_4	Metropolitan location
Xmq_5	White race
Xmq_6	Gender
Xmq_7	R & D experience
Xmq_8	Technical experience

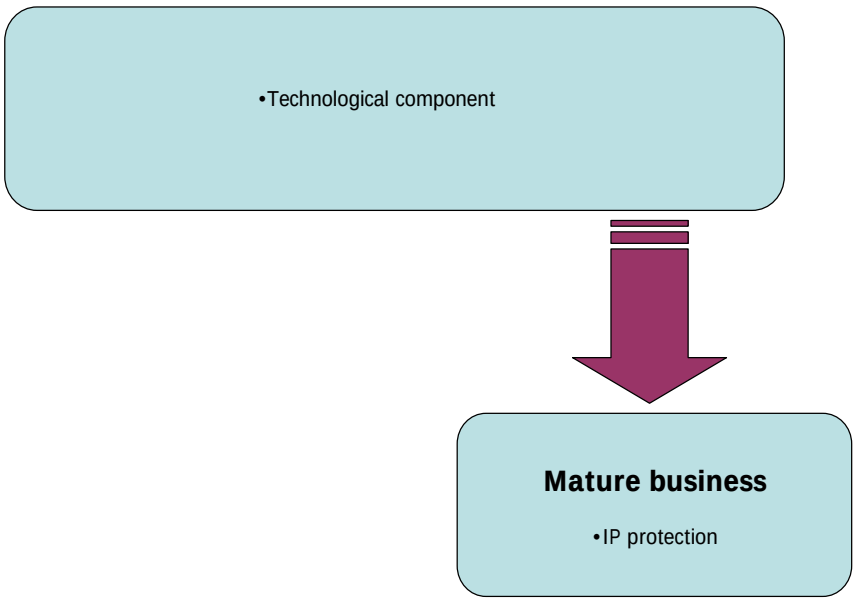


Figure 5.26 Correlations with intellectual property (IP) protection

Warning: The sample frequency of this test is only 18. The validity of the model fit is therefore questionable.

The correlations with *intellectual property protection* are as follows:

Table 5.26: Intellectual property protection	
1	Mature businesses that protect their intellectual property tend to have a low technological component while those that do not protect their IP tend to have a high technological component. *Chi-square = 2.45; Parameter = 1.94; Probability = 0.1172*

The mathematical equation for *intellectual property protection* is the following:

$$Y'mr = Amr + Bmr_1 Xmr_1 \qquad [5 – 23]$$

Where:

Y'mr Intellectual property protection

Amr	Y-intercept = -3.89
Bmr$_1$	Parameter in Table 5.26
Xmr$_1$	Technological component

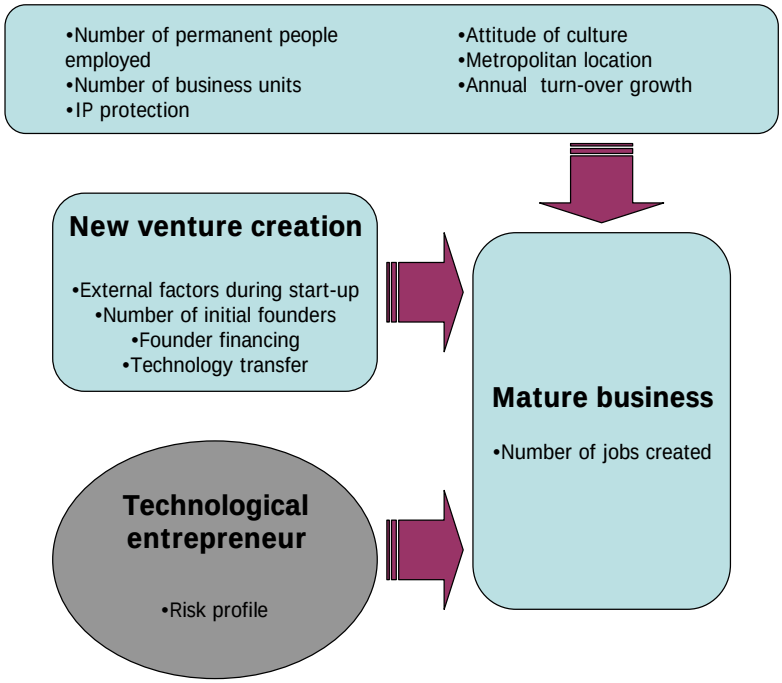


Figure 5.27 Correlations with number of jobs created

The correlations with *number of jobs created* are as follows:

Table 5.27: Number of jobs created	
1	*Businesses that employ more people tend to create more jobs than those employing fewer people. *Parameter = 35.73; Probability = 0.0001*
2	*Businesses with more business units or branches tend to create more jobs than those with fewer business units or branches. *Parameter = 46.77; Probability = 0.0017*
3	Entrepreneurs who come from cultures that are negative towards entrepreneurship tend to create less new jobs than those who come from conducive cultures. *Parameter = -19.58; Probability = 0.0775*
4	Businesses operating in the rural areas or towns tend to create more jobs than those in metropolitan areas. *Parameter = -25.19; Probability = 0.0598*
5	Entrepreneurs who rated the listed external factors that influenced their business during start-up positive tend to create less jobs than those who rated them negative.

	Parameter = -33.00; Probability = 0.0838
6	Businesses that protect their intellectual property through a patent (local or international) tend to create more jobs than those without IP protection. *Parameter = 31.81; Probability = 0.0850*
7	Businesses that were started by more than one founder tend to create more jobs than those that were started by one founder only. *Parameter = 17.44; Probability = 0.1260*
8	Businesses that reported high annual turn-over growth figures tend to create less new jobs than those that reported lower growth figures. *Parameter = -15.93; Probability = 0.1485*
9	Businesses that were financed during start-up with more founders' capital tend to create more jobs than those that were financed with external capital. *Parameter = 9.78; Probability = 0.1381*
10	Entrepreneurs with a risk averter profile tend to create less new jobs than those with a risk taker profile. *Parameter = -13.35; Probability = 0.1974*
11	Businesses that transferred technology more directly tend to create more jobs than those that reported no technology transfer. *Parameter = -6.82; Probability = 0.1832*

The mathematical equation for *number of jobs created* is the following:

$$Y'ms = Ams + Bms_1Xms_1 + \ldots\ldots\ldots + Bms_{11}Xms_{11} \qquad [5-24]$$

Where:

$Y'sm$	Number of jobs created
Ams	Y-intercept = 33.13
$Bms_1 – Bms_{11}$	Parameters in Table 5.27
Xms_1	Number of people employed
Xms_2	Number of business units
Xms_3	Attitude of culture towards entrepreneurship
Xms_4	Geographical location
Xms_5	External factors during start-up
Xms_6	IP protection
Xms_7	Number of initial founders
Xms_8	Annual turn-over growth
Xms_9	Founder financing
Xms_{10}	Risk profile
Xms_{11}	Technology transfer

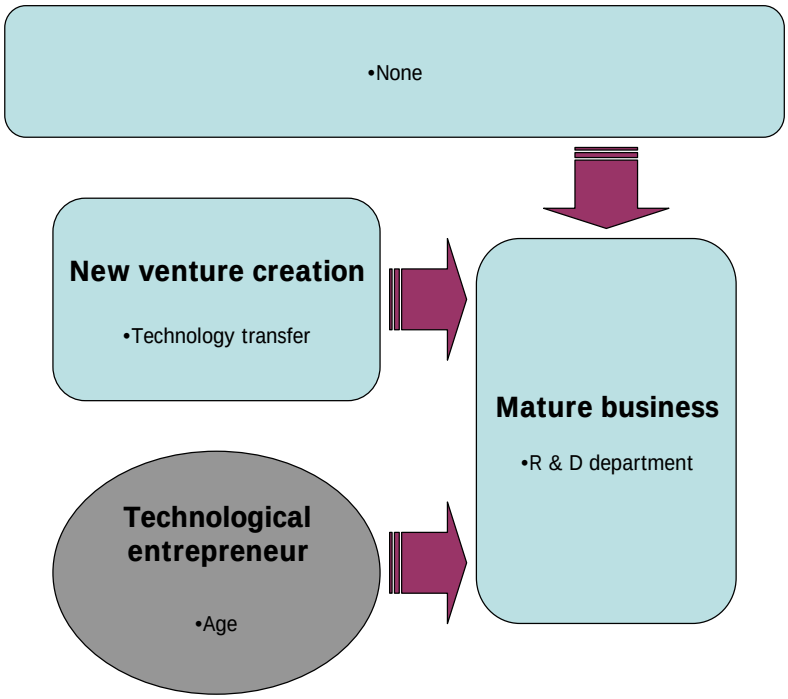


Figure 5.28 Correlations with R & D department

Warning: The sample frequency of this test is only 21. The validity of the model fit is therefore questionable.

The correlations with the *R & D department* are as follows:

Table 5.28: R & D department	
1	*Mature businesses managed by young entrepreneurs tend to have R & D departments while those managed by older entrepreneurs tend not to have R & D departments. *Chi-square = 5.32; Parameter = 0.27; Probability = 0.0211*
2	Mature businesses that transferred technology directly during start-up tend not to have R & D departments while those that transferred technology vaguely (or no transfer at all) tend to have more R & D departments. *Chi-square = 3.59; Parameter = -3.52; Probability = 0.0582*

The mathematical equation for *R & D department* is the following:

$$Y'mt = Amt + Bmt_1Xmt_1 + \ldots\ldots\ldots + Bmt_2Xmt_2 \qquad [5-25]$$

Where:

Y'mt	R & D department
Amt	Y-intercept = -8.21
$Bmt_1 – Bmt_2$	Parameters in Table 5.28
Xmt_1	Age
Xmt_2	Technology transfer

The final framework of correlations with the mature enterprise shown graphically in Figure 5.29 includes all the predictors as *environmental influences,* the *new venture creation process* and the *technological entrepreneur* which influence the predicted *mature business.*

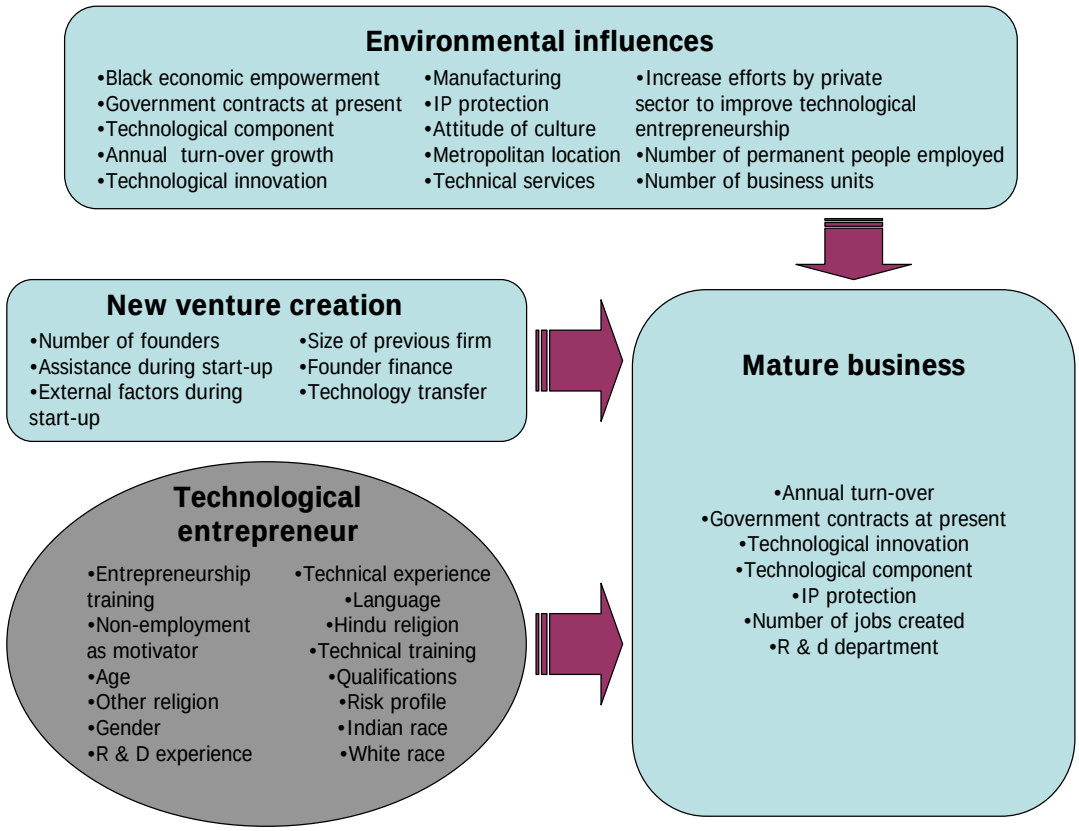


Figure 5.29 Framework of all correlations with mature business

5.5 CONSTRUCTING THE THREE-PART MODEL

5.5.1 Model for the technological entrepreneur

Five environmental categories were identified which influence the technological entrepreneur. Correlations with probabilities lower than 0.20 or 20% are grouped in these categories as follows:

Table 5.29: Environmental categories which influence the technological entrepreneur (correlations with probabilities <0.20)

1	**Family background** ▪ Position as child in the family ▪ Self-employed status of parents
2	**Personality traits** ▪ Challenge as a motivator to start new business ▪ Risk profile of entrepreneur
3	**Growing up experience** ▪ Age when introduced to entrepreneurship ▪ Technical training ▪ Role model ▪ Formal qualifications ▪ Training in entrepreneurship
4	**Cultural influences** ▪ Hindu religion ▪ Other religions ▪ Indian entrepreneurs ▪ Home language ▪ Cultural attitude towards entrepreneurship
5	**Physical traits** ▪ Age ▪ Gender

These environmental categories and their relationships with the technological entrepreneur constitute the first part of the model as presented in Figure 5.30.

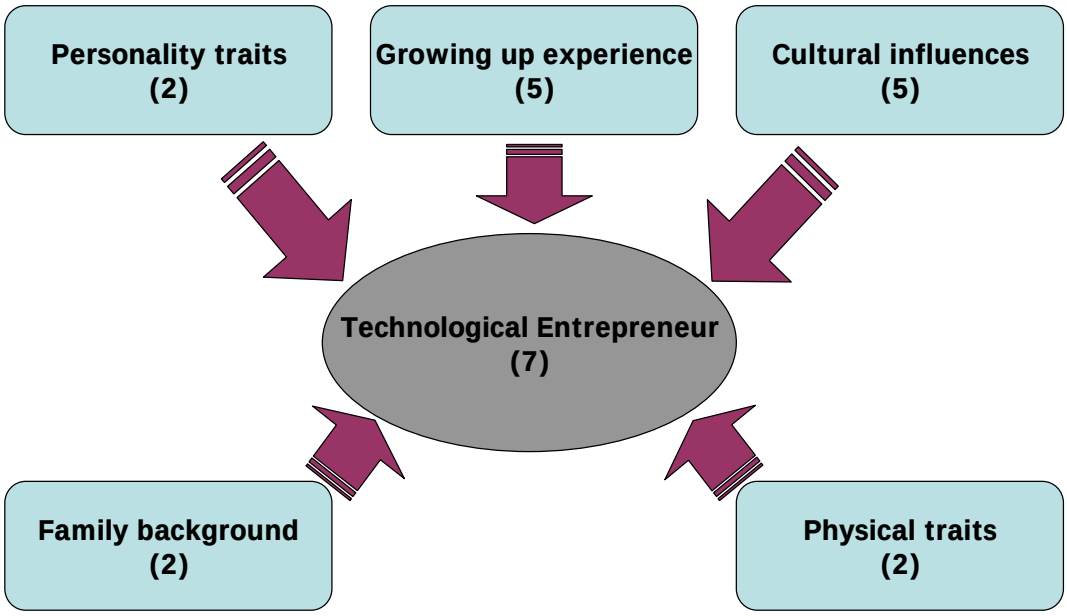


Figure 5.30 Proposed model of the technological entrepreneur part 1

In this part of the model the *technological entrepreneur* is represented by the equation:

$$Te = \sum_{i=m}^{t} Y'ei \qquad [5 - 26]$$

Where:

Te	Technological entrepreneur
Y'ei	The seven dependent variables *Y'em* to *Y'et* (excluding 'o')

5.5.2 Model for the new venture creation process

Three environmental categories were identified which influence the new venture creation process. Correlations with probabilities lower than 0.20 or 20% are grouped in these categories as follows:

Table 5.30: Environmental categories which influence the new venture creation process (correlations with probabilities <0.20)

1	**Technological entrepreneur** ▪ Qualifications ▪ Language ▪ Money as motivator ▪ Independence as motivator ▪ Challenge as motivator ▪ Position as child in family ▪ Technical training ▪ Self-employed status of parents ▪ Age when stated first business ▪ Family income at the age of 18 years ▪ Age when introduced to entrepreneurship ▪ Entrepreneurship training ▪ Hindu religion ▪ Role model ▪ Risk profile ▪ White entrepreneurs ▪ Indian entrepreneurs ▪ Gender ▪ Age
2	**Technology specific** ▪ Degree of technology transfer ▪ Technological component ▪ Period between idea and start-up ▪ IP protection ▪ Technical services ▪ Number of founders
3	**Start-up assistance** ▪ Assistance during start-up ▪ External private financing ▪ Metropolitan location ▪ Cultural attitude towards entrepreneurship ▪ Insufficient tax incentives ▪ External factors affecting start-up ▪ Government contracts at start-up

These environmental categories and their relationships with the new venture creation process constitute the second part of the model as presented in Figure 5.31.

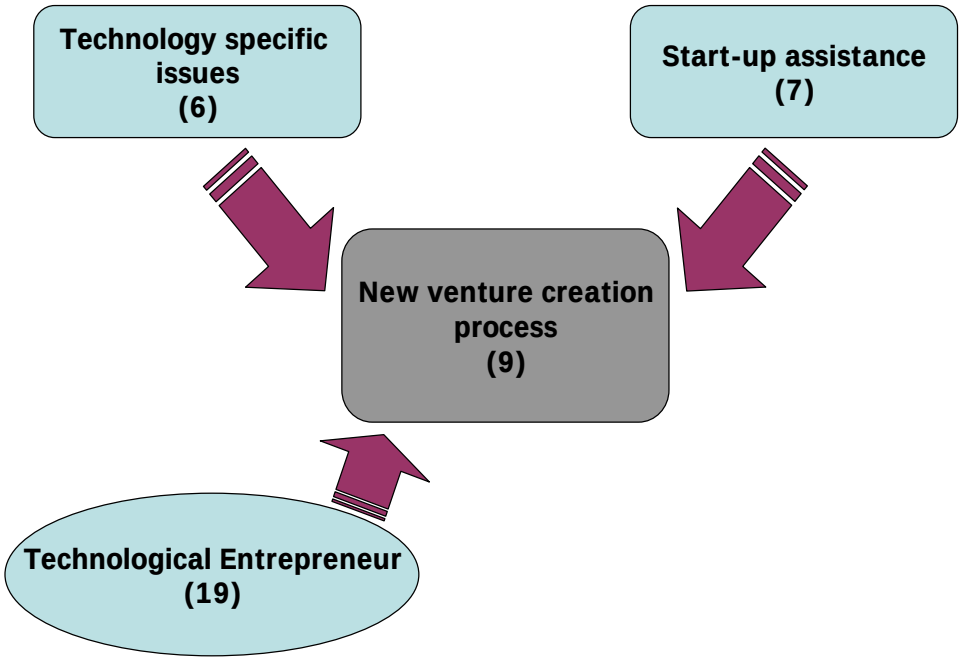


Figure 5.31 Proposed model of the new venture creation process part 2

In this part of the model the *new venture creation process* is represented by the equation:

$$Nv = \sum_{i=m}^{v} Y'vi \qquad [5 - 27]$$

Where:

Nv	New venture creation process
Y'vi	The nine dependent variables *Y'vm* to *Y'vv* (excluding 'o')

5.5.3 Model for the mature business

Four environmental categories were identified which influence the mature enterprise. Correlations with probabilities lower than 0.20 or 20% are grouped in these categories as follows:

Table 5.31: Environmental categories which influence the mature business (correlations with probabilities <0.20)	
1	**Technological entrepreneur** ▪ Entrepreneurship training ▪ Non-employment as motivator ▪ Age ▪ Other religion ▪ Gender ▪ R & D work experience ▪ Technical work experience ▪ Language ▪ Hindu religion ▪ Technical training ▪ Qualifications ▪ Risk profile ▪ White entrepreneurs ▪ Indian entrepreneurs
2	**New venture creation process** ▪ Number of founders ▪ Assistance during start-up ▪ External factors affecting start-up ▪ Size of previous firm ▪ Founder's finance ▪ Technology transfer
3	**Enterprise specific** ▪ Technological component ▪ Annual turn over growth ▪ Technological innovation ▪ Manufacturing sector ▪ IP protection ▪ Metropolitan location ▪ Technical services sector ▪ Number of people employed ▪ Number of business units/branches
4	**Business environment** ▪ Black empowerment status ▪ Government contracts at present ▪ Increase efforts by private sector to improve technological innovation ▪ Cultural attitude towards entrepreneurship

These environmental categories and their relationships with the mature business constitute the third part of the model as presented in Figure 5.32.

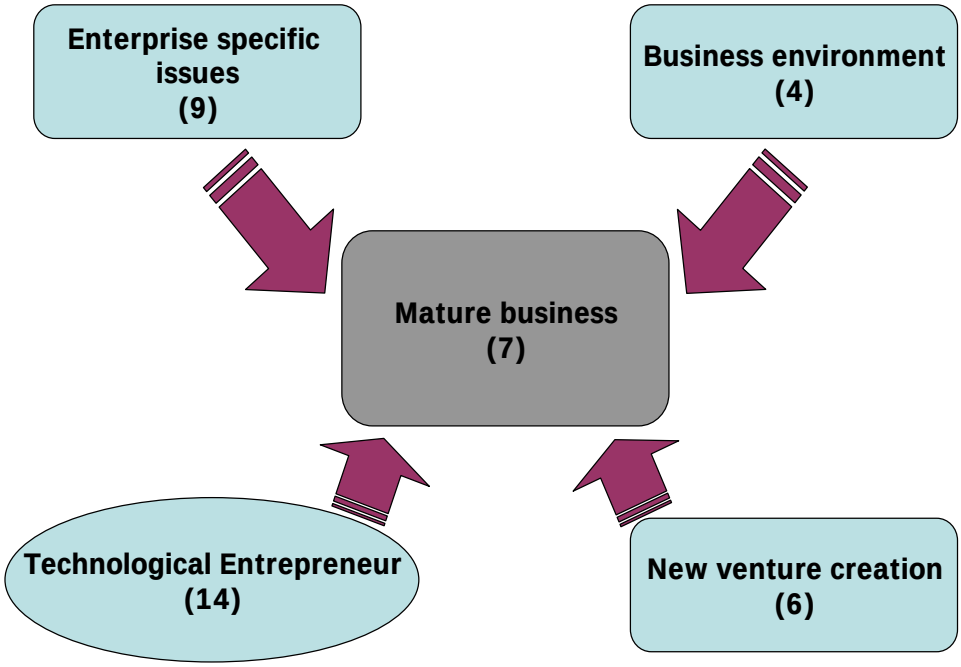


Figure 5.32 Proposed model of the mature business part 3

In this part of the model the *mature business* is represented by the equation:

$$Mb = \sum_{i=m}^{t} Y'mi \qquad [5 - 28]$$

Where:

Mb	Mature business
Y'mi	The seven dependent variables *Y'mm* to *Y'mt* (excluding 'o')

5.6 RESULTS: MEM/MPM/MOT STUDENTS

The following frequency distribution results were obtained from the analysis, which are displayed in graphical format in Appendix C.

5.6.1 Profile of student survey sample

The profile of the survey sample can be summarised as follows:

'It consists mainly of students aged between 20 and 25 years (42%), belonging to the white race group (63%) and mainly male students (83%). The majority of students have not founded a business before (75%) and of those who have done so, less than half (45%) have founded technology-based businesses. By far the largest portion has completed their tertiary qualification at a South African University (85%) with the majority having a B-degree (77%) in the engineering discipline (84%). The largest part has also completed primary and secondary education in South African government schools (87%), and has received the following entrepreneurship training: No training in primary schools (99%), no training in secondary schools (93%) and some training in tertiary institutions (56%). Just more than half of the group (57%) has received some form of entrepreneurship training prior to the post-graduate course. The majority of the total group regards their prior entrepreneurship training as poor or totally inadequate (80%) and an even larger part of the group (90%) that did in fact receive prior entrepreneurship training, regards the training as poor/inadequate. In conclusion, the contribution of the specific entrepreneurship course is regarded as significant (77%) and the majority of the group has strong aspirations to start a new venture in future (82%)'.

5.6.2 Relationships between variables

Several relationships were investigated by using the *chi-square goodness of fit test statistic* which investigates *only single (one-to-one) relationships* and the following were found:

Table 5.32: Student sample correlations	
1	No correlation was found between starting previous businesses and entrepreneurship training. *Chi-square = 0.0027; Probability = 0.9587*
2	No correlation was found between race group and entrepreneurship training. *Chi-square = 2.5488; Probability = 0.2796*
3	No correlation was found between degree institutions and entrepreneurship training. *Chi-square = 2.1043; Probability = 0.1469*
4	No correlation was found between gender and entrepreneurship training. *Chi-square = 0.3017; Probability = 0.5828*
5	No correlation was found between race and starting previous businesses. *Chi-square = 2.0668; Probability = 0.3558*
6	No correlation was found between age group and starting previous businesses. *Chi-square = 0.6644; Probability = 0.7246*
7	No correlation was found between gender and starting previous businesses. *Chi-square = 1.1659; Probability = 0.2802*
8	*Some positive correlation was found between gender and entrepreneurial aspirations where female students reported higher entrepreneurial aspirations than male students. *Chi-square = 4.0954; Parameter = positive; Probability = 0.0430*
9	*Some positive correlation was found between race group and entrepreneurial aspirations where black students reported higher entrepreneurial aspirations than white students. *Chi-square = 7.2098; Parameter = positive; Probability = 0.0272*
10	No correlation was found between highest qualification and technology business founded. *Chi-square = 2.1813; Probability = 0.7025*
11	No correlation was found between degree and technology business founded. *Chi-square = 2.6066; Probability = 0.2716*
12	No correlation was found between schooling and entrepreneurship training. *Chi-square = 1.5005; Probability = 0.2206*
13	*Significant negative correlation was found between age and all prior entrepreneurship training, where younger students reported more entrepreneurship training (at all levels) and older students less entrepreneurship training (at all levels). *Chi-square = 25.9325; Parameter = negative; Probability = 0.0001*
14	*Significant negative correlation was found between age and entrepreneurship training at tertiary institutions, where younger students reported more entrepreneurship training at tertiary institutions and older students less entrepreneurship training at tertiary institutions. *Chi-square = 27.7902; Parameter = negative; Probability = 0.0001*

Refer to Appendix C for detail results of above correlation analysis.

The results are presented graphically in Figure 5.33.

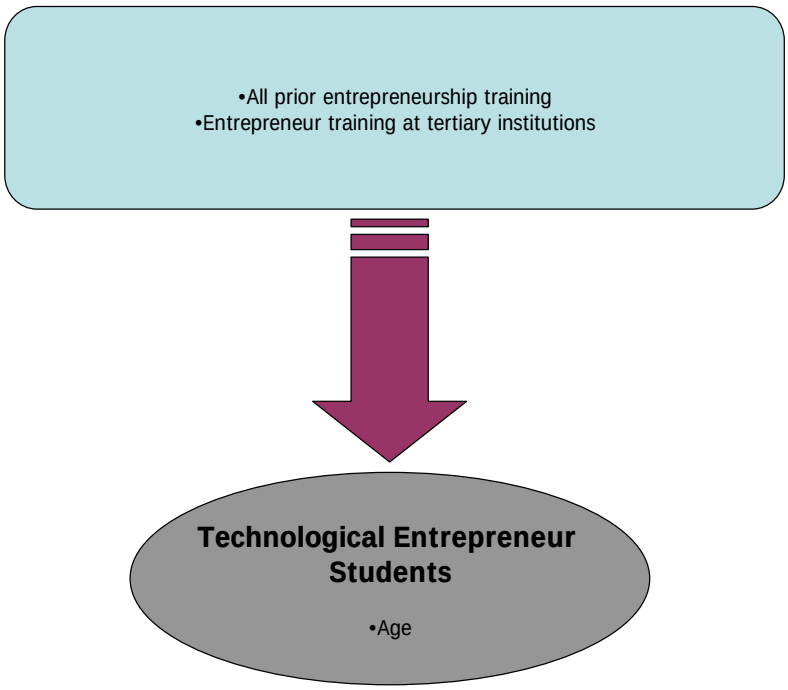


Figure 5.33 Correlations with age of entrepreneur students

5.7 SUMMARY

Chapters 1 to 3 set the scene for the actual research, which is discussed in Chapter 4. In this Chapter the research results are discussed in detail and presented by means of data tables, figures, graphs and explanations. The data gathering process and method are described, followed by a brief theoretical background of the statistical analysis techniques used. Distribution and regression analysis are used to configure a three-part model from the three entities of the technological entrepreneurship domain in emerging regions. These three entities are:

- The entrepreneur;
- The new venture creation process;
- The mature business.

The statistical technique of regression analysis is used to determine correlations between a set of predetermined dependent variables for each of the three entities

and a set of predetermined independent variables. The strongest correlations between these sets of variables or combinations of variables are extracted and interpreted in terms of the research framework. This Chapter also contains the inference of new hypotheses, where several hypotheses with strong correlations ($P < 0.0001$) emerged.

In the next and last Chapter, the research findings are tested against the original propositions which were formulated for the research project and how the proposed model is meant to fill the 'theory gap'.

CHAPTER SIX

CONCLUSIONS

AND

RECOMMENDATIONS

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

'To exist is to change, to change is to mature, to mature is to go on creating oneself endlessly'.

Henry Bergson, French philosopher (De Necker 1997:55).

6.1 RESEARCH RESULTS

6.1.1 Summary of findings

In this Chapter, the research results culminate into conclusions and recommendations to various role players. The important findings are summarised either in tabular format, or in charts and figures to provide an overall view. The propositions are evaluated for validity and the contributions to the existing body of knowledge are revisited.

6.1.1.1 Technological entrepreneur profile

The profile of the survey sample of technological entrepreneurs is summarised in Table 6.1.

Table 6.1: Summary of profile: Technological entrepreneur

CATEGORY	FREQUENCY OR MEAN
Gender	Male: 90%
Age	46.5 years
Age when started first business	32.2 years
Language	English: 86.1%
Religion	Christian: 45.4% Hindu: 43%

Race	Indian: 54.8% White: 39.5%
Position as child in family	Eldest: 26.8% 2nd eldest: 26.4%
Self-employed status of parents	34.8%
Family income at age of 18	Less than R5,000: 77.5%
Qualifications	School: 36.7% Technical: 47.1% University: 16.2%
Primary field of training	Technical: 53.4%
Formal training in entrepreneurship	None: 59.5%
Work experience	Technical: 10.1 years
Size of previous firm (number of employees)	6 < 50: 45.3%
Primary motivating factor to start own business	Independence: 38.5%
Role model	No: 60%
Risk profile	Risk-manager: 44.4% Risk-taker: 44%
Strongest entrepreneurial characteristic	Dedication: 90.5%
Weakest entrepreneurial characteristic	Tolerance of risk: 54.9%
Age when first introduced to entrepreneurship	24.8 years
Attitude of culture towards entrepreneurship	Neutral: 44.5% Conducive: 39.5%

6.1.1.2 Enterprise profile

The profile of the survey sample enterprise is summarised in Table 6.2

.

Table 6.2: Summary of profile: Enterprise

CATEGORY	FREQUENCY OR MEAN
Geographical location	Metropolitan: 57.8% Towns and rural: 42.2%
Core business	Manufacturing: 45.4% Technical services: 30%
Annual turn over	R0.25m < R1m: 33.2%
Turn over growth over past three years	0 < 10%: 51%
Number of employees	6 < 50: 63.6%
Number of branches	One: 72.9%
Value of assets	R0.1m < R1m: 39.2%
Government contracts at starting	Less than 20%: 95.5%
Government contracts at present	Less than 20%: 85.2%
Technological innovation	Good or average: 79.4%
Number of years in operation	11.9 years
Technological component	Average: 51.4%

6.1.1.3 New venture creation

The profile of the survey sample of new venture creation process is summarised in Table 6.3.

Table 6.3: Summary of profile: New venture creation process	
CATEGORY	**FREQUENCY OR MEAN**
Period between idea and start-up	3.3 years
Technology transfer	Direct or partial: 58.8%
Number of founders	One: 54.6%
Original founders still owners	66.2%
Owners skills	Complimentary: 46.9%
Financing by owners	>80% own: 61.7%
External financing	Family: 38.1% Commercial banks: 37.1%
Assistance during start-up	Private sector: 15.2% None: 42.4%
IP protection	No patent: 78.9%

6.1.1.4 Mature enterprise profile

The profile of the survey sample mature enterprise is summarised in Table 6.4.

Table 6.4: Summary of profile: Mature enterprise	
CATEGORY	**FREQUENCY OR MEAN**
Annual turn over expectations	As expected: 57.9%
Annual turn over growth expectations	As expected: 54.9%
Profitability expectations	As expected: 53.8%
Previous business failures	Yes: 11.9%
Employment of additional managerial skills	No: 54.8%
Personnel management skill rating	Good: 55.8%
Responsible for marketing function	Owner: 63.2%
Use of formal written procedures	Yes: 75.2%
Number of jobs created over past 5 years	14.4 jobs
R & D department	No: 80%
Black ownership	100% black owned: 50%

6.1.1.5 Entrepreneurship education

The profile of the survey sample of MEM/MPM/MOT students is summarised in Table 6.5.

Table 6.5: Summary of profile: MEM / MPM / MOT students	
CATEGORY	**FREQUENCY OR MEAN**
Age	20 < 25: 42%

Race	White: 63%
Gender	Male: 83%
Founded a business before	No: 75%
Technological business founded before	Yes: 45%
Tertiary education	SA university: 85%
Qualifications	B-degree: 77%
Discipline	Engineering: 84%
School education	SA Gov. schools: 87%
Previous entrepreneurship training	No (Primary school): 99% No (Secondary school): 93% Some (Tertiary Institution): 56% Some in all: 57%
Rating of prior entrepreneurship training	Poor or inadequate: 80%
Contribution of course	Significant: 77%
Aspirations to start own business	Yes: 82%

6.1.1.6 Other aspects

The list of possible external factors which influenced the entrepreneurs' business success is summarised in Table 6.6.

Table 6.6: Summary of list of external factors affecting business success

RATING	FREQUENCY OR MEAN
Not at all	Central Government initiatives: 81.6% Central Government polices: 77.9% Non-Governmental organisations: 77.1% Provincial Government initiatives: 77% Local Government initiatives: 72.5% SME development initiatives: 69.9% Tax incentives: 69.7% Black empowerment policies: 58.7% Private sector initiatives: 52% Healthy climate for business opportunities: 39.8%
Negatively	Black empowerment policies: 16.3% Local Government initiatives: 9.7% Central government policies and programs: 9.5%
Positively	Healthy climate for business opportunities: 56.1% Private sector initiatives: 43.5% SME development initiatives: 26%

The ranking by entrepreneurs of the causes for lack of technological innovation is summarised in Table 6.7.

Table 6.7: Ranking of causes for lack of technological innovation

RANKING	CAUSES
1	Lack of resources (time, money, staff)
2	Insufficient assistance and initiatives from Government

3	Poor or no return on efforts to improve own technological innovation abilities
4	Lack of skills and knowledge to innovate
5	Easy and cheap access to existing technologies.

The ranking by entrepreneurs of the causes for lack of technological innovation is summarised in Table 6.8.

Table 6.8: Ranking of causes for new technological business failures

RANKING	CAUSES
1	Insufficient assistance and initiative from Government
2	Insufficient training in entrepreneurial skills
3	Availability of and access to venture capital
4	Insufficient assistance and initiatives from the private sector
5	Insufficient training in business management skills
6	Non-sympathetic culture and upbringing towards entrepreneurship
7	Availability of and access to mentorship programs
8	Insufficient tax incentives
9	Racial and sexual discrimination
10	Other

The ranking by entrepreneurs of the measures to develop technological entrepreneurship is summarised in Table 6.9.

Table 6.9: Ranking of measures to develop technological entrepreneurship

RANKING	MEASURES
1	Improve the development of technological entrepreneurship skills during primary, secondary and tertiary education
2	Improve efforts to positively influence society's perception towards entrepreneurship in general
3	Increase efforts by the Central/Provincial/Local Government
4	Increase efforts by the private sector
5	Other.

6.1.2 Three-part model

The three-part model is given in Figures 6.1, 6.2 and 6.3.

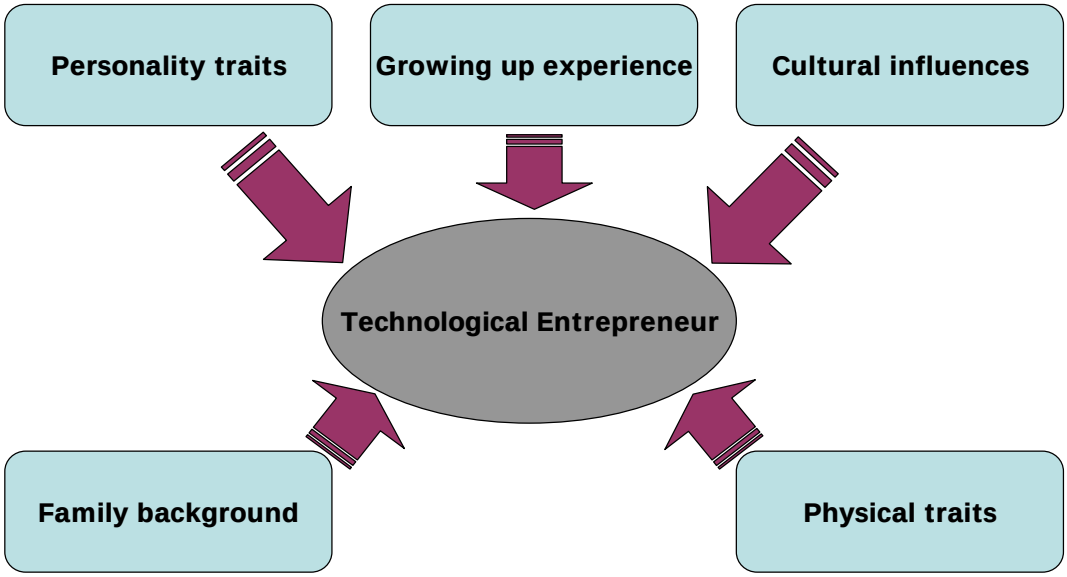


Figure 6.1 Model of the technological entrepreneur part 1

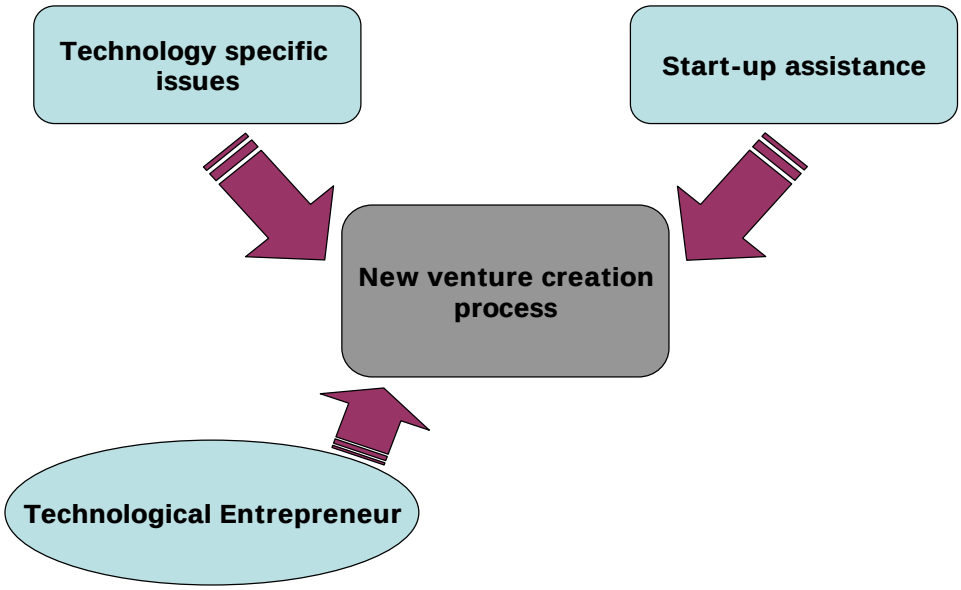


Figure 6.2 Model of the new venture creation process part 2

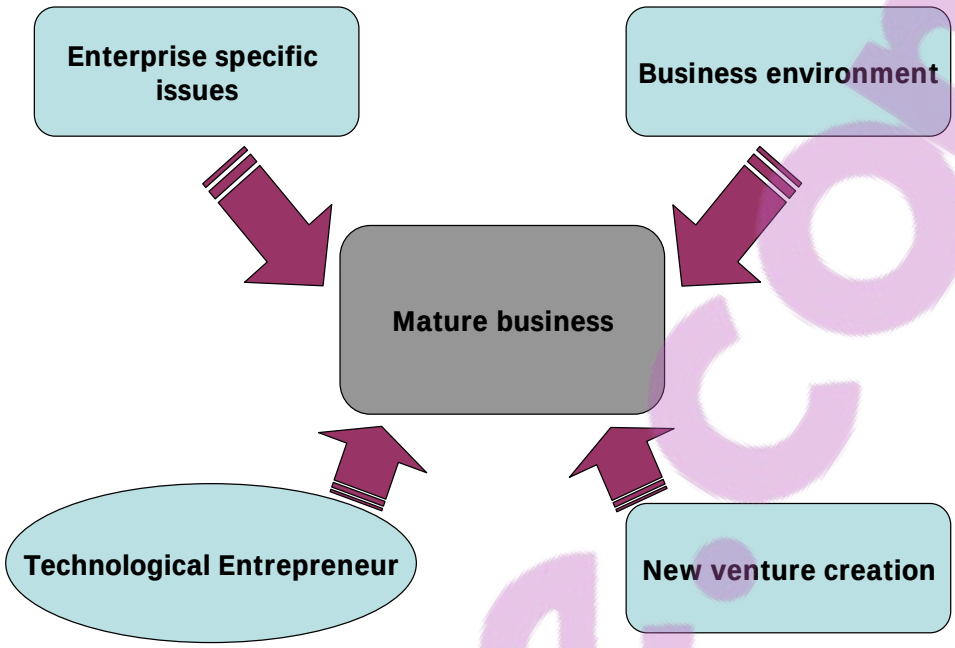


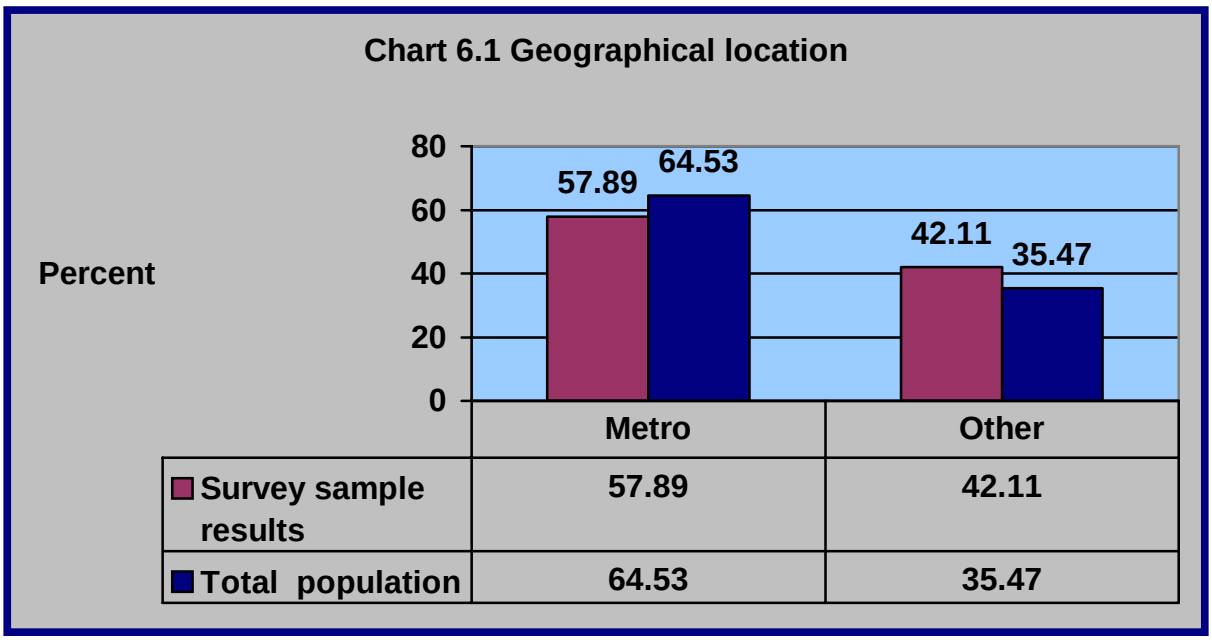
Figure 6.3 Model of the mature business part 3

6.1.3 Survey sample representation

The profile of the final results received from the survey sample entrepreneurs (n=210) in KwaZulu-Natal were compared with the total population group in the following three areas:

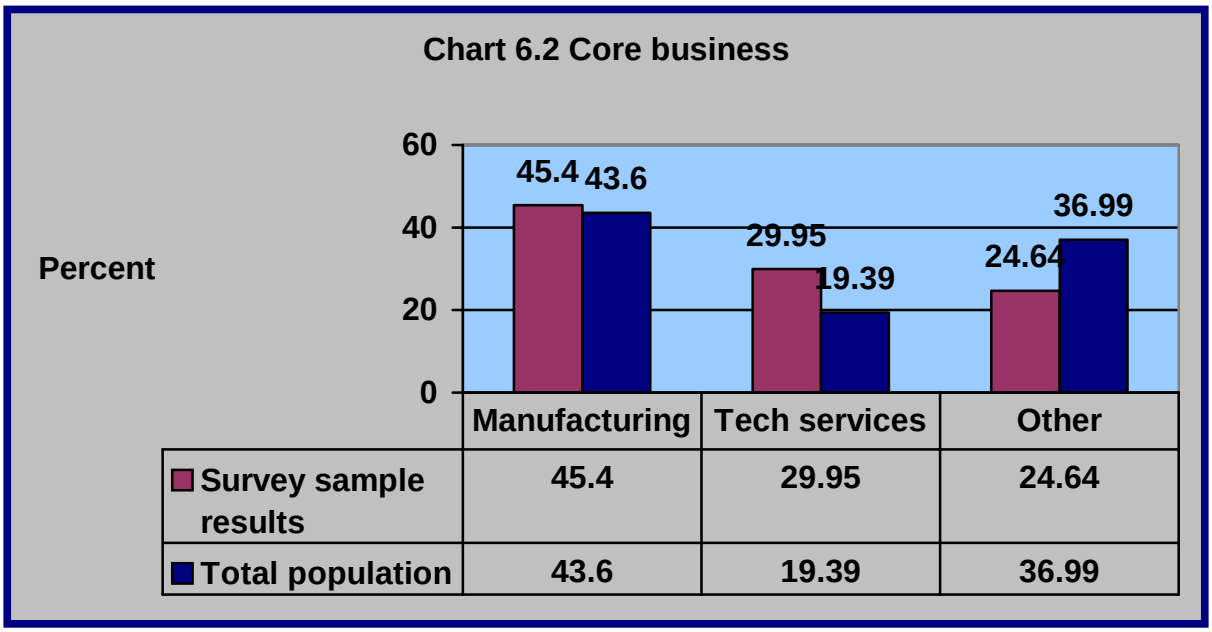
- Geographical location;
- Core business;
- Self-employed race profile.

The comparative figures are given in Charts 6.1, 6.2 and 6.3.



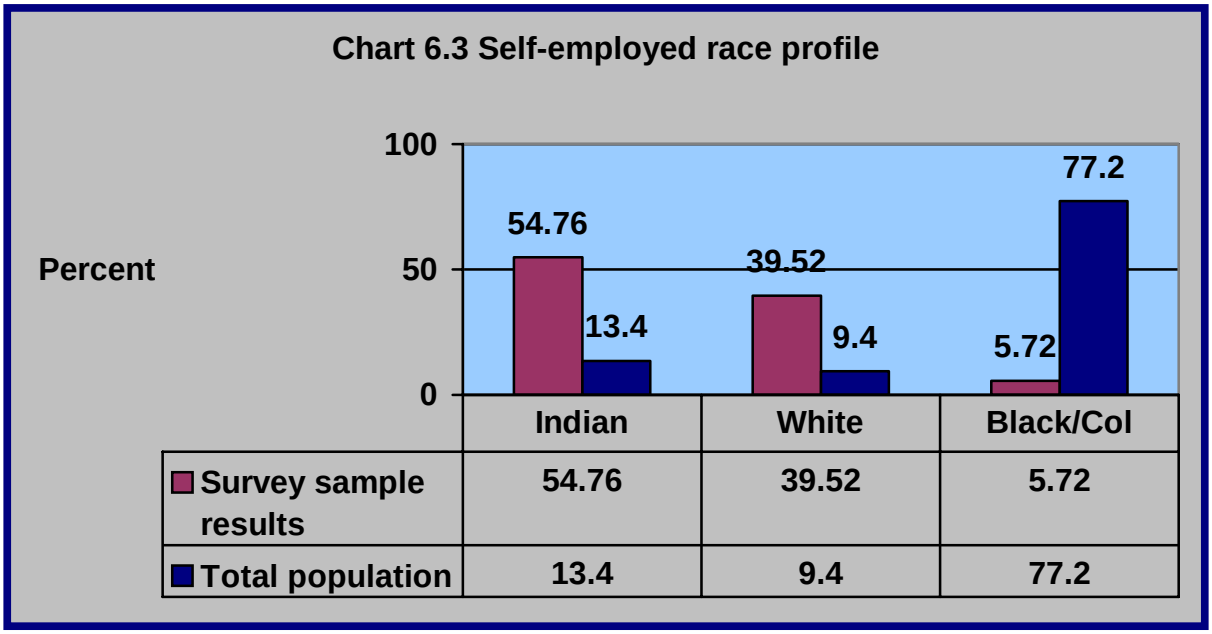
Source: Braby's data base (2004).

It is evident from the geographical comparison that the final survey sample profile is closely related to that of the total technological company population profile and that the results obtained can be considered to be representative in this regard.



Source: Braby's data base (2004).

The same comment is applicable to the core business profile of the survey sample: It is closely related to that of the total study population and can therefore be regarded as representative.



Source: GEM (2004).

The race profile comparison above shows vast differences in the racial composition, primarily due to the fact that the total population group figures obtained from the GEM report of 2004 are those that are self-employed in all sectors of the national economy. These sectors include *commercial* and the *informal sectors*, which show that 77% of the Black population is actively involved as self-employed participants of the economy. The survey sample ratios indicate domination by Indian and White entrepreneurs and these ratios include entrepreneurs in the *technological* and *formal* sectors only, and exclude the commercial and informal sectors. The total population figures listed represent South Africa as a whole, while the survey sample represents only one of the nine provinces of South Africa. The survey sample result ratios show that Black and Coloured participants are not well-represented as technological entrepreneurs in KwaZulu-Natal.

6.1.4 Evaluation of Proposition1: Three-part model for technological entrepreneurship domain

Proposition 1, as discussed in previous Chapters, is repeated as follows:

The technological entrepreneurship domain in emerging economic regions can be presented by a three part model consisting of three primary entities which are each inter-correlated with each other, as well as environmental influences. The three primary entities are:

- *The entrepreneur (person);*
- *The new venture creation process; and*
- *The mature business.*

6.1.4.1 The entrepreneur model part one

The following results were obtained from the model building regression analysis of the research data for the *entrepreneur:*

- Eight (8) dependent variables of the technological entrepreneur were originally selected;
- Eighteen (18) independent variables were originally identified and inserted in the regression model building analysis;
- Sixteen (16) of these identified independent variables showed a correlation with seven (7) of the eight dependent variables in various combinations;
- Ten (10) of the sixteen independent variables that correlated, showed significant correlation (a probability index of less than 5%) with the seven dependent variables.

6.1.4.2 New venture creation process model part two

The following results were obtained from the model building regression analysis of the research data for the *new venture creation process:*

- Nine (9) dependent variables of the new venture creation process were originally selected;

- Thirty-four (34) independent variables were originally identified and inserted in the regression model building analysis;
- Thirty-two (32) of these identified independent variables showed a correlation with the nine dependent variables in various combinations;
- Seventeen (17) of the thirty-two independent variables that correlated, showed significant correlation (a probability index of less than 5%) with the nine dependent variables.

6.1.4.3 Mature business model part three

The following results were obtained from the model building regression analysis of the research data for the *mature business:*

- Seven (7) dependent variables of the mature business were selected;
- Thirty-eight (38) independent variables were originally identified and inserted in the regression model building analysis;
- Thirty-three (33) of these identified independent variables showed a correlation with the seven dependent variables in various combinations;
- Thirteen (13) of the thirty-three independent variables that correlated, showed significant correlation (a probability index of less than 5%) with the seven dependent variables.

A summary of the correlation results for the three-part model is given in Table 6.10.

Table 6.10: Summary of correlation results of three-part model

ITEM	DESCRIPTION	ORIGINAL	FINAL RESULTS
1	**Entrepreneur model part one**		
1.1	Dependent variables	8	7
1.2	Independent variables	18	16
1.3	Total correlations	-	16
1.4	Strong correlations	-	10
2	**New venture creation model part two**		
2.1	Dependent variables	9	9
2.2	Independent variables	34	32
2.3	Total correlations	-	32
2.4	Strong correlations	-	17
3	**Mature enterprise model part three**		
3.1	Dependent variables	7	7
3.2	Independent variables	38	33
3.3	Total correlations	-	33
3.4	Strong correlations	-	13

6.1.4.3 Evaluation

- The three-part model that resulted from the regression analysis process consists of the three primary entities i.e. entrepreneur, new venture creation process and mature business;
- These three entities are sufficiently inter-correlated with each other and the environment to form a three-part model;
- *Sufficient evidence was found in support of Proposition 1.*

6.1.5 Evaluation of Proposition 2: Technological entrepreneurship profile comparison

Proposition 2, as discussed in previous Chapters, is repeated as follows:

The profile of technological entrepreneurs in emerging regions is different to that of their counterparts in developed regions, but also has distinct similarities.

6.1.5.1 Profile comparison

The profile of the survey sample of technological entrepreneurs in this research project is given earlier in this Chapter. If it is assumed for comparison purposes that the profile of the survey sample technological entrepreneurs in this research project is representative of those in developing regions and the profile of the survey sample technological entrepreneurs in the USA as researched by Roberts is representative of developed regions, Proposition 2 can be evaluated. The results indicated in Table 6.11 compare with those of Roberts (1991:45-99):

Table 6.11: Comparison between this research results and that of Roberts (1991)

ITEM	CATEGORY	ROBERTS	THIS RESEARCH
1	Gender	Not available	Male (90%)
2	Mean age	Not available	46.5 years
3	Mean age when started first business	37 years	32.2 years

4	Language	English	English (86.1%)
5	Religion	Christian (75%) Jewish (20%)	Christian (45.4%) Hindu (43%)
6	Race	Not available	Indian (54.8%) White (39.5%)
7	Position in family	Eldest son (55%)	Eldest or second eldest child (53.3%)
8	Employment status of parents	Father self-employed (51%)	Father or mother self-employed (34.8%)
9	Family income level at age of 18 years	Not available	Less than R5000/annum (77.5%)
10	Qualifications	High School (1%) College without a degree (9%) University B-degree (30%) University M-degree (29%) PhD degree (31%) University degree (90%)	School grades 1-12 (36.7%) Technical certificate or diploma (47.1%) University degree (16.2%)
11	Primary field of training	Engineering	Technical (53.4%)
12	Formal training in entrepreneurship	Not available	None (59.5%)
13	Previous work experience	Technical (16.1years mean)	Technical (10.5 years mean)
14	Size of previous firm	Not available	6 to 50 employees (45.3%)
15	Primary motivating factors to start own business	Independence (38.9%) Challenge (30.6%) Money (12.5%) Other (18.1%)	Independence (38.5%) Challenge (24%) Money (22.6%) Non-employment (12.5%) Other (2.4%)
16	Role model	Not available	None (60%)
17	Risk profile	“Inventor” personality	Risk-manager (44.4%) Risk-taker (44%)
18	Strongest entrepreneurial characteristic	Need for power (97%)	Dedication (90.5%)
19	Weakest entrepreneurial characteristic	Need for affiliation (35%)	Tolerance of risk (54.9%)
20	Mean age when first introduced to entrepreneurship	Not available	24.8 years
21	Rating of cultural attitude towards entrepreneurship	Not available	Neutral (44.5%)
22	Period between idea and start-up	Mean of 9 years	Mean of 3.3 years
23	Number of founders	Mean of 2	Mean of 1.56

The various quantitative variables of the two studies are shown in Charts 6.4, 6.5 and 6.6.

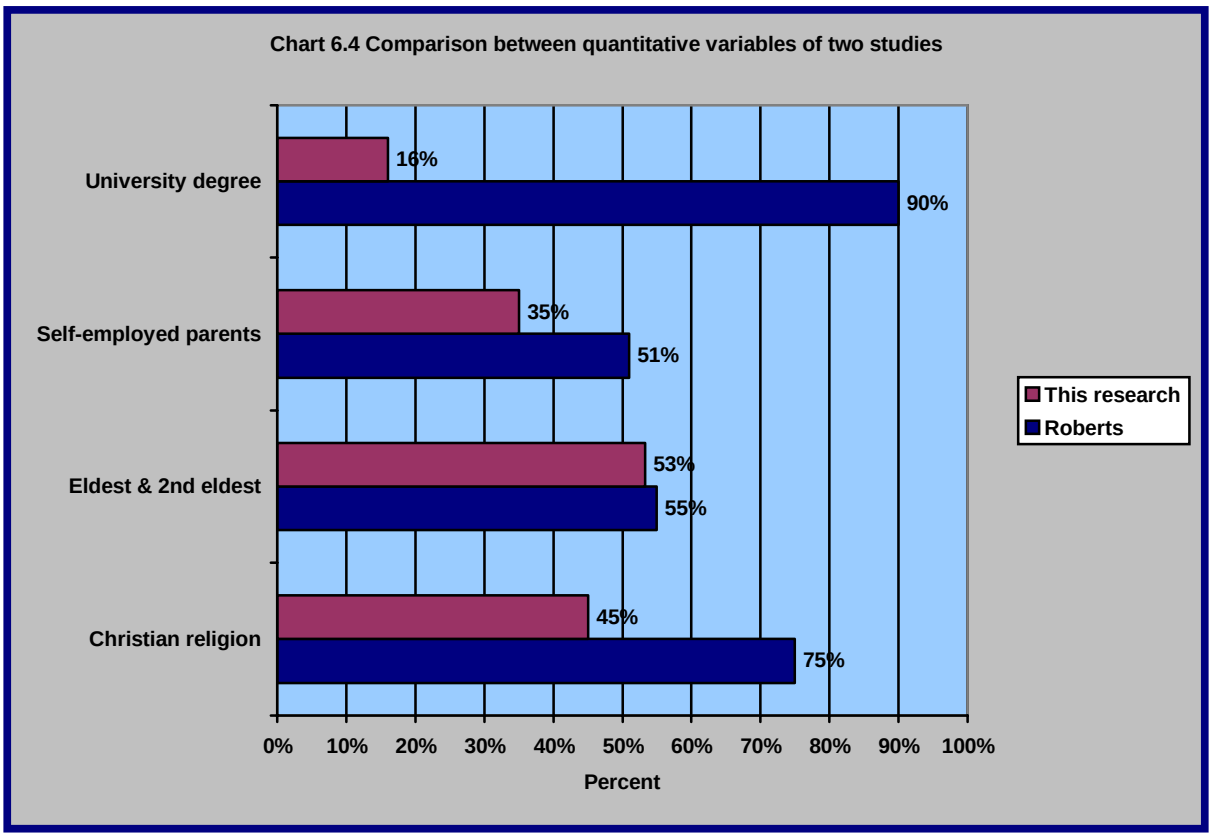


Chart 6.4 Comparison between quantitative variables of two studies
University degree
16%
90%
Self-employed parents
35%
51%
Eldest & 2nd eldest
53%
55%
Christian religion
45%
75%
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent
This research
Roberts

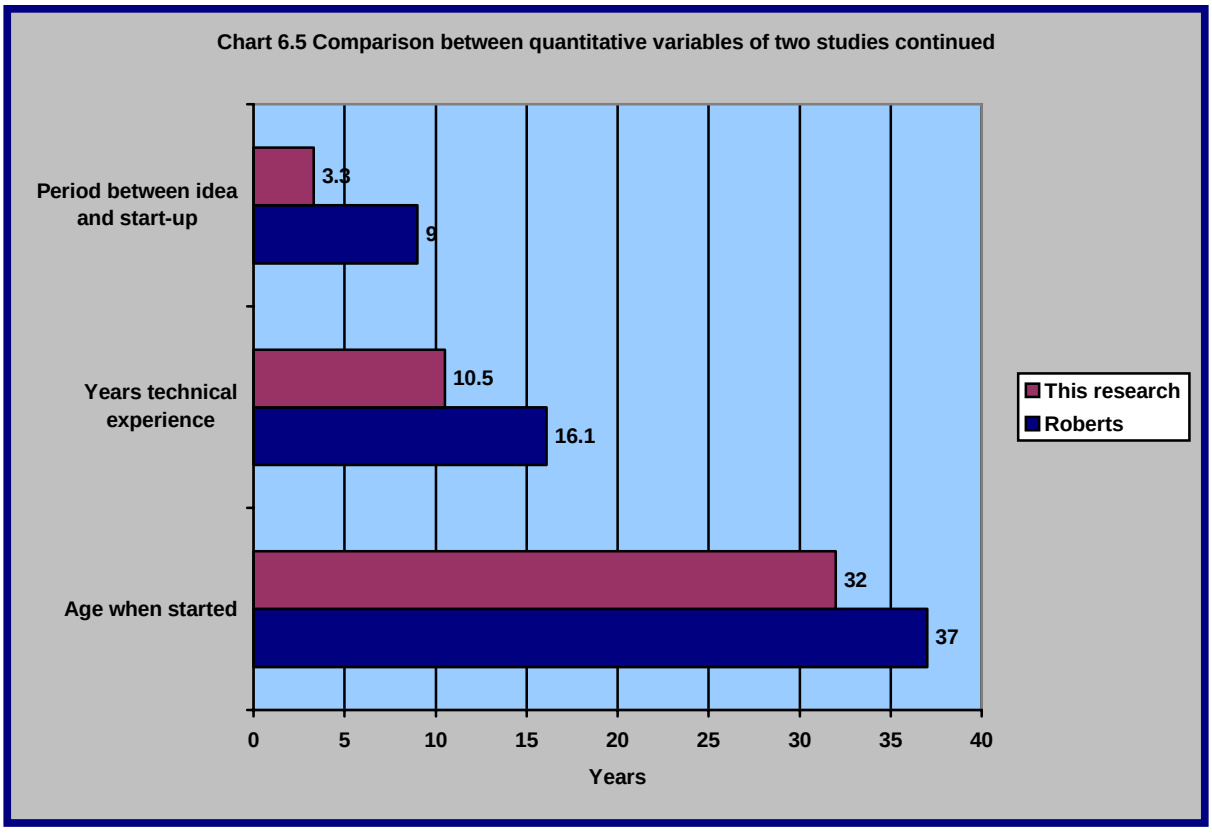
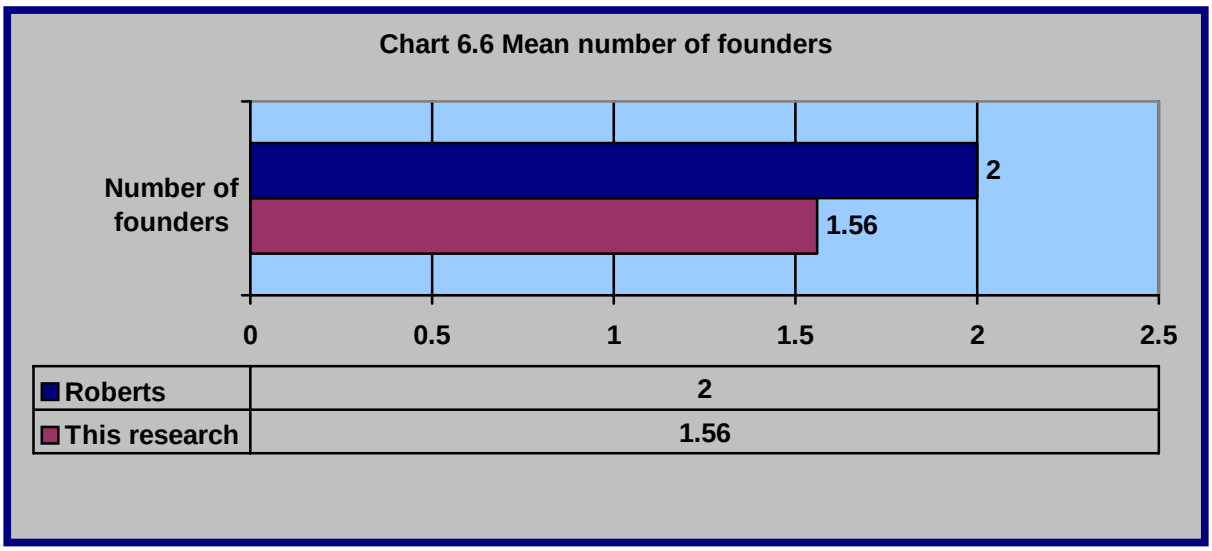


Chart 6.5 Comparison between quantitative variables of two studies continued
Period between idea and start-up
3.3
9
Years technical experience
10.5
16.1
Age when started
32
37
0
5
10
15
20
25
30
35
40
Years
This research
Roberts



6.1.5.2 Differences in profiles

The following differences are prominent:

- Technological entrepreneurs in the survey sample from developing regions were generally younger than their counterparts in the sample from developed regions, when starting their first business;
- A significantly smaller portion of technological entrepreneurs in the survey sample from developing regions had fathers who were self-employed in comparison to technological entrepreneurs in the sample from developed regions;
- The majority of technological entrepreneurs in the sample from developing regions had either only a high school qualification or a technical certificate or diploma while the largest portion by far of technological entrepreneurs in the sample from developed regions had a University degree;
- Technological entrepreneurs in the sample from developing regions had significantly shorter working experience in the technical field than the experience of their counterparts in the sample from developed regions;
- Technological entrepreneurs in the sample from developing regions rated money (financial reasons) as a motivating factor to start their new business higher than technological entrepreneurs in the sample from developed regions;

- The period between the idea and the actual start-up of technological entrepreneurs in the sample from developing regions was significantly shorter than that of their counterparts in the sample from developed regions.

6.1.5.3 Similarities in profiles

The following similarities are prominent:

- Technological entrepreneurs from both regions' survey samples were either the eldest or second eldest child in their family;
- Technological entrepreneurs from both regions' survey samples rated their motivating factors to start their own businesses in the same order i.e. independence, challenge and money (from most important to least important);
- New technology-based businesses from both regions' survey samples had more than one founder.

6.1.5.4 Evaluation

- It is evident from the comparison above that the profile of the technological entrepreneur in developing or emerging regions, as represented by this research sample profile, is different to that of the technological entrepreneur in developed regions as represented by the sample profile of Roberts (1991).
- It is also evident that the two profiles have several distinct similarities.
- *Sufficient evidence was found in support of Proposition 2.*

6.1.6 Evaluation of Proposition 3: Formal entrepreneurship training

Proposition 3**,** as discussed in previous Chapters, is repeated as follows:

The extent of formal entrepreneurship training in primary, secondary and tertiary educational programs in South Africa is inadequate in relation to its importance in the development process of technological entrepreneurs.

6.1.6.1 Results from main questionnaire to entrepreneurs

The following results were obtained from the main questionnaire to technological entrepreneurs:

- Nearly sixty percent (59.5%) of practicing entrepreneurs in the survey sample of respondents indicated that they have never received formal training in entrepreneurship before;
- Insufficient entrepreneurship training was ranked second highest on the list of ten possible causes for technological business failures by respondents in the survey sample;
- Improvement of entrepreneurship training and skills development was ranked highest on the list of five possible measures to increase technological entrepreneurship in emerging regions by respondents in the survey sample;
- Entrepreneurs with lower qualifications (school) received more formal training in entrepreneurship than those with higher qualifications (Technical or University degree);
- English-speaking entrepreneurs received more formal training in entrepreneurship than those speaking other languages such as Zulu, Xhosa or Afrikaans;
- Entrepreneurs who listed insufficient entrepreneurship training as a cause for new technological business failures had less previous business failures than those who listed other causes;
- Entrepreneurs who received entrepreneurship training received more direct assistance from their previous employer while those who received no entrepreneurship training received less direct assistance.

The results mentioned above are a direct indication of the negative influence that insufficient or a *lack of entrepreneurship training* has on the development of technological entrepreneurship. The following correlations are indicative of possible *incorrect entrepreneurship training* on the development of technological entrepreneurship:

- Those entrepreneurs with little or no formal training in entrepreneurship had more role models than entrepreneurs with formal entrepreneurship training;
- Mature businesses that were started by founders who had entrepreneurship training had smaller annual turn over than those that were started by un-trained entrepreneurs.

6.1.6.2 Results from questionnaire to MEM / MPM / MOT students

The following results were obtained from questionnaires to MEM / MPM / MOT students:

- Younger students had more entrepreneurship training (all) and older students less entrepreneurship training (all) prior to their present studies;
- Younger students had more entrepreneurship training specifically at tertiary institutions and older students less entrepreneurship training specifically at tertiary institutions;
- The vast majority of student (99.4%) did not receive any formal entrepreneurship training in primary schools (Grades 1 to 7);
- The vast majority of students (93.2%) did not receive any formal entrepreneurship training in secondary schools (Grades 8 to 12);
- The majority of students (56%) received formal training in entrepreneurship at tertiary institutions (Universities or Technikons);
- The majority of students (79.6%) rated the formal entrepreneurship training they received prior to their present course as ‘poor or inadequate’.

6.1.6.3 Evaluation

- It is evident from the results of the two independent studies above that the extent of formal entrepreneurship training in primary, secondary and tertiary educational programs in South Africa is inadequate in relation to its importance in the development process of technological entrepreneurs.
- *Sufficient evidence was found in support of Proposition 3.*

6.1.7 Inference of new hypotheses

Several new hypotheses were derived from the research which has strong statistical evidence to validate them. A summary of those with low probabilities (P < 0.0001) is given in Table 6.12.

Table 6.12: Summary of new hypotheses with significant statistical evidence	
1	Entrepreneurs who were introduced to entrepreneurship at a younger age tend to start their business earlier than those who were introduced later. *Probability < 0.0001*
2	Younger entrepreneurs tend to start their new businesses earlier than their older counterparts. *Probability < 0.0001*
3	Younger entrepreneurs tend to be introduced to entrepreneurship earlier than older entrepreneurs. *Probability < 0.0001*
4	Entrepreneurs whose parents were self-employed tend to be introduced to entrepreneurship at a younger age than their counterparts whose parents were not self-employed. *Probability < 0.0001*
5	Mature enterprises with a high technological component tend to report higher levels of technological innovation in their businesses than those with an average or lower technological component. *Probability < 0.0001*
6	Businesses that employ more people tend to create more jobs than those employing fewer people. *Probability < 0.0001*
7	Younger students reported more entrepreneurship training (all levels) and older students less entrepreneurship training (all levels). *Probability < 0.0001*
8	Younger students reported more entrepreneurship training at tertiary institutions and older students less entrepreneurship training at tertiary institutions. *Probability < 0.0001*

6.1.8 Validation of model

The degree of model fit was tested by measuring the adjusted R-square values for linear regression fitting and maximum rescaled R-square values for logistic regression fitting. An R-square value of 0 indicates that there is no model fit of the defined variables, while a 1.0 value indicates a perfect model fit. These values are given in Table 6.13.

Table 6.13: Adjusted R-square and maximum rescaled R-square values

ITEM	INDIVIDUAL MODELS (DEPENDENT VARIABLE Y)	SURVEY SAMPLE FREQUENCY	ADJUSTED R-SQUARE	MAXIMUM RESCALED R-SQUARE
1	**Linear regression**			
1.1	Period between idea and start-up	183	0.1107	-
1.2	Technology transfer	188	0.1782	-
1.3	Age when started first new business	192	0.4549	-
1.4	Age introduced to entrepreneurship	201	0.2142	-
1.5	Risk profile	200	0.0595	-
1.6	Entrepreneurial characteristics	206	0.0157	-
1.7	Technological innovation	193	0.2412	-
1.8	Annual turnover	175	0.1310	-
1.9	Technological component	17	0.8751	-
1.10	Number of jobs created	178	0.1981	-
2	**Logistic regression**			
2.1	Role model	204	-	0.1441
2.2	External private financing	106	-	0.2161
2.3	External commercial financing	100	-	0.1418
2.4	Business incubator assistance during start-up	45	-	0.5729
2.5	Founder financing	115	-	0.1722
2.6	Previous employer assistance during start-up	44	-	0.1748
2.7	Private sector assistance during start-up	41	-	0.4538
2.8	Business failures reported	170	-	0.1852
2.9	Government contracts at present	190	-	0.1261
2.10	Formal training in entrepreneurship	206	-	0.0733
2.11	Motivating factors	200	-	0.0721
2.12	IP protection	166	-	0.0488
2.13	R&D department	164	-	0.0150

The twenty three dependent variables which constitute the three parts of the derived model (seven for technological entrepreneur, nine for venture creation and seven for mature business) indicate a relative good model fit for a population of this diverse and non-homogeneous nature. Seventeen of the twenty three R-square values are higher than 0.1 with the highest values being 0.8751 (n=17) and 0.5729 (n=45). The highest R-square values are reported for the smallest survey sample frequencies as expected.

6.2 CONTRIBUTIONS TO THEORY AND PRACTICE

6.2.1 Summary review of existing theory

The existing theory on technological entrepreneurship in emerging regions as detailed in Chapter 2 is repeated as follows:

6.2.1.1 Primary theories

The main body of existing theory can be summarised in the following four primary categories:

- The generic entrepreneurship theory, as proposed by Bolton et al (2000) in their work 'Entrepreneurship: Talent, Temperament, Technique';
- The profile of technological entrepreneurs in developed regions, as proposed by Roberts (1991) in his book 'Entrepreneurs in High Technology: Lessons from MIT and Beyond';
- The development of technological entrepreneurship, as proposed by Roberts (1991) in the same book as above;
- The environments for entrepreneurial development, as proposed by Gnyawali et al (1994).

6.2.1.2 Secondary theories

The following is a summary of the most significant secondary or supplementary theories:

- Knowledge of technology, with emphasis on:
  Technological base;
  Technological innovation;
  Technology and economical growth;
  Technology transfer;
  Commercialisation of technology.
- Knowledge of entrepreneurs and economic growth, with emphasis on:
  Small, medium and micro enterprises;
  Intrapreneurship;
  Roles of government policies, private sector initiatives and education and training.
- Knowledge of technology in emerging regions, with emphasis on:
  The role of science and technology;
  Technological colonies.
- Knowledge of entrepreneurship in emerging regions, with emphasis on:

The experience of several countries classified as emerging, such as the former East Germany, Nigeria, South Africa, Taiwan, and China etc.

6.2.2 Summary review of theory gap

The theory gaps as identified in Chapter 2 are repeated as follows:

6.2.2.1 Theory gap in entrepreneurship education

- *Little is known about the efficiency of entrepreneurship training and education in emerging regions, especially in the technological disciplines.*

6.2.2.2 Theory gap in technological entrepreneurship in emerging regions

- *There is not a representative model for the technological entrepreneurship domain in emerging regions which consists of specific entities and their inter-relationships;*
- *Little is known about the profile of the technological entrepreneur in emerging regions, with specific references to the family background, personality traits, educational profile and work experience and how it compares with profiles in developed regions.*

6.2.3 Contribution to new theory

The results of this research project contribute the following new theory to the exiting body of knowledge:

6.2.3.1 It proposes a new three-part model of the technological entrepreneurship domain in emerging regions comprising the three primary entities which are sufficiently inter-correlated with each other and the environment;

6.2.3.2 It proposes a number of dependent variables in this three-part model, identifies several independent variables that influence them and determines the relationships between them;

6.2.3.3 It identifies the typical profile of the technological entrepreneur in an emerging region and compares it with the typical profile of the technological entrepreneur in a developed region;

6.2.3.4 It supports previous research findings on the critical role that training in entrepreneurship plays in the development of entrepreneurs in general;

6.2.3.5 It identifies the lack of entrepreneurship training in the formal educational system of South Africa, in particular the lack of such training in tertiary technological educational programs in South Africa.

6.2.3.6 It derives several new hypotheses with strong statistical evidence which contributes to the present understanding of technological entrepreneurship in emerging societies.

6.3 SELF ASSESSMENT

6.3.1 Critical evaluation

The following items can be classified as having an influence on the research project and ultimately its findings:

- The fact that only one province was selected as sample frame versus the total country or ultimately several emerging countries or regions. The selection of one typical province was necessary due to the practical and resource limitations of the project;
- The Braby's commercial database could be seen as non-representative of all the technological businesses in the province of KwaZulu-Natal. The database is made up of all businesses registered in Southern Africa that either has a listing in the applicable country's official telephone directory, or is registered with an official Business Chamber, or with the National Registrar of Companies. These sources covers the vast majority of the formal businesses in this region;
- The size of the final survey sample (210) could be seen as too small to make accurate conclusions from and regard them as representative of the total study

population. Again, the practical and resource constraints are the limiting factors in this regard;

- Possible manipulation of the survey sample by the research assistants. This aspect was controlled by each assistant registering the companies that submitted a completed questionnaire, which could be used to check the integrity of the data gathering process. Although the human factor is always a risk during research activities such as this, it is believed that the control measures have limited them significantly.

6.3.2 Impact on findings

The impact of all the abovementioned critical evaluation items is not significant, for the following reasons:

- The study is limited to a specific regional or provincial study, which does not necessarily implicate the larger population groups such as the total South Africa, other developing countries or these countries or regions as a group. The studies done on other survey samples such as the MIT spin-off companies of Roberts (1991) also have the same limitation. Analogies from this three-part model and the research results can be drawn with other similar regions, when the specific differences between them are kept in mind.
- The important findings of the research such as the lack or poor quality of entrepreneurship training, poor perceptions by the practicing entrepreneur of the government's (all levels) efforts to assist small enterprises and poor representation of black technological entrepreneurs are extremely strong messages which would not be affected significantly by the possible limitations listed above.

6.4 CONCLUSIONS

The most significant conclusions are summarised as follows:

6.4.1 Cultural heritage of the technological entrepreneur

- The study revealed that *environmental heritage, both in terms of growing-up experiences and cultural aspects, does have an influence on the entrepreneurial behaviour of technological entrepreneurs in emerging societies.* This finding is true insofar as the environmental influences on the development of the entrepreneur are concerned. These influences include 1) home language, 2) religion, 3) age when first introduced to entrepreneurship, 4) attitude of society towards entrepreneurship, 5) self-employed status of parents and 6) family income at the age of 18 years.
- *No evidence was found that genetic inheritance such as race and gender has any direct influence on entrepreneurial behaviour.* Where race featured in certain relationships, they are all environmentally related cases where the dependent variables are dictated by cultural or societal views. Examples are where race is a factor in the award of government contracts or influences the nature of funding sources during start-up. In these cases race should be classified as an environmental heritage rather than a genetic heritage. The Black technological entrepreneurs in the survey sample constitute a small minority (5.7%). This is somewhat surprising, especially when compared to the findings of the South African Global Entrepreneurship Monitor survey (GEM 2004) that Black entrepreneurs make up a large portion (77.2%) of the total population of all entrepreneurs. This discrepancy can be attributed to the fact that the GEM statistics indicate total self-employment per race group, which includes all types of business categories such as street vendors in the informal sector of the economy. The sample frame consists of technological entrepreneurs in the formal sector only. The logical conclusion drawn from this is that Black entrepreneurs in the study province are mostly involved in other than technology types of enterprises.
- The study supports the views of Roberts (1991), Drucker (2001) and Timmons (1994) that, while certain entrepreneurial personality traits are associated with successful entrepreneurs, *environmental influences such as cultural and growing-up heritage contribute significantly to the 'making' of technological entrepreneurs.* It also supports the view of Wickham (2004) that the process of entrepreneurship is fundamentally universal for all communities and that multi-cultural and economically emerging society only influence the 'surface veneer'.

6.4.2 First-born issue

- The results clearly indicate that there is no dominant order in the position as a child in the family. Roughly one quarter of the respondents each was the first-, second- or third-born child in their families. No significant relationship between the position as a child in the family (predictor) and any dependent variable could be found.
- It supports the findings of Roberts (1991) that first-born children are not more likely than their siblings to become high-technology entrepreneurs;
- It does not support the findings of Henning et al (1977) and Brockhaus et al (1986) that entrepreneurs tend to be the oldest child in the family.

6.4.3 Self-employed status of parents

- One third of the respondents come from families where either the mother or father was self-employed. The influence of the parents' status on the entrepreneurial behaviour of respondents reflects strongly in the numerous relationships that emanated from the regression analyses.
- It supports the findings of Roberts (1991) that entrepreneurs are very likely to have self-employed fathers;
- It also supports the view of Hisrich et al (1984) that having self-employed parents provides a strong inspiration for the entrepreneur.

6.4.4 Financing the new technological venture

- The significant relationships that were identified during the model building regression analysis indicate the strong influences of environmental factors on the nature of start-up financing of technology-based ventures. The factors with strong relationships are inter alia 1) the extent of technical training, 2) religion, 3) extent of government contracts, 4) assistance during start-up, 5) race, 6)

technological component of products or services, 7) language, 8) age and 9) the family income of the young entrepreneur.

- The findings of the study support that of Roberts (1991) in that the majority of founders used their savings or own funds to finance their new technological venture and a small percentage utilizes venture capital funds;
- The findings are different to that of Roberts (1991) in that a large portion of the respondents utilized commercial banks while Roberts reported a zero percentage; and a large portion of the respondents utilized funds from family and friends while Roberts found it to be a lesser figure from this source.

6.4.5 Entrepreneurship training

- The majority of practicing entrepreneurs in technology-based businesses have not received any formal training in entrepreneurship, but regard this specific aspect as critical in the development of technological entrepreneurship;
- Formal entrepreneurship training and education in the primary and secondary schooling system in South Africa was virtually non-existent at the time that the respondents were at school;
- Training in entrepreneurship is primarily given at tertiary institutions (Universities) and only in recent years;
- The formal entrepreneurship training that was in fact received (primarily in tertiary institutions) is regarded as poor or totally inadequate;
- There is a significant correlation between age and entrepreneurship training, where younger students reported more training and older students less training, indicating that entrepreneurship training has only emerged in recent years;
- No correlation was found between any other demographic variable, educational institution or entrepreneurial history and entrepreneurship training. In the light of the multi-racial and multi-cultural composition of the South African population, this finding is significant as it shows that the influences of the country's past education policies (such as racial

segregation), no longer has any major influence on entrepreneurship education and training.

6.4.6 Contribution to existing body of knowledge

The three-part model derived from this research provides insight into the development of the technological entrepreneur in a multi-cultural and emerging environment. It also proposes a structure whereby the technology and enterprise specific factors that affect the new venture creation process and development to a mature business thereafter, can be arranged. It specifically provides supplementary knowledge to the following existing models:

- It verifies the model of Roberts (1991) for the development of the technological entrepreneur in a multi-cultural and emerging economy in terms of the personality traits, growing up experience and family background;
- It supplements the model of Roberts (1991) for the development of the technological entrepreneur with the addition of the cultural component;
- It supplements the model of Gnyawali et al (1994) with the influence of start-up assistance during the new venture creation process;
- It verifies the model of Schubert in Klandt *et al* (1993) in terms of the strong influence that training and education in entrepreneurship has on the entrepreneur's development and success.

6.5 RECOMMENDATIONS

6.5.1 Policy implications

Several prominent aspects have emerged from the research results from which decision makers in South Africa and other emerging regions can benefit during future policy and strategy formulations. They are:

- The importance is highlighted of cultural influences such as race group, language, religion and *society's view of entrepreneurship* on the development process of the technological entrepreneur and his/her success in the new

venture creation process, as well as the further growth to a mature business. These influences are supported by the strong and numerous correlations found during the model building process, as well as the suggestion to improve society's view towards entrepreneurship which was ranked second by respondents as a measure to improve technological entrepreneurship;

- There is a *perceived lack of government assistance (central/provincial/local)* during the start-up and further growth phases of the technological enterprises in terms of insufficient tax incentives, initiatives, development programs and the availability of venture capital. This view is supported by the fact that insufficient government assistance was ranked second as a cause of lack of technological innovation, first as a cause for technological business failures and the improvement of efforts by the central/provincial/local government ranked third as a measure to improve technological entrepreneurship. Insufficient access to and availability of venture capital was ranked third as a cause for technological business failures;
- There is a *perceived failure of the government's black empowerment policies and efforts to assist new technological enterprise formation.* This view was presented by respondents despite the fact that the mean age of their businesses is 11.9 years, which means that the majority were founded around the time when the present government came into power in 1994. The view is further supported by the fact that 50% of the respondent enterprises are wholly owned by individuals classified as Black, Indian or Coloured, and 11% are co-owned by Black, Indian or Coloured individuals. More than 85% of respondents reported less than 20% government contracts either during start-up or at present. In addition, the poor representation of Black (other than White or Indian) founders (5.7%) of new technological enterprises does not reflect the racial composition of the sample society's self-employed profile for all types of enterprises (77.2%);
- The importance is highlighted of the *lack of training in entrepreneurship* and the negative effect that it has had on the development of technological entrepreneurs and their later successes. The fact that nearly 60% of respondents reported no formal training in entrepreneurship, plus the ranking of insufficient entrepreneurship training as second cause for technological

business failures, and the improvement of training in entrepreneurship as first measure to improve technological entrepreneurship support this notion;

- A small percentage of technological entrepreneurs utilize *venture capital organizations* to finance seed, start-up or early-stage requirements. Respondents in the research survey sample also listed 'poor availability of and access to venture capital' as the third highest ranked reason for technological business failures. These sentiments are confirmed by the South African Global Entrepreneurship Monitor report (GEM 2004);
- Note should be taken of the *predictors that strongly influence funding sources and trends* of technology-based new ventures. Factors such as government contracts at start-up, extent of technical training and assistance during start-up are all factors that policy makers can direct, which will in turn improve the financing environment for new technology-based ventures.

6.5.2 Future research areas

The following future research areas have been identified:

6.5.2.1 Expansion of the model

The model can be expanded through further research to include three additional elements that are crucial to the entrepreneurial process in the technological domain. These three elements are:

- *Available opportunities;*
- *Degree of Technological Innovation;* and
- *Venture Capital.*

6.5.2.2 Opportunities

Specific issues to be researched are:

- Availability of opportunities in South Africa for the technological entrepreneur;
- Ability of South African technological entrepreneurs to spot and explore opportunities.

6.5.2.3 Technological innovation

Specific issues to be researched are:

- Creative abilities of technological entrepreneurs and development of creative thinking patterns;
- Technological entrepreneurs' knowledge of the discipline of innovation and the process of innovation.

6.5.2.4 Sources of funding

Specific issues to be researched are:

- Reasons for the perceived "poor availability of venture capital" to the technological entrepreneur;
- Reasons for the perceived "poor access to venture capital" by technological entrepreneurs;
- Reasons for the poor utilization of venture capital funding;
- The sources of and financing methods of seed and venture capital.

6.5.2.5 Cultural heritage

Specific issues to be researched are:

- The embedded views of various cultural groups on the concept and practices of entrepreneurship, specifically in the technological domain;
- The embedded views of various religions on the concept of entrepreneurship, specifically in the technological domain.

6.5.2.6 Other

Other issue to be researched are:

- The degree of IP protection and extent of R & D department functioning in new venture creation and mature businesses in multi-cultural emerging societies.
- To what extent do present day educational curricula (primary, secondary and tertiary institutions) in South Africa include any form of entrepreneurship training programmes or courses.

6.6 SUMMARY

The final Chapter provides an overview of the research project by summarising the findings in tables, charts and figures. The propositions which were originally formulated were evaluated for validity and the contributions to the existing theory and body of knowledge were revisited. A critical self-evaluation is presented to assess any inherent deficiencies which the research methodology might have and possible effects on the research results.

A series of conclusions are drawn on key issue covered by the research domain such as:

- Cultural heritage of the technological entrepreneur;
- First-born issue;
- Self-employment status of the entrepreneurs' parents;
- Financing the new technological venture; and
- Entrepreneurship training.

In the final recommendations, several contemporary issues are highlighted from which decision makers in South Africa and other emerging regions can benefit during future policy and strategy formulations. The thesis concludes with a list of recommended future research areas.

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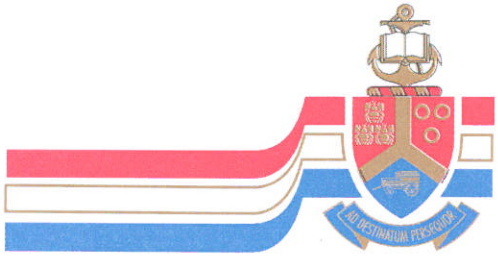
APPENDIX A

QUESTIONNAIRE TO TECHNOLOGICAL ENTREPRENEURS

Fax: (012) 362-5307
e-mail: tinus.pretorius@eng.up.ac.za



University of Pretoria
Faculty of Engineering, The Built Environment and Information Technology

Department of Engineering and Technology Management

3 November 2004

3 November 2004

Dear Respondent

RESEARCH PROJECT ON TECHNOLOGICAL ENTREPRENEURSHIP

I am currently conducting research on the ***development of technological entrepreneurship in emerging countries*** such as South Africa. This research forms part of my PhD studies at the Department of Engineering and Technology Management, Faculty of Engineering, Built Environment and Information Technology, University of Pretoria.

A significant part of the research project focuses on the following issues:

- Personal profile of the practicing ***technological entrepreneur*** (person);
- The ***new venture creation process*** of the technological enterprise;
- The ***further development*** of the new venture into a ***mature business***;
- The ***environmental influences*** on the entrepreneur, the venture creation and further growth processes.

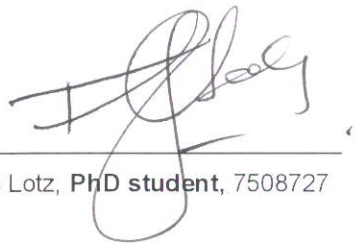
Despite the internationally acknowledged notion that new venture creation in the technological business domain is a cornerstone for growth and job creation in developing nations, the ***present body of knowledge on technological entrepreneurship in emerging countries is fairly limited.***

You have been identified as a ***practicing technological entrepreneur*** and your participation in the research project will contribute significantly to enhance the existing knowledge base. It should take approximately ***15 minutes to complete the questionnaire*** and any queries should be directed to the research assistant administrating the questionnaire.

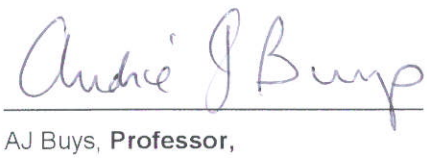
Your valued time and co-operation in completing the attached questionnaire is sincerely appreciated. The questionnaire is ***completed anonymously*** and the information will be treated ***confidentially*** in accordance with the ethical standards underwritten by the University of Pretoria.

A summary of the research findings could be e-mailed to you early in 2005. Kindly contact the student at his e-mail address plppret@mweb.co.za should you be interested.

Thank you,



Frans Lotz, **PhD student,** 7508727



AJ Buys, **Professor,**
Study Leader: Department of Engineering & Technology Management

UNIVERSITY OF PRETORIA : DEPARTMENT OF ENGINEERING AND TECHNOLOGY MANAGEMENT

QUESTIONAIRE A : ENTREPRENEURS

RESEARCH PROJECT ON TECHNOLOGICAL ENTREPRENEURS

INSTRUCTIONS TO COMPLETE THE QUESTIONAIRE

1. Please mark with an X in the block(s) where the numbers 1,2,3 etc. appear opposite your selected answer, or write your answer in the space provided.

2. Use a pen of any colour to mark the X in the appropriate block, or type an X next to the appropriate number when using an electronic copy of the questionnaire.

3. Do not write or mark any blocks in the column designated "For official use only".

4. Where a number is required in your answer, write the number in the space provided, or type the number in when using an electronic copy of the questionnaire. An example of this is the following:

   What is your present age?

   31 years

5. There can only be one answer (marked with an X) in any question with one set of chronological numbering 1,2,3 etc. An example of this is the following:

What is your core business?

1	2	3 X	4
Manufacturing	Mining	Construction	Other

6. There can be more than one answer (marked with an X) in any question with more than one set of chronological numbering 1,2,3 etc. An example of this is the following:

Rate your entrepreneurial abilities?

	Poor	Average	Good
Independence	1 X	2	3
Dedication	1	2 X	3
Leadership	1 X	2	3
Perseverance	1	2	3 X
Adaptability	1	2	3 X

7. Where more than one answer could be possible in your particular case, select the most appropriate one only or highest ranked one only. A specific instruction to mark one block only is given as part of the question. An example is the following:

Is your intellectual properly protected by (mark one block only):

1	2 X	3
SA patent	International patent	No patent at all

8. The following is an example of an incorrect answer:

What is your present religion?

1	2	3	4
Muslim X	Hindu	Christian	Other X

9. Where the question requires a rating to be allocated to several questions given, write the numbers 1 (highest ranking) to e.g. 10 (lowest ranking) in the blank space provided. An example of this is the following:

Rate the following measures to improve technological entrepreneurship by writing the numbers 1 (most important) to 5 (least important) into the blank spaces below:

Increase efforts to positively influence society's perception towards entrepreneurship in general	2
Improve the development of technological entrepreneurial skills during primary, secondary and tertiary education	1
Increase efforts by the private sector	4
Increase efforts by Central / Provincial / Local Governments	3
Other measures (list them in question 56)	5

DEFINITIONS

The following definitions should help to clarify terms used in the questionnaire:

1. **Innovation** - Systematic application of creative ideas to explore

market opportunities.

2. **Entrepreneur** - Is a person who habitually creates and innovates to build something of recognized value around perceived opportunities.

3. **Technology** - Is the utilization of technical knowledge (produced through science to create wealth) through techniques to perform some useful function.

4. **Technological entrepreneur** - Is a person who practices entrepreneurship in a technology based industry or enterprise.

5. **Intellectual property** - Is the business idea, technology or knowledge which is unique to the enterprise, process, service or entrepreneur.

6. **Foreign capital** - Is capital or financial resources obtained from any other source than the founders or owners.

7. **Venture capital** - Is capital or funds specifically ear marked for application in newly founded enterprises.

8. **Government** - Includes all central (national), provincial, local (municipalities and metros) government bodies, as well as government agencies and semi-government institutions such as Telkom, Eskom etc.

9. **Emerging countries** - Is a term used to describe the so-called developing or third world countries

UNIVERSITY OF PRETORIA : DEPARTMENT OF ENGINEERING AND TECHNOLOGY MANAGEMENT

QUESTIONNAIRE A : ENTREPRENEURS

RESEARCH PROJECT ON TECHNOLOGICAL ENTREPRENEURS

Please mark with an X in the block(s) where the numbers 1, 2, 3 etc appear opposite your selected answer(s), or write your answer in the space provided.	**For office use only**
1. Respondent number	V1 [ ][ ][ ] (1 2 3)

PART A: ENTREPRENEUR

2. What is your present age?

_____ years

V2 [ ][ ] (4 5)

3. What age where you when you started your first business?

_____ years

V3 [ ][ ] (6 7)

4. What sex are you?

Male	1
Female	2

V4 [ ] 8

5. What is your home language?

1	2	3	4	5
English	Afrikaans	Zulu	Xhosa	Other

V5 [ ] 9

6. What is your present religion? (Mark one block)

1	2	3	4	5
Christian	Muslim	Hindu	Jewish	Other

V6 [ ] 10

7. To what race group do you belong?

1	2	3	4	5
Black	Indian	White	Coloured	Other

V7 [ ] 11

8. What is your position as a child in your family?

1	2	3	4	5	6
Eldest	2nd Eldest	3rd Eldest	4th Eldest	5th Eldest	Other

V8 [ ] 12

9. What was the level of your family income per month when you were 18 years old?

1	2	3	4	5
R0 - R 1,000	R1001- R 5,000	R5001- R 10,000	R10001- R 20,000	R20001- more

V9 [ ] 13

10. What was the employment status of your parents when you were 18 years old?

	Yes	No			
Father worked	1	2	V10		14
Father self- employed	1	2	V11		15
Mother worked	1	2	V12		16
Mother self-employed	1	2	V13		17

11. What is your present academic qualifications?

	Yes	No			
School grades 1-11	1	2	V14		18
Matric grade 12	1	2	V15		19
Artisanship (Trade test)	1	2	V16		20
Technical College Certificate	1	2	V17		21
Technicon Certificate and/or diploma	1	2	V18		22
Technicon degree	1	2	V19		23
University Bachelor degree	1	2	V20		24
University Masters degree	1	2	V21		25
University Doctoral degree	1	2	V22		26
Other	1	2	V23		27

12. What is your present <u>primary</u> field of training? (Mark only <u>one</u> block)

1	2	3	4	5			
Technical	Commerce	Human Sciences	Agricultural	Other	V24		28

13. Have you ever attended any formal training program or course in entrepreneurship?

1	2			
Yes	No	V25		29

14. How many years working experience did you have before you started your business?

Research & development	_____ years	V26		30 31
Technical	_____ years	V27		32 33
Supervisory/ Managerial	_____ years	V28		34 35
Sales	_____ years	V29		36 37
Other	_____ years	V30		38 39

15. What was the size of the last firm which you worked for before you started your own business? (Mark <u>one</u> block)

1	2	3	4			
1-5 employees	6-50 employees	51-200 employees	201 & more employees	V31		40

16. Which one of the following factors motivated you most to start your own business? (Mark one block)

1	2	3	4	5
Money	Challenge	Independence	Non-employment	Other

V32 41

17. Did you have a role model who inspired you to start your own business?

1	2
Yes	No

V33 42

18. Which one category describes your own risk profile best? (Mark only one block)

1	2	3
Risk taker	Risk manager	Risk averter

V34 43

19. Rate your own abilities against the following entrepreneurial characteristics:

	Poor	Average	Good		
Independence	1	2	3	V35	44
Dedication	1	2	3	V36	45
Perseverance	1	2	3	V37	46
Motivation to excel	1	2	3	V38	47
Leadership	1	2	3	V39	48
Opportunity orientation	1	2	3	V40	49
Tolerance of risk and uncertainty	1	2	3	V41	50
Adaptability	1	2	3	V42	51
Logical (analytical) thinking	1	2	3	V43	52
Creative (holistic) thinking	1	2	3	V44	53

20. What age were you when you were first introduced to the concept of entrepreneurship?

_____ years

V45 54 55

21. Rate the general attitude of the culture in which you grew up, towards entrepreneurship. (Mark only one block)

1	2	3
Conducive to entrepreneurship	Neutral or apathetic toward entrepreneurship	Negative toward entrepreneurship

V46 56

PART B : ENTERPRISE DETAILS

22. In which one of the following geographical areas is the core (head office, main factory, workshops etc.) of your business located?

1	2	3
Metropolitan	Towns	Rural area

V47 57

23. What is your core business? (Mark only one block)

1	2	3	4	5	6
Manufacturing	Technical services	Mining	Construction	Research and Development	Other

V48 58

24. What is the present annual turnover of your business?

1	2	3	4
R1-R240 000	R240 001-R1m	R1,1m - R5m	R5,1m and more

V49 59

25. What is the average annual turnover growth in your business over the past 3 years? (Mark only one block)

1	2	3	4
Negative growth	0-10% per year	11-50% per year	51% and more per year

V50 60

26. What is the total number of people employed in your business at present (permanent & temporary)?

1	2	3	4
1-5	6-50	51-200	200 and more

V51 61

27. How many business units or branches does your business have?

1	2	3
1	2-5	6 or more

V52 62

28. What is the total value of all your business assets (excluding land and buildings)?

1	2	3	4
0-R100 000	R100 001-R1m	R1,1m-R5m	R5,1m and more

V53 63

29. What is the percentage of Government (central, provincial and local) contracts of the total turnover of your business?

	0-20%	21-80%	81-100%
At starting date	1	2	3
At present	1	2	3

V54 64
V55 65

30. To what extent does your business apply technological innovation (i.e. systematic application application of creative ideas to explore market opportunities) in your product / process / service? (Mark only one block)

1	2	3	4	5
Non-existent	Poor	Average	Good	Excellent

V56 66

31. How long has your present business been in operation?

_____ years

V57 [ ][ ] 67 68

32. What is the technological component of your product/process/service:? In other words, to what extent do you use technology in your core business of production/processing or servicing? (Mark only one block)

1	2	3
Non-existent	Average	High

V58 [ ] 69

PART C : FORMATION OF NEW ENTERPRISE

33. What period has passed between the date when you first felt the need to start your own business (thought of the idea) and the actual start date of your new business?

_____ years

V59 [ ][ ] 70 71

34. To what degree was existing technology (i.e. manufacturing processes, construction or mining methods, service methodology etc.) transferred from your previous employer to your new enterprise?

1	2	3	4
Direct	Partial	Vague	No transfer

V60 [ ] 72

35. How many initial founders (who were owners) were there in the business?

1	2	3
1 (myself)	2 (myself + 1)	3 or more

V61 [ ] 73

36. How many of the original founder members are still owners today?

1	2	3	4
Only me	All of them	Some of them	None of them

V62 [ ] 74

37. If there were more than one founder member, did their skills and capabilities during the first year : (Mark only one block)

1	2	3	4
Compliment each other	Did nothing for each other	Were destructive to each other	Not applicable

V63 [ ] 75

38. In what ratio did you (the founder(s)) finance your business initially? (Mark only one block)

Own capital Foreign capital	20% or less 80% or more	1
Own capital Foreign capital	between 21% and 79% between 79% and 19%	2
Own capital Foreign capital	80% or more 20% or less	3

V64 [ ] 76

39. Of the foreign capital, which of the following other institutions contributed to your financing during the first year of your business operation?

	Yes	No		
Family	1	2	V65	77
Friends	1	2	V66	78
Other private individuals ("angels")	1	2	V67	79
Venture capital fund organisations	1	2	V68	80
Commercial banks	1	2	V69	81
Public stock issues	1	2	V70	82
Non-financial institutions	1	2	V71	83
Other	1	2	V72	84

40. Which of the following institutions assisted you directly during the business start-up period?

	Yes	No			
Previous employer	1	2	V73		85
Government	1	2	V74		86
Private sector	1	2	V75		87
Non-governmental organisations	1	2	V76		88
Business incubator	1	2	V77		89
Other	1	2	V78		90
None at all	1	2	V79		91

41. Have you protected your business idea(s) (i.e. intellectual property) by registering:
(Mark <u>one</u> block only)

1	2	3			
A South African patent	An International patent	No patent at all	V80		92

PART D : NEW ENTERPRISE SUCCESS

42. How did your business perform against your projections on average over the past 3 years?

	Below expected	As expected	Above expected			
Annual turnover	1	2	3	V81		93
Growth	1	2	3	V82		94
Profitability	1	2	3	V83		95

43. Has any one or more of your previous business ventures failed before due to :

	Yes	No			
Insolvency	1	2	V84		96
Voluntary closure	1	2	V85		97
None	1	2	V86		98

44. Do you employ additional managerial skill (in addition to the founders) in the management team of your business at present?

1	2			
Yes	No	V87		99

45. How do you rate your own personnel (people) management skills?

1	2	3	4	5			
Non-existent	Poor	Average	Good	Excellent	V88		100

46. Who is primarily responsible for the marketing function in your business? (Mark only one block)

1	2	3	4			
In-house specialists	External firms	Owner(s)	Nobody in particular	V89		101

47. Does your firm use formal written procedures on issues such as personnel, quality control, purc budgeting etc.?

1	2			
Yes	No	V90		102

48. How many new permanent jobs were created by your business during the past 5 years?

_____ Jobs

V91 | | | | | 103 104 105 106

49. Does your company have a Research and Development department?

1	2			
Yes	No	V92		107

50. In what way did the following external factors influence your business' success during the first 3 years?

	Negatively	Not at all	Positively			
Central Government policies & programs	1	2	3	V93		108
Central Government initiatives	1	2	3	V94		109
Provincial Government initiatives	1	2	3	V95		110
Local Government initiatives	1	2	3	V96		111
Private sector initiatives	1	2	3	V97		112
Non-governmental organisations initiatives	1	2	3	V98		113
Tax incentives	1	2	3	V99		114
Healthy climate for business opportunities	1	2	3	V100		115
Development initiatives of Small, Medium & Micro Enterprises (SMEE)	1	2	3	V101		116
Black empowerment policies	1	2	3	V102		117

51. Rate the following factors as causes for a lack of technological innovation in your firm, or alternatively in South African firms in general, by writing the numbers 1 (biggest cause) to 5 (smallest cause) in the blank spaces below:

Insufficient assistance and initiatives from Government		V103		118
Poor or no return on efforts to improve own technological innovation abilities		V104		119
Lack of resources (time, money, staff)		V105		120
Lack of skills and knowledge to innovate		V106		121
Easy and cheap access to existing technologies		V107		122

52. Does your firm qualify at present as a:
(Mark <u>one</u> block only)

1	2	3			
Black owned business where blacks own 100% of business	Black empowered business where blacks own 1%-99% of business	White owned business where blacks own 0% of business	V108		123

<u>Note:</u> Black in this question includes Coloured, Indian and other than white race groups.

53. Rate the following factors as causes for new technological business failures by writing the numbers 1 (biggest cause) to 10 (smallest cause) in the blank spaces below :

Insufficient assistance and initiatives from Government		V109		124
Insufficient assistance and initiatives from the private sector		V110		125
Insufficient training in entrepreneurial skills		V111		126
Non-sympathetic culture and upbringing towards entrepreneurship		V112		127
Insufficient training in business management skills		V113		128
Racial and sexual discrimination		V114		129
Availability of and access to venture capital		V115		130
Availability of and access to mentorship programs		V116		131
Insufficient tax incentives		V117		132
Other causes (list them in 54)		V118		133

54. Write down any other causes than the above, in order from biggest (first) and smallest (last) causes for new technological business failures:

54a		V119	134
54b		V120	135
54c		V121	136
54d		V122	137
54e		V123	138

55. Rate the following measures to improve the development of technological entrepreneurship in emerging countries by writing the numbers 1 (most important) to 5 (least important) into the blank spaces below :

Increase efforts to positively influence society's perception towards entrepreneurship in general		V124	139
Improve the development of technological entrepreneurial skills during primary, secondary and tertiary education		V125	140
Increase efforts by the private sector		V126	141
Increase efforts by the Central / Provincial / Local Governments		V127	142
Other measures (list them in 56)		V128	143

56. Write down any other measures than the above, in order from most important (first) and least important (last) which are necessary to develop technological entrepreneurship in emerging countries:

56a		V129	144
56b		V130	145
56c		V131	146
56d		V132	147
56e		V133	148

WE THANK YOU FOR YOUR EFFORT AND VALUABLE TIME SPENT WHILE COMPLETING THE QUESTIONNAIRE.

APPENDIX B

QUESTIONNAIRE TO MOT / MPM / MEM STUDENTS

Fax: (012) 362-5307
e-mail: mmulder@postino.up.ac.za

University of Pretoria

Faculty of Engineering, The Built Environment and Information Technology

Department of Engineering and Technology Management

17 September 2002

Dear Student

RESEARCH PROJECT ON TECHNOLOGICAL ENTREPRENEURS

I am currently conducting research on the development of technological entrepreneurship in emerging countries such as South Africa. This research forms part of my PhD studies at the Department of Engineering and Technology Management, University of Pretoria.

A significant part of the research project focuses on the entrepreneurship content of formal technical training programmes at educational institutions. To assess the extent of entrepreneurial training of a sample group of MOT, MPM and MEM students such as yourselves, will contribute significantly to the knowledge base of the research topic.

Your valued time and co-operation in completing the attached questionnaire is sincerely appreciated. The questionnaire is completed anonymously and the information will be treated confidentially in accordance with the ethical standards underwritten by the University of Pretoria.

Thank you

.....
Frans Lotz, PhD student, 7508727

.....
JK Visser, **Professor**
Acting Head of Department:
Engineering & Technology Management

QUESTIONNAIRE B

RESEARCH PROJECT ON TECHNOLOGICAL ENTREPRENEURS

Please mark with an X in the block(s) where the numbers 1, 2, 3 etc appear opposite your selected answer(s)

For office use only

1. Respondent number

V1 [ ][ ][ ] 1 – 3

2. What is your present age?

1	2	3	4	5	6	7
20-25yrs	26-30yrs	31-35yrs	36-40yrs	41-50yrs	51-60yrs	61yrs & older

V2 [ ] 4

3. Have you ever founded alone, or co-founded with someone else, a new business venture where none existed before?

Yes	No
1	2

V3 [ ] 5

4. If the answer is yes on question 3, was the venture a technology based business?

1	2	3
Yes	No	Not Applicable

V4 [ ] 6

5. To what race group do you belong?

1	2	3	4	5
Black	Indian	White	Coloured	Other

V5 [ ] 7

6. Where did you complete the largest portion of your primary and secondary education?

In South African government schools	1
In South African private schools	2
In schools of any other African country	3
In schools on any other continent	4

V6 [ ] 8

7. What is your present highest qualification?

1	2	3	4
B-degree	Hons-degree	M-degree	PhD-degree

V7 [ ] 9

8. To which group does your tertiary qualification (B-degree) belong?

Natural science (eg BSc Physics)	1
Applied science (eg BSc QS)	2
Engineering (eg BEng)	3
Other	4

V8 [ ] 10

9. At which institution group did you obtain your tertiary qualification (B-degree)?

South African university	1
South African technicon	2
Universities /Technicons in other African countries	3
Universities / Technicons on other continents	4

V9 [ ] 11

10. Have you received any formal training in entrepreneurship (as a subject in the course curriculum) in any of the following educational stages :

		1	2		
10.1	Primary school	Yes	No	V10	12
10.2	Secondary school	Yes	No	V11	13
10.3	University or technicon (B-degree)	Yes	No	V12	14

11. In your opinion, classify the extent of formal training in the subject entrepreneurship which you received prior to your present studies, into one of the following categories :

Totally adequate ie no further improvements required	1	V13	15
Good with only minor improvements necessary	2		
Poor with major improvements necessary	3		
Totally inadequate ie drastic improvements required	4		

12. If you have not done so already, do you have strong aspirations to start a new venture in future?

1	2	3		
Yes	No	Not applicable	V14	16

13. In your opinion, to what extent did the subject "New Ventures and Entrepreneurship" in your Hons/Masters degree programme contribute to the development of your own entrepreneurial abilities?

1	2	3		
Significantly	Minor	Not at all	V15	17

14. What sex are you?

1	2		
Male	Female	V16	18

We thank you for your effort and valuable time spent while completing the questionnaire.

APPENDIX C

STUDENT QUESTIONNAIRE RESULTS

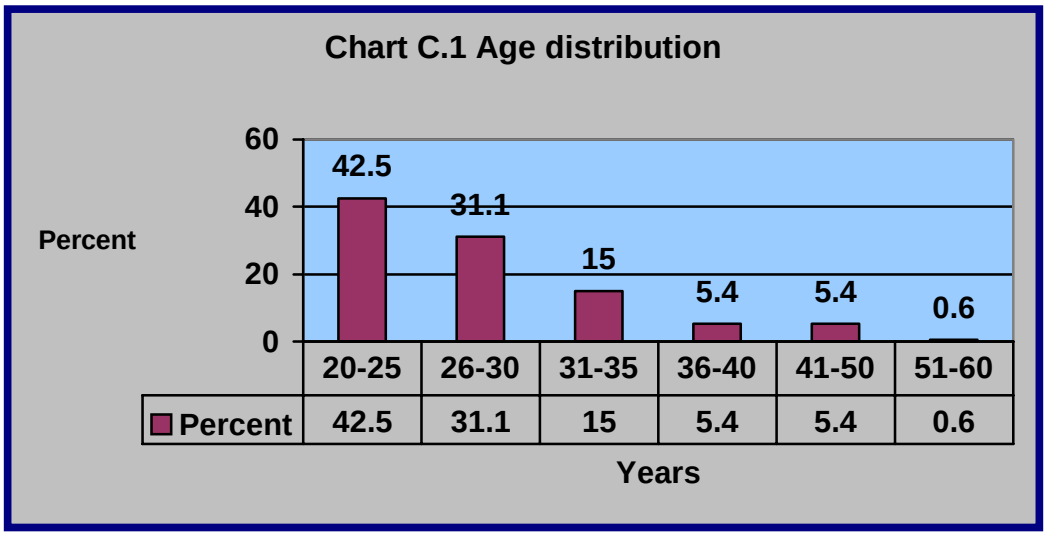
APPENDIX C

STUDENT QUESTIONNAIRE RESULTS

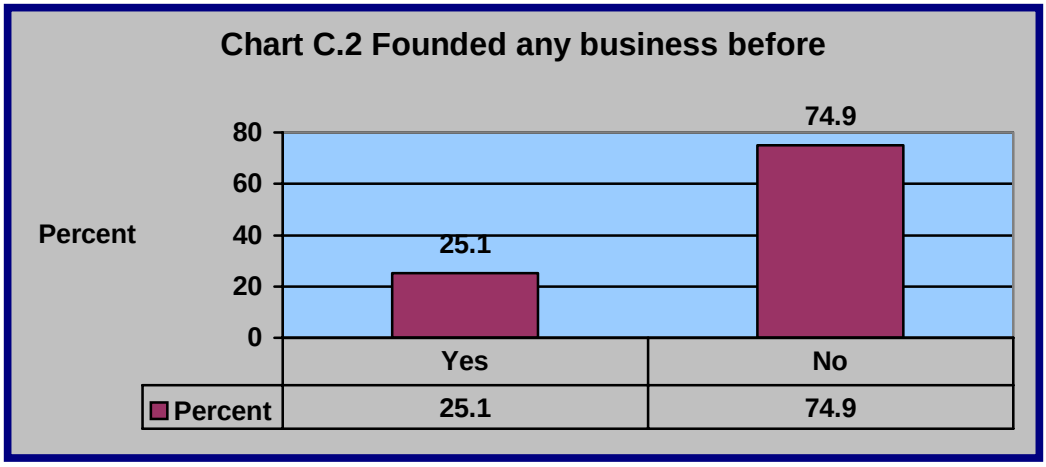
1. FREQUENCY ANALYSIS

1.1. Limited personal information

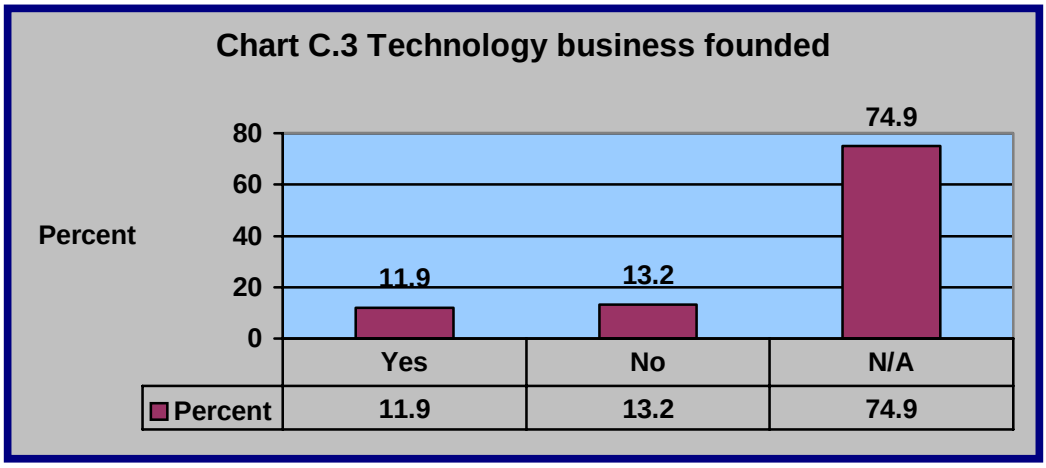
1.1.1. Age distribution



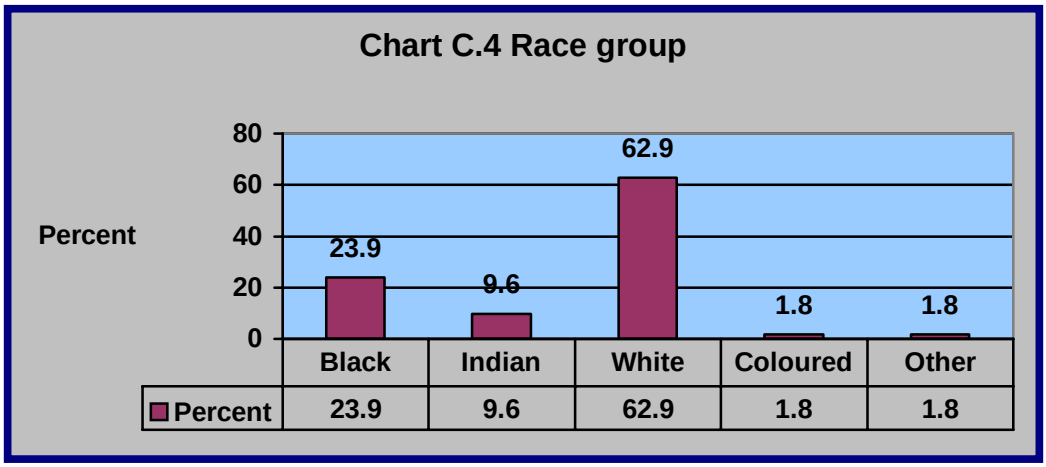
1.1.2. Founded any business before



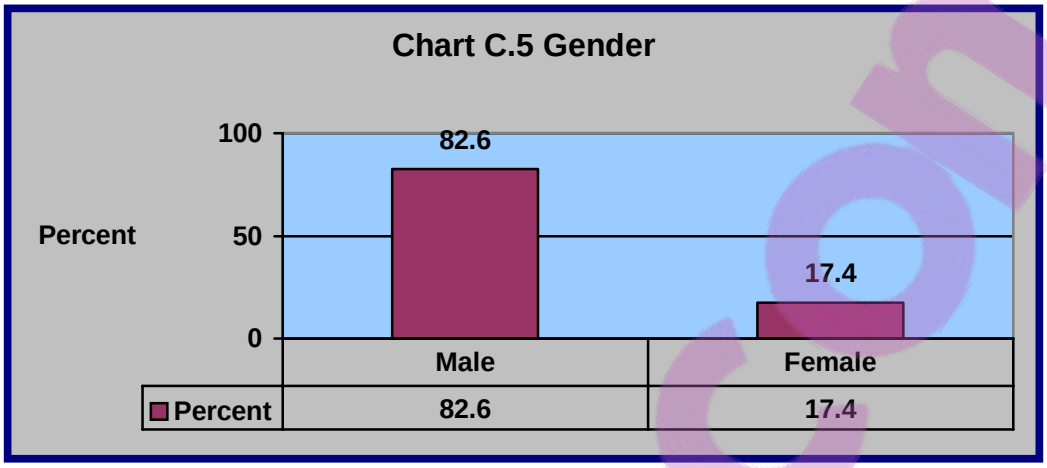
1.1.3. Technological business founded



1.1.4. Race group

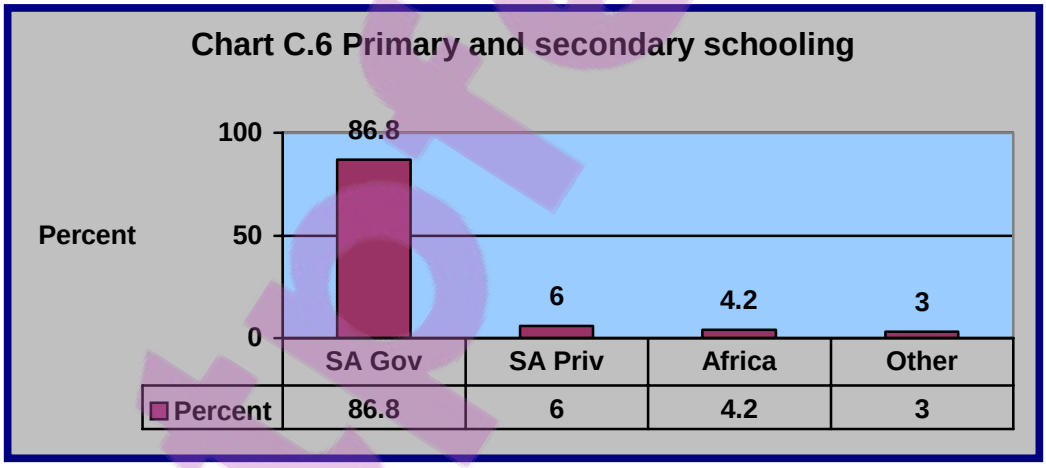


1.1.5 Gender

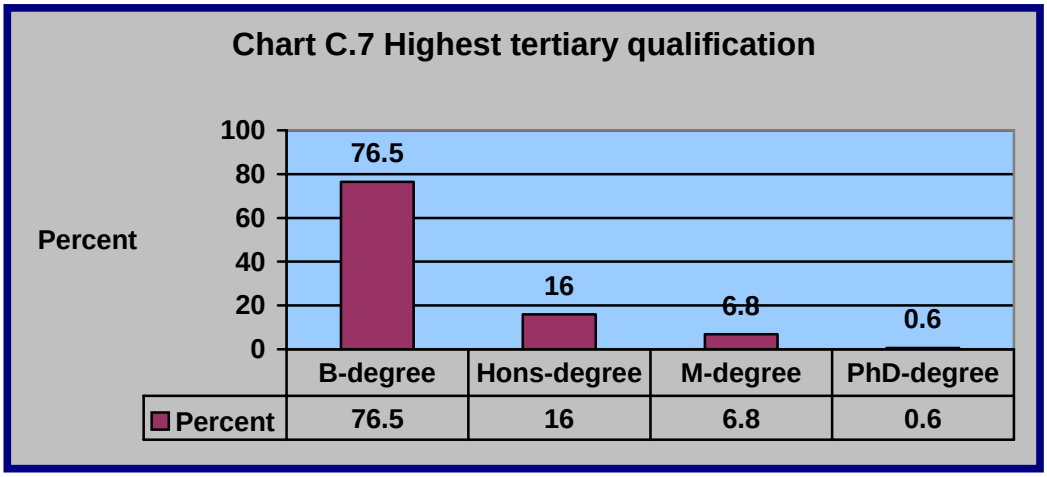


1.2. Basic training and educational profile

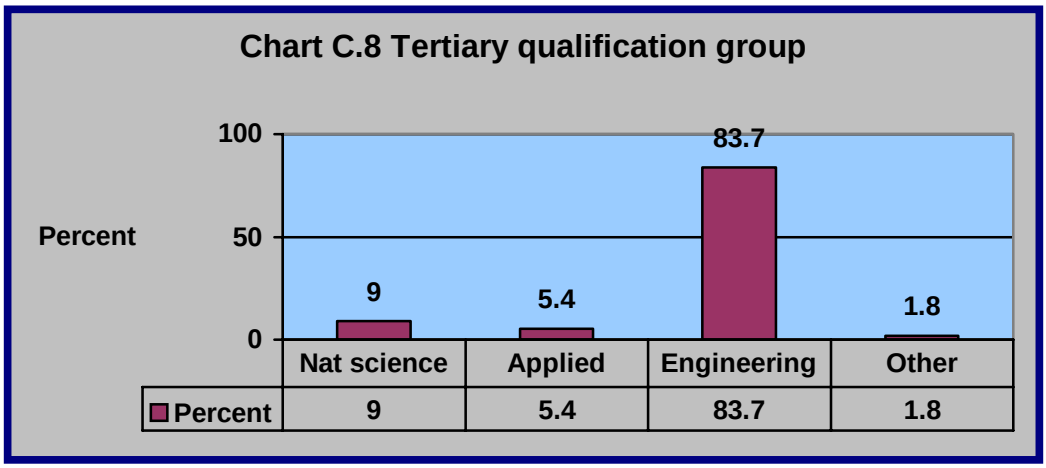
1.2.1. Primary and secondary schooling history



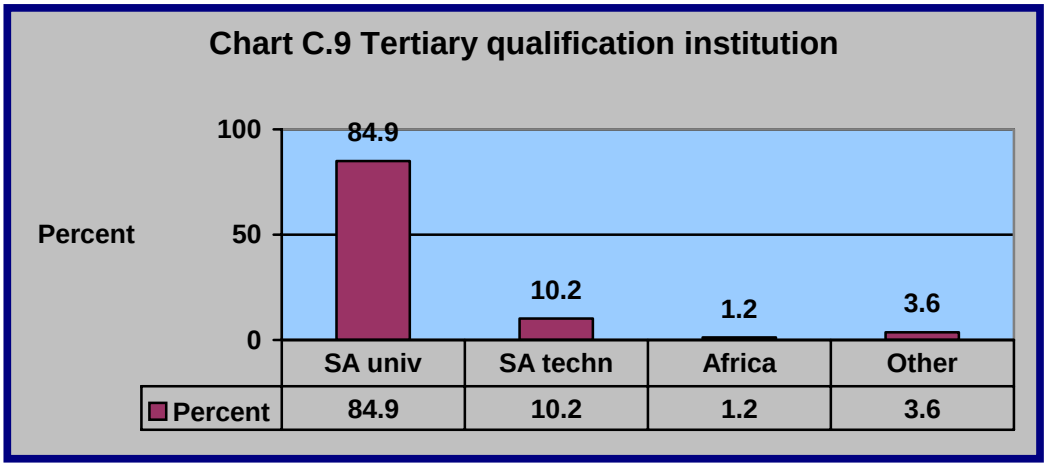
1.2.2. Highest tertiary qualification



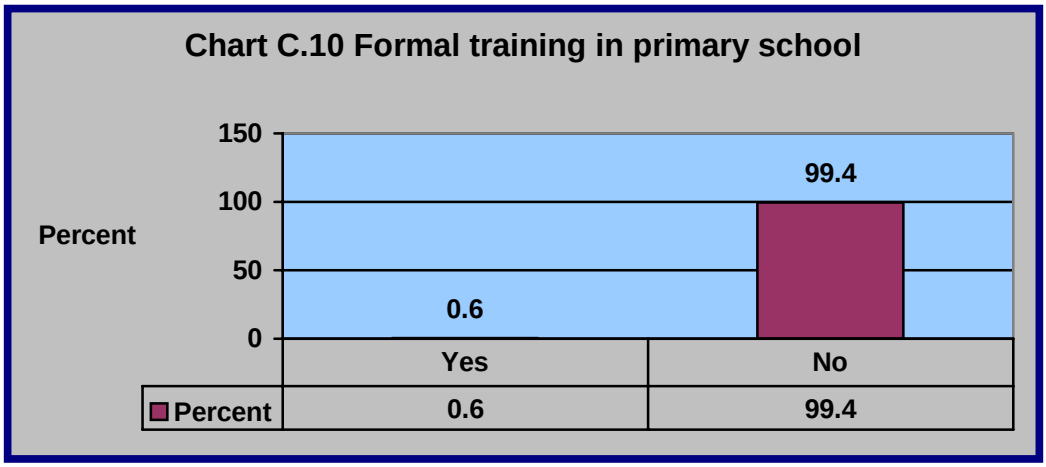
1.2.3. Tertiary qualification grouping

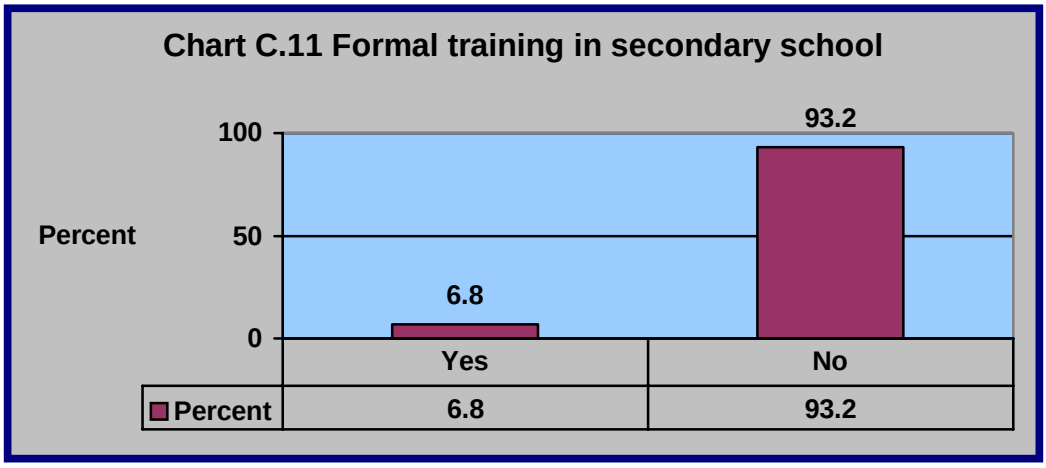


1.2.4. Tertiary qualification institution



1.2.5. Formal training history in entrepreneurship





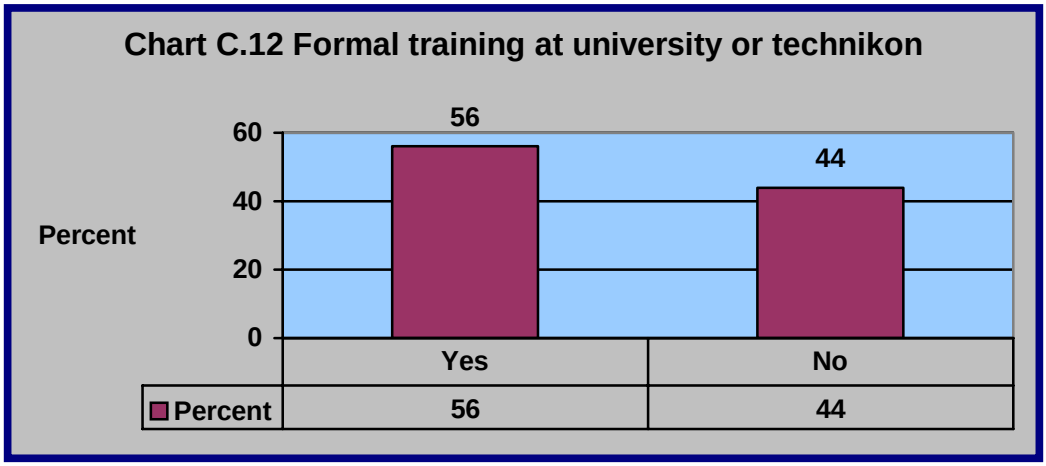


Chart C.12 Formal training at university or technikon
Percent
60
40
20
0
56
44
Yes
No
Percent
56
44

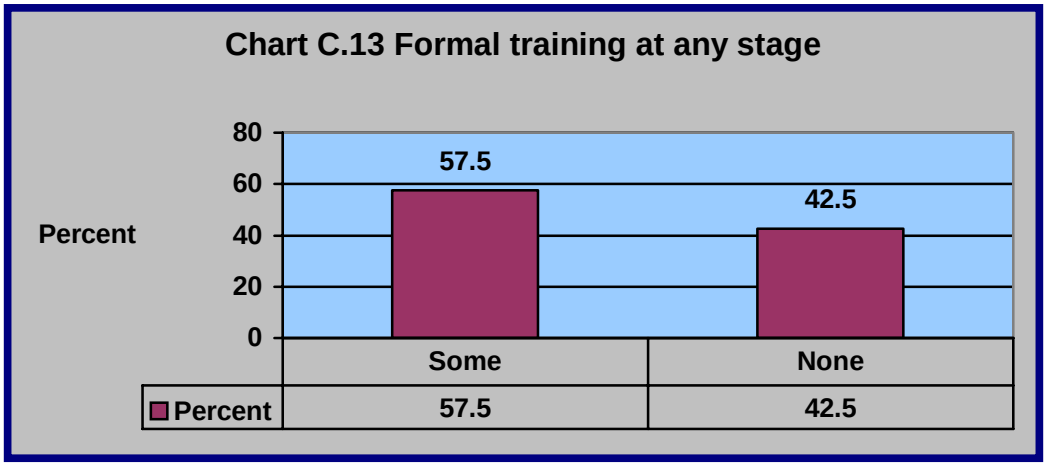
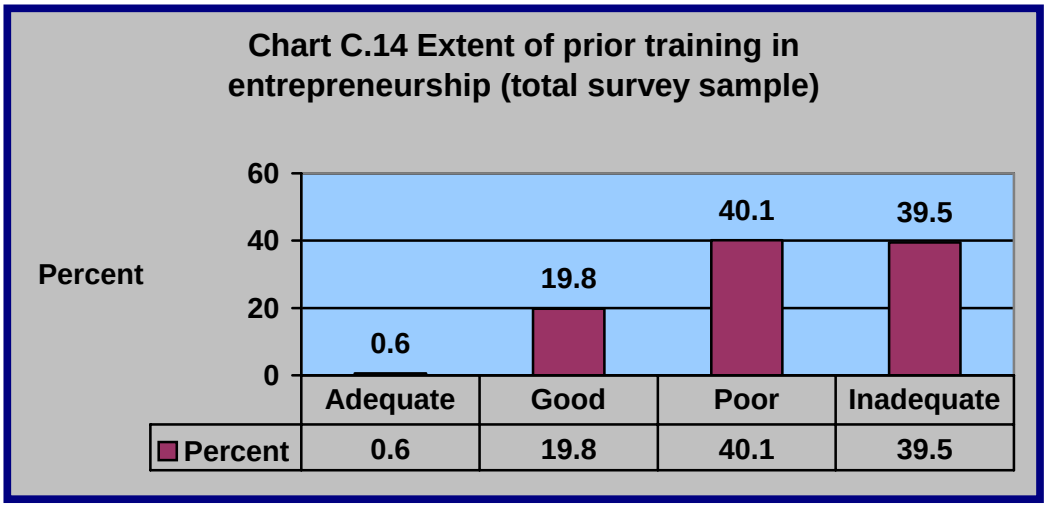
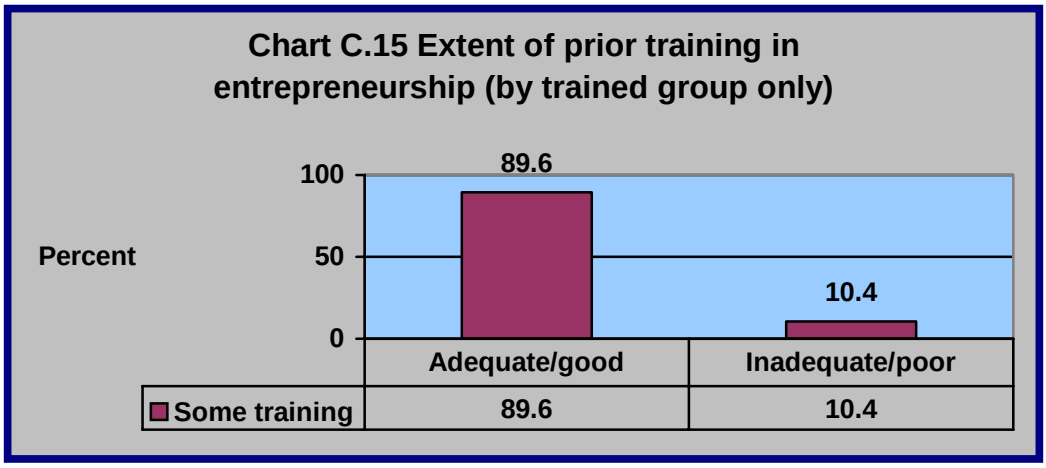


Chart C.13 Formal training at any stage
Percent
80
60
40
20
0
57.5
42.5
Some
None
Percent
57.5
42.5

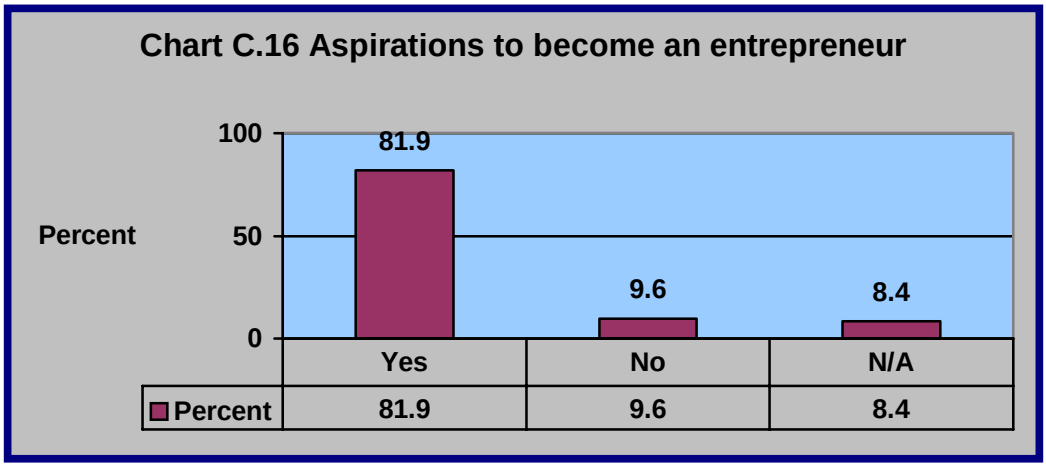
1.3. Assessment of importance of training and education in entrepreneurship

1.3.1. Extent of prior formal training in entrepreneurship

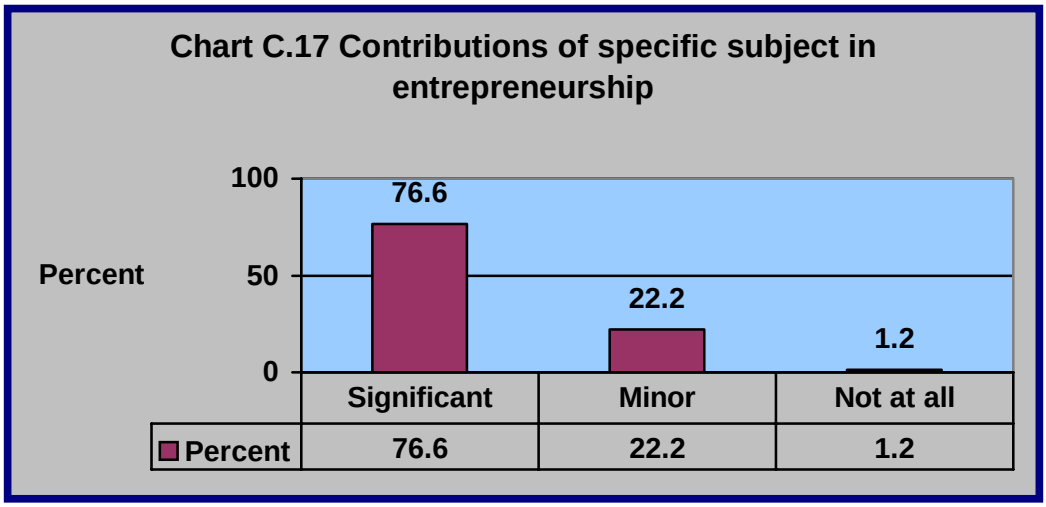




1.3.2. Aspirations to become an entrepreneur

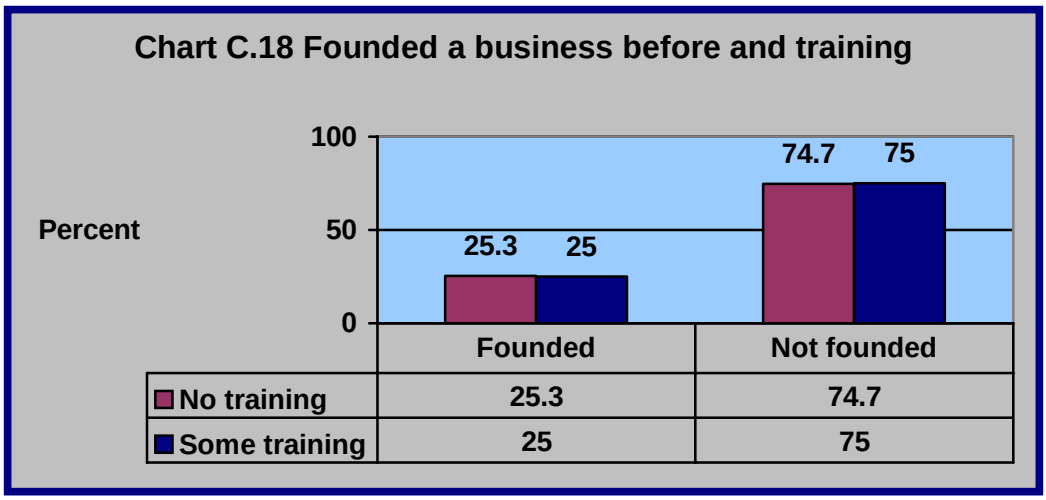


1.3.3. Contribution of specific subject in entrepreneurship



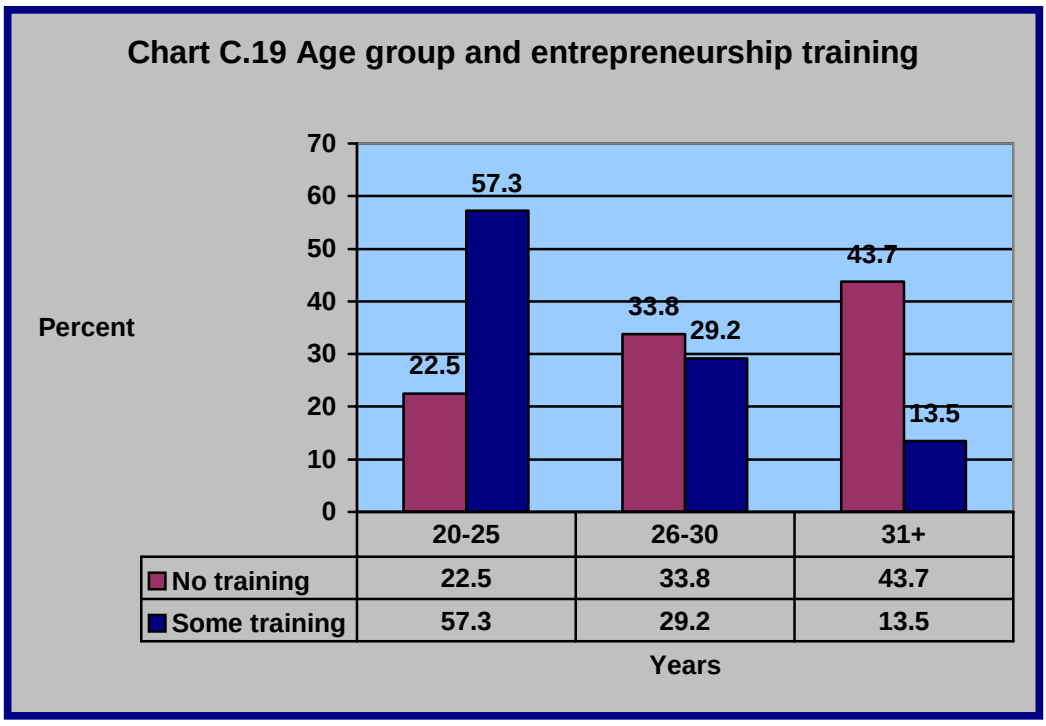
2. CORRELATION ANALYSIS

2.1. Founded a business before and entrepreneurship training



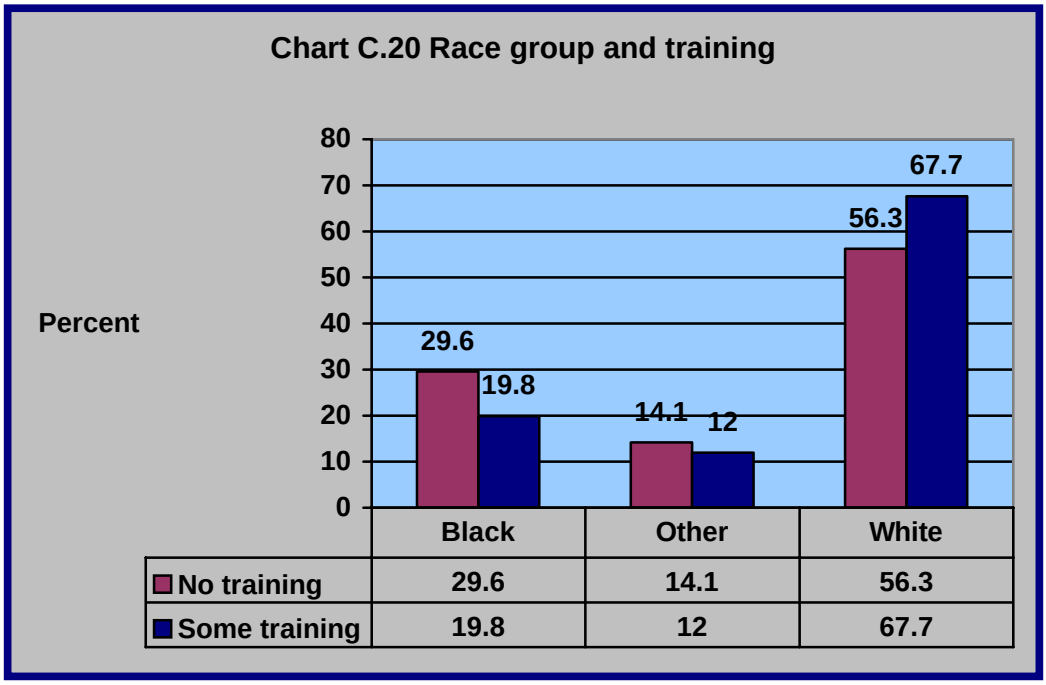
Chi-square value is 0.0027 and probability is 0.9587

2.2. Age and entrepreneurship training



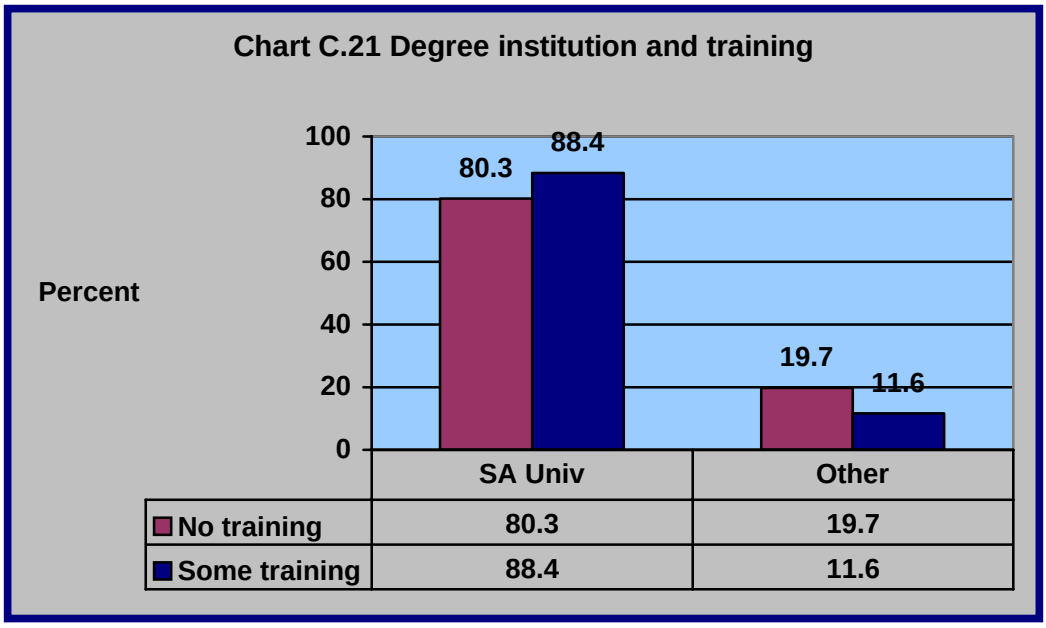
Chi-square value is 25.9325 and probability is 0.0001

2.3. Race group and training



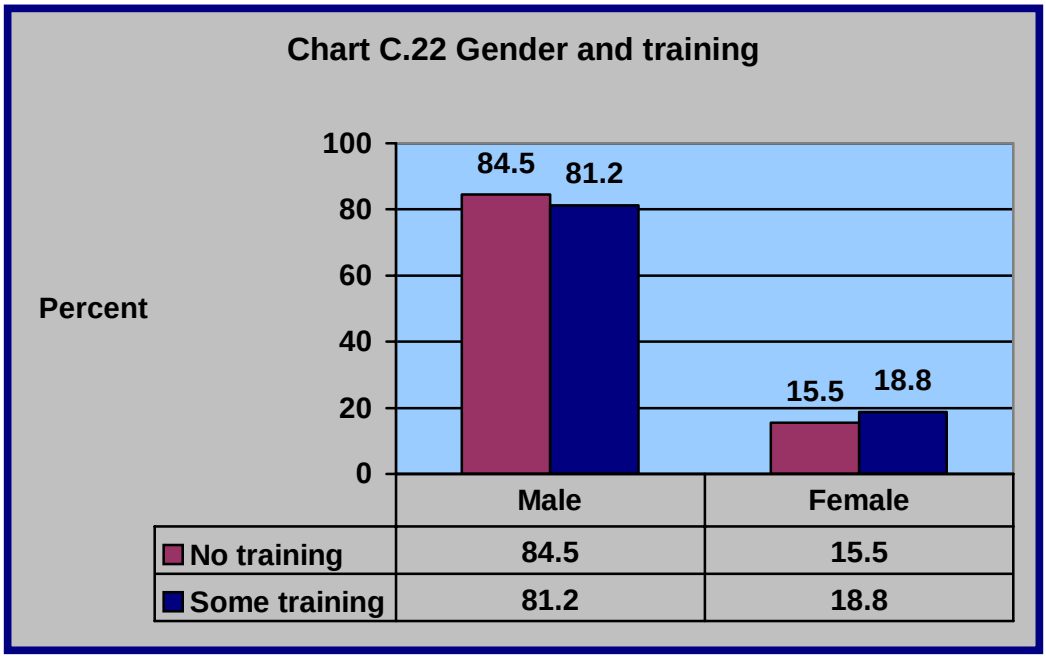
Chi-square value is 2.5488 and probability is 0.2796

2.4. Degree institution and training



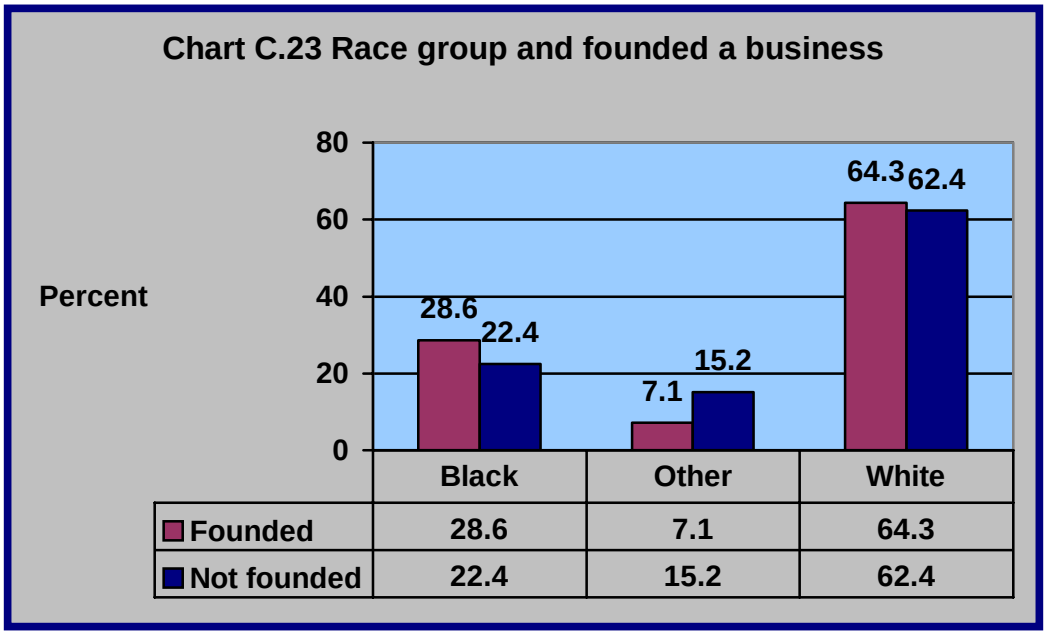
Chi-square value is 2.1043 and probability is 0.1469

2.5. Gender and training



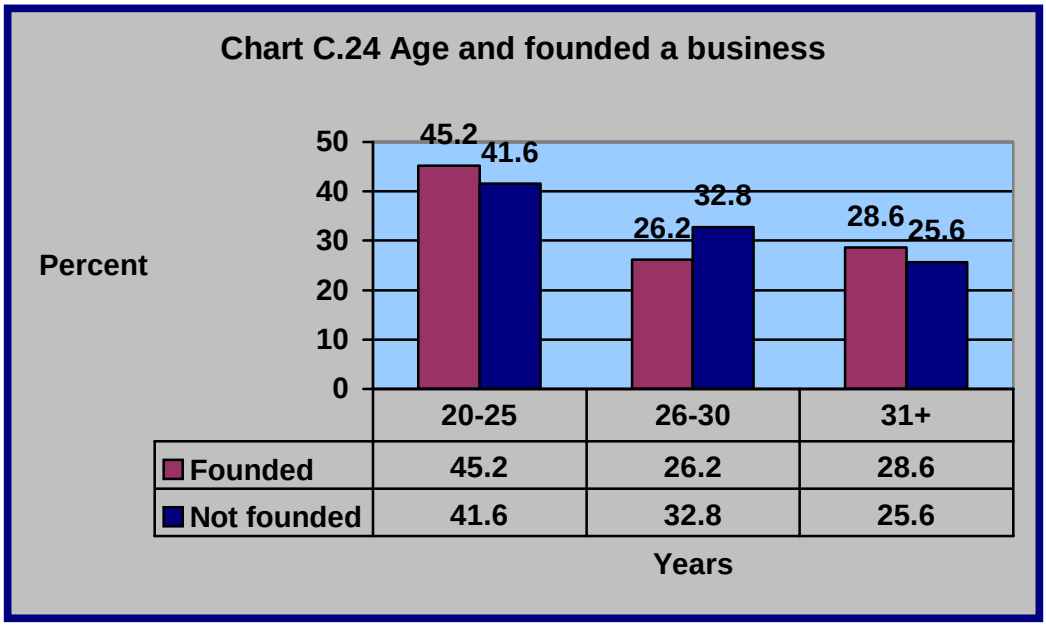
Chi-square value is 0.3017 and probability is 0.5828

2.6. Race group and founded a business



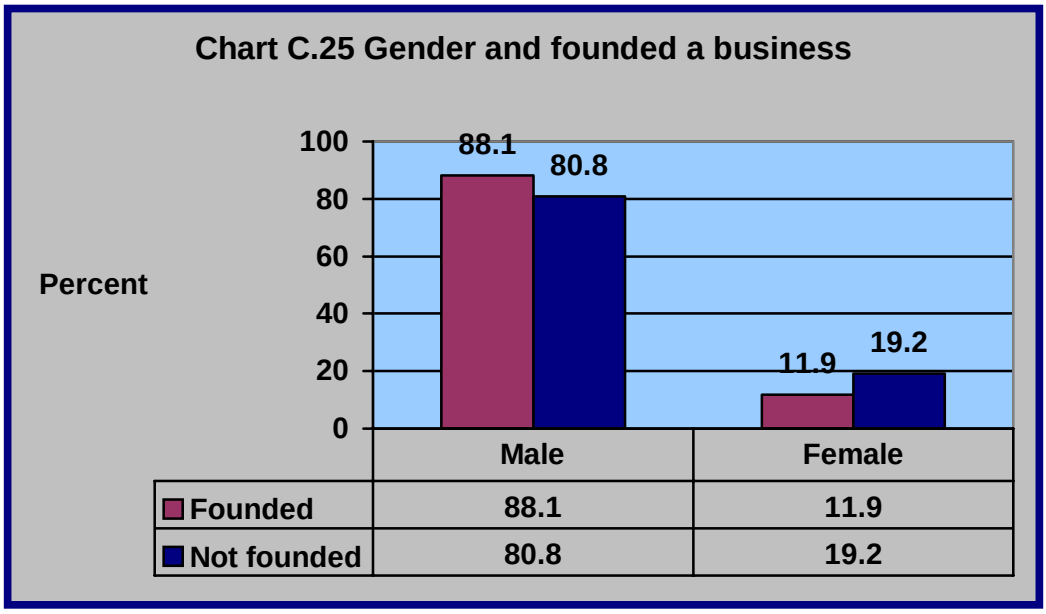
Chi-square value is 2.0668 and probability is 0.3558

2.7. Age and founded a business



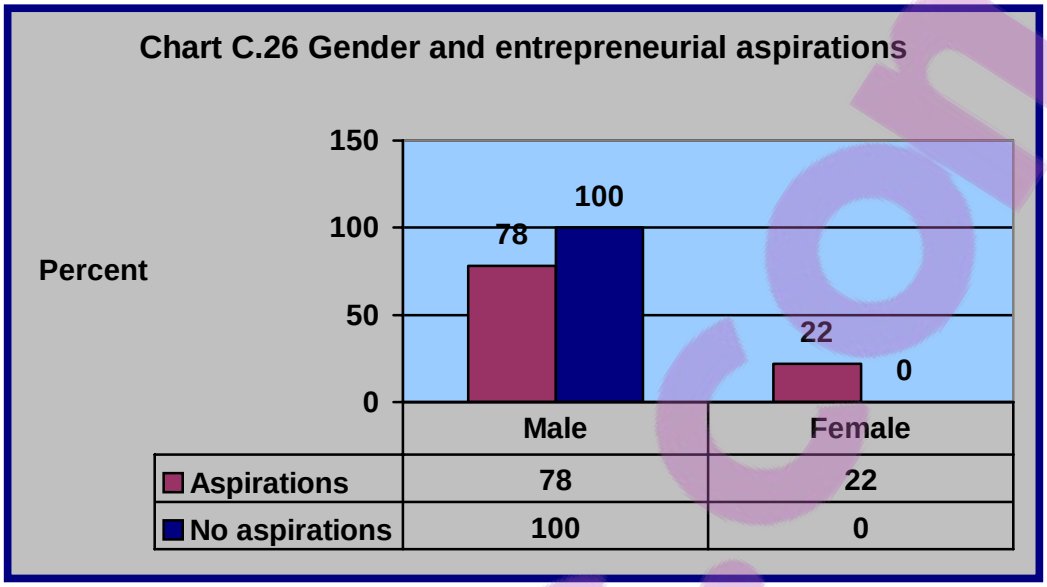
Chi-square value is 0.6643 and probability is 0.7246

2.8. Gender and founded a business



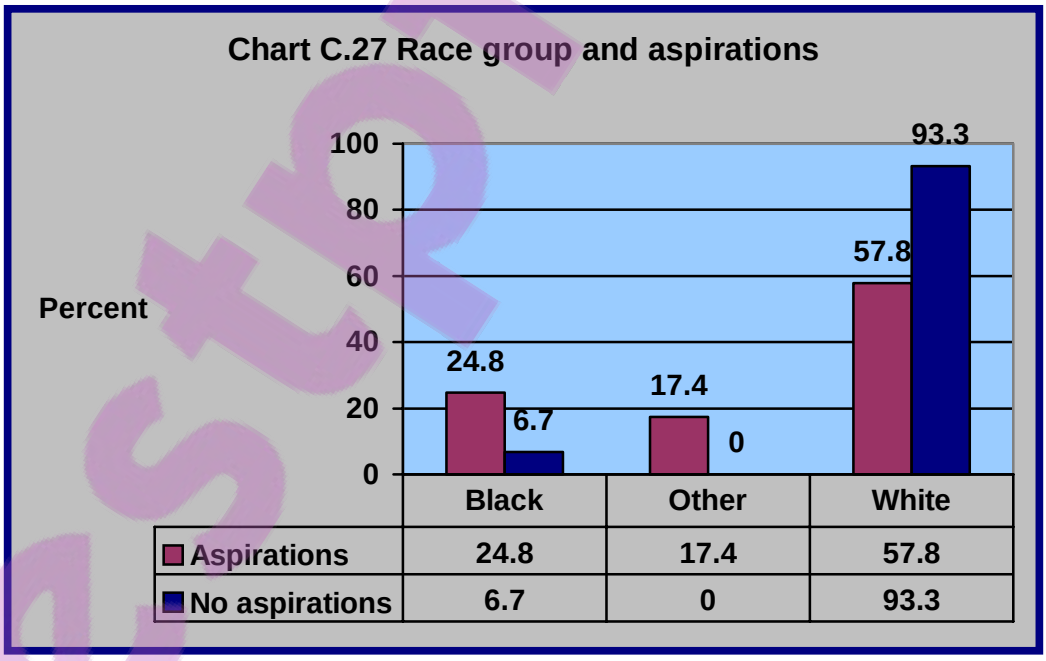
Chi-square value is 1.1659 and probability is 0.2802

2.9. Gender and entrepreneurial aspirations



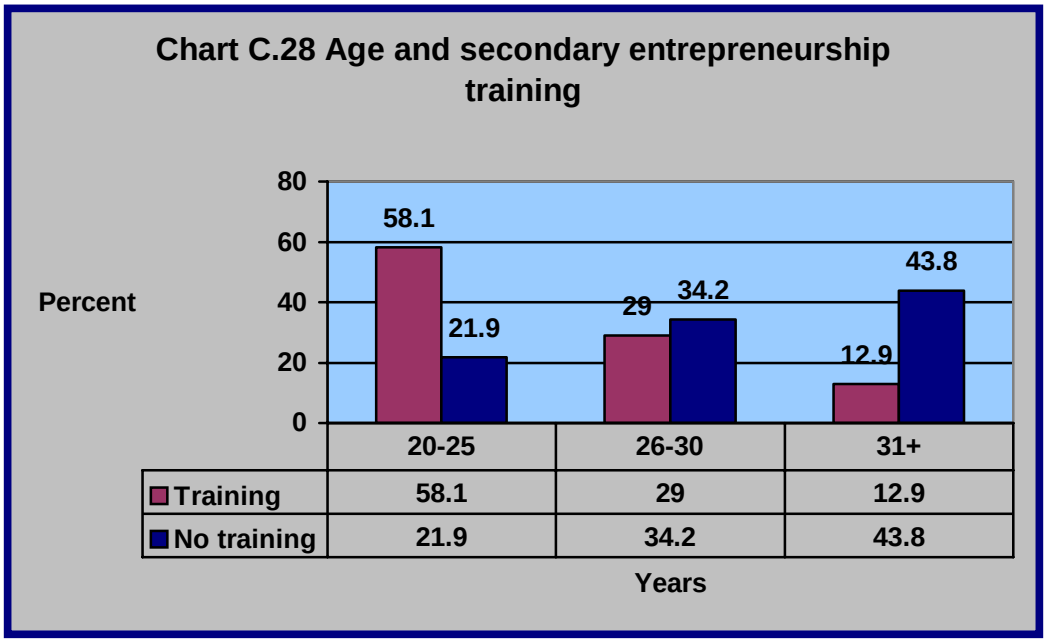
Chi-square value is 4.0954 and probability is 0.0430

2.10. Race group and entrepreneurial aspirations



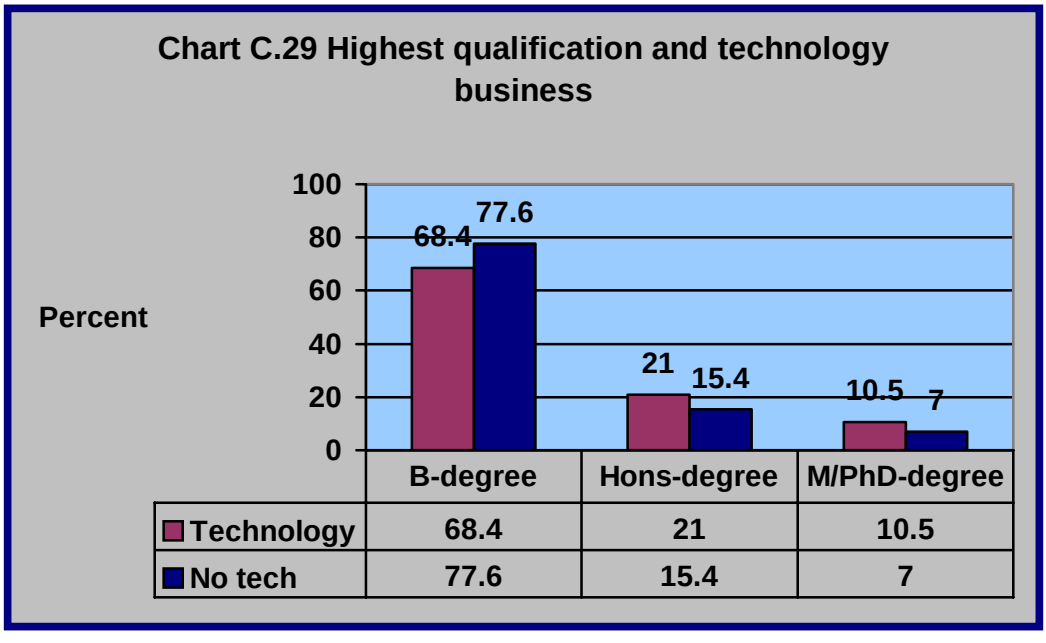
Chi-square value is 7.2098 and probability is 0.0272

2.11. Age and university/technikon entrepreneurship training



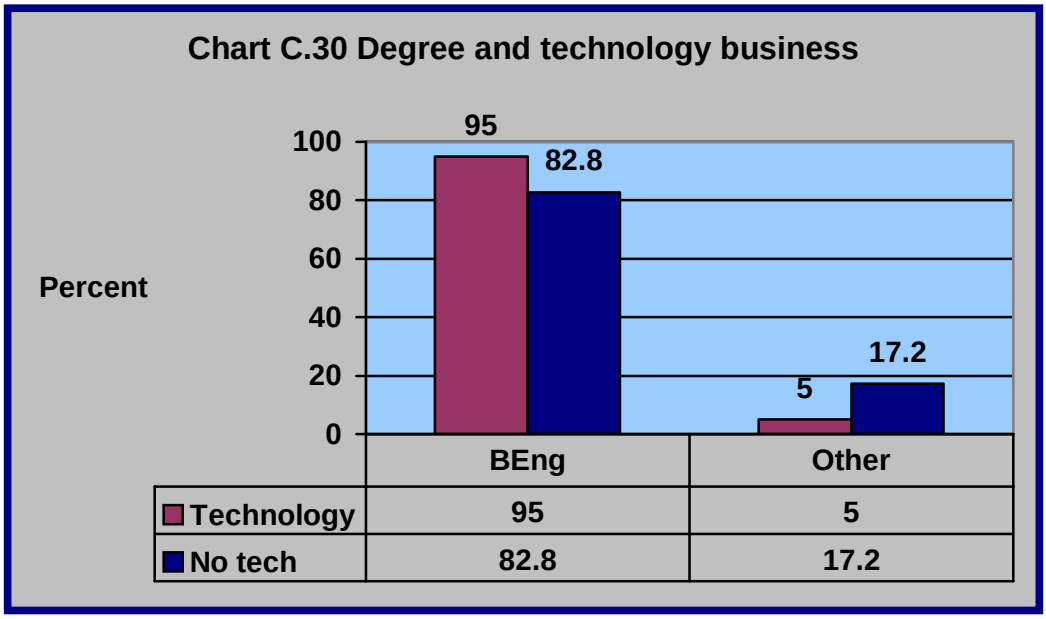
Chi-square value is 27.7902 and probability is 0.0001

2.12. Highest qualification and technology business



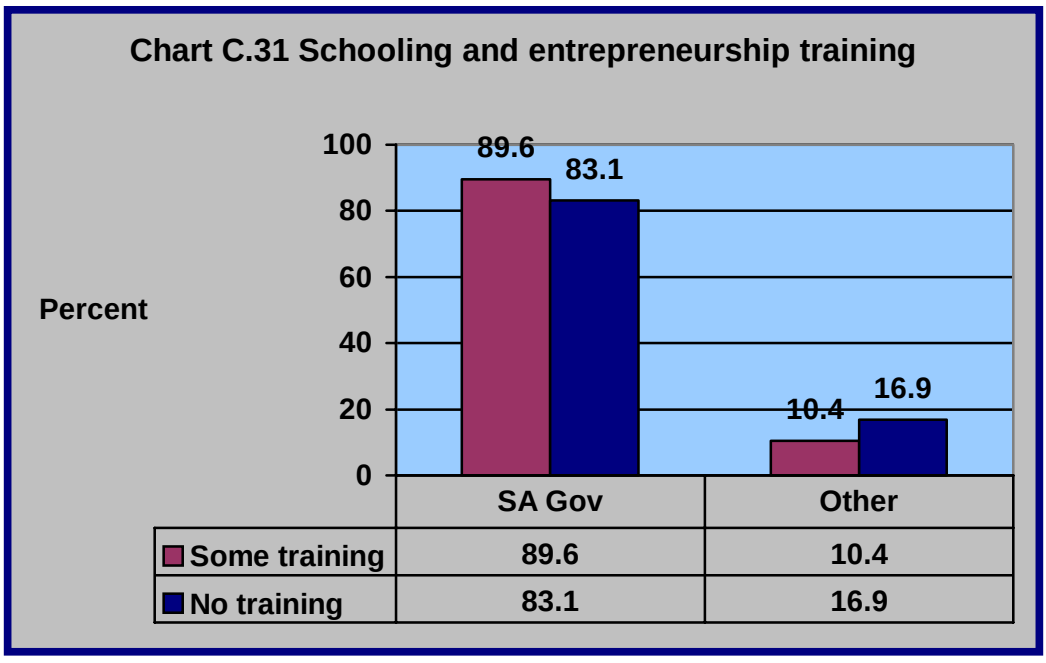
Chi-square value is 2.1813 and probability is 0.7025

2.13. Degree and technology business



Chi-square value is 2.6066 and probability is 0.2716

2.14. Schooling and entrepreneurship training



Chi-square value is 1.5005 and probability is 0.2206

APPENDIX D

ENTREPRENEUR QUESTIONNAIRE RESULTS

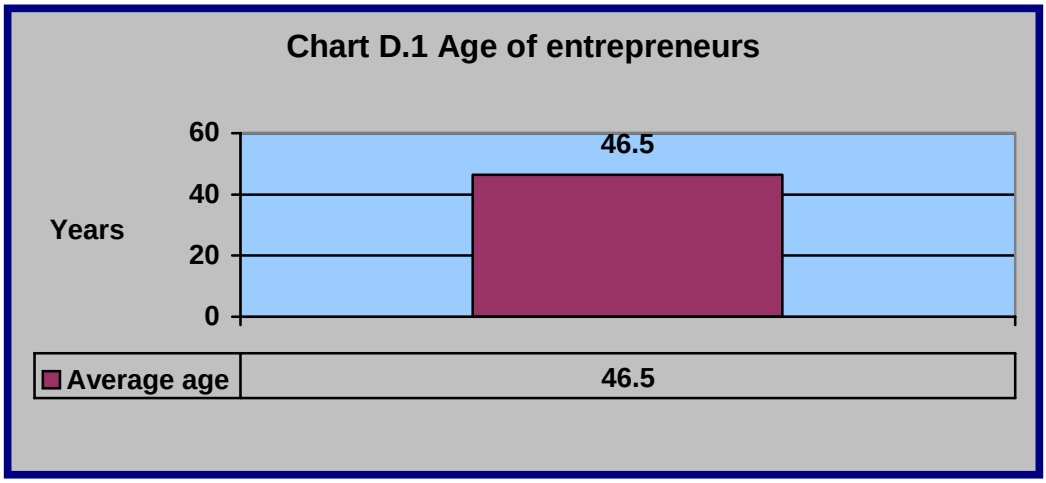
APPENDIX D

ENTREPRENEUR QUESTIONNAIRE RESULTS

1. FREQUENCY ANALYSIS

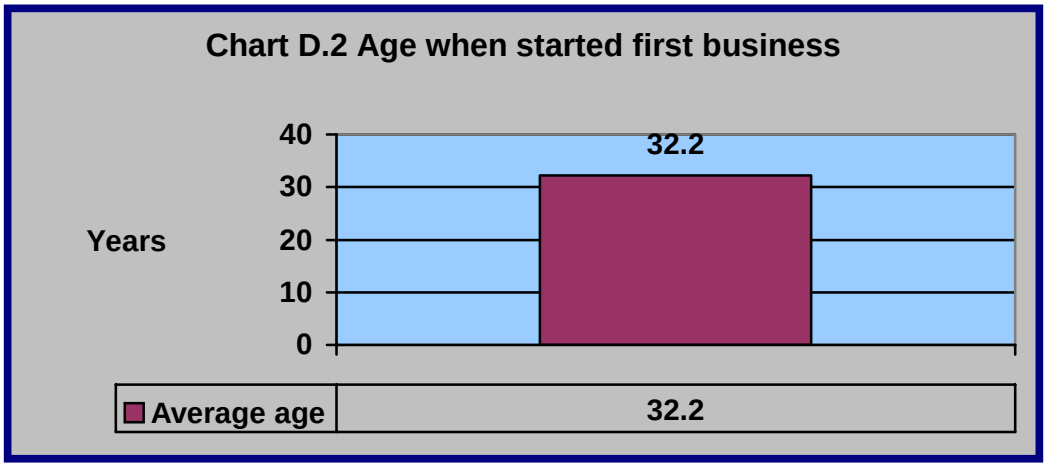
1.1. Entrepreneurs

1.1.1. Age of entrepreneurs (V2)



- Standard deviation: 10.99
- Minimum: 23
- Maximum: 75

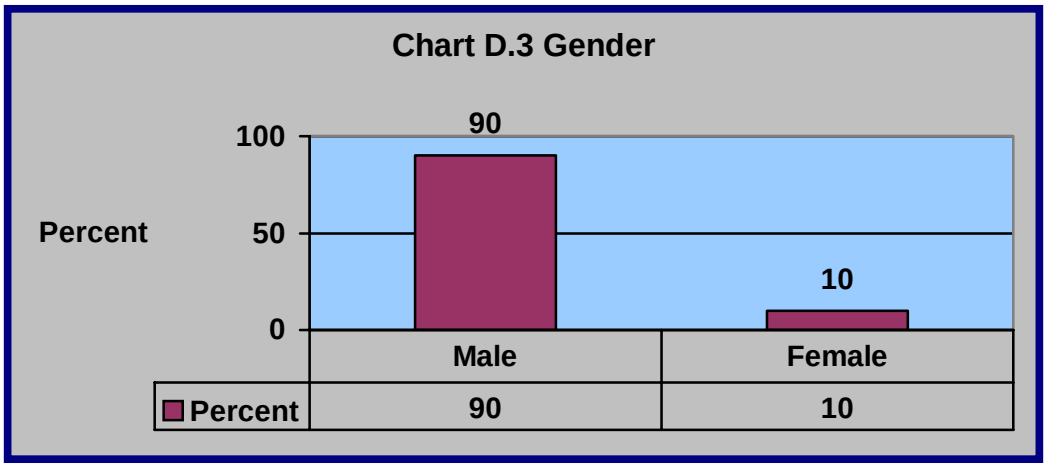
1.1.2. Age when started first business (V3)



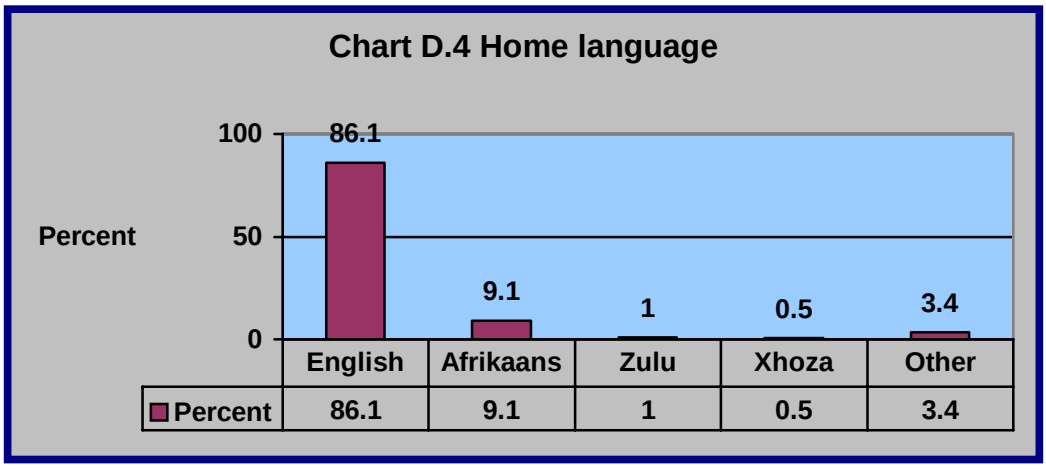
- Standard deviation: 8.89
- Minimum: 6

- Maximum: 60

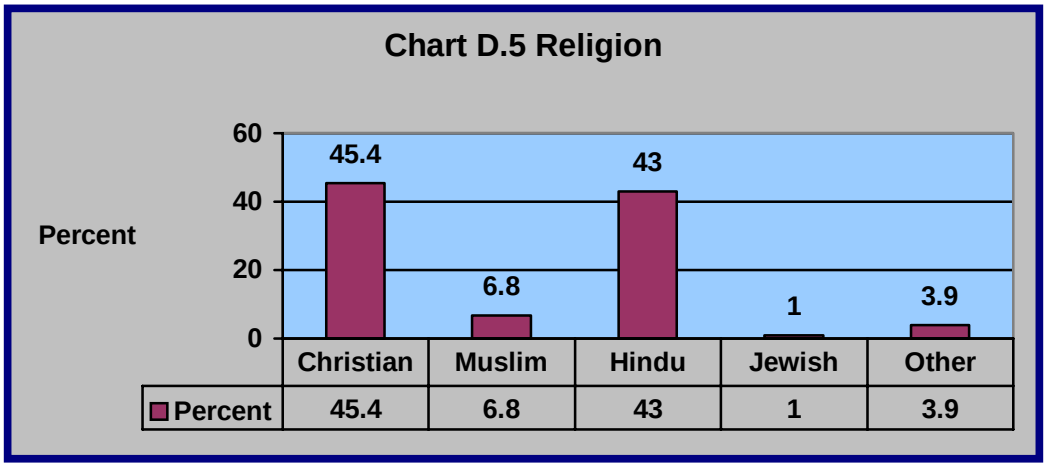
1.1.3. Gender (V4)



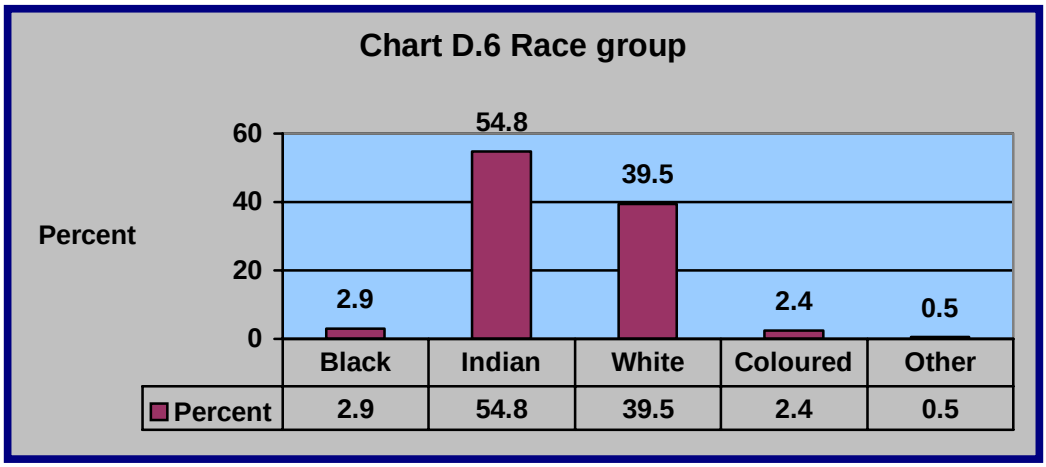
1.1.4. Home language (V5)



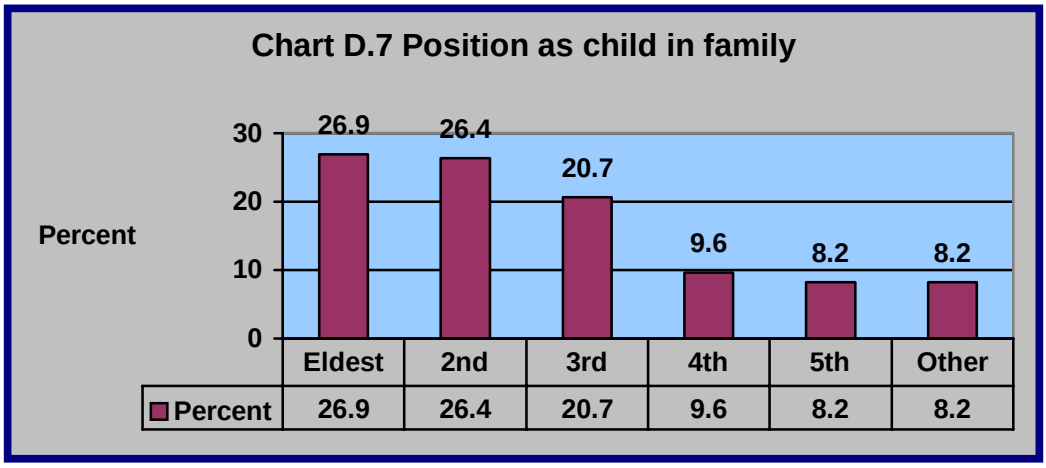
1.1.5. Religion (V6)



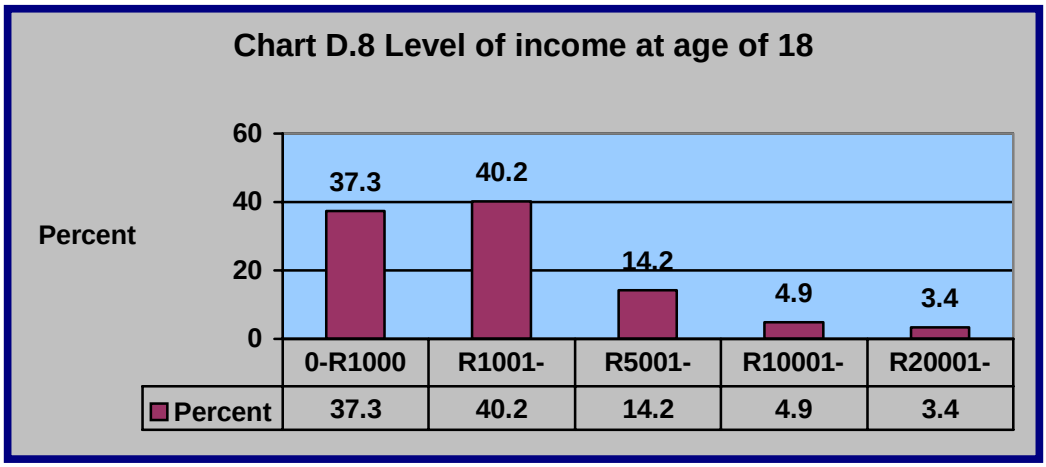
1.1.6. Race group (V7)



1.1.7. Position as child in family (V8)

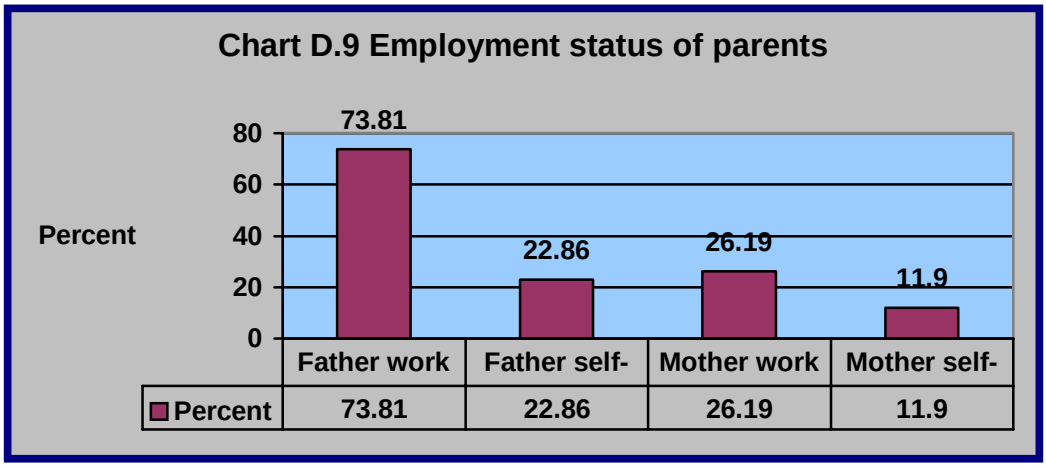


1.1.8. Level of income at age of 18 (V9)



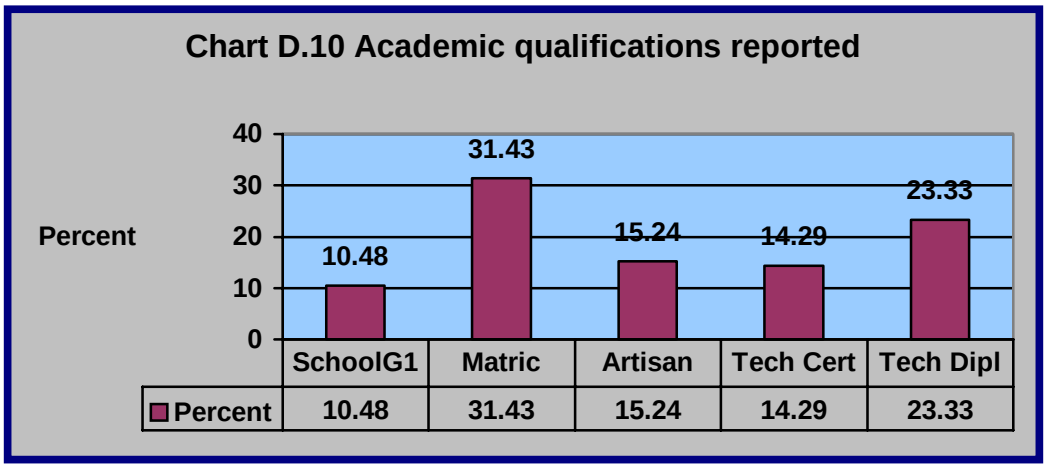
- *0 – R1,000*
- *R1,001 – R5,000*
- *R5,001 – R10,000*
- *R10,001 – R20,000*
- *R20,001 – more*

1.1.9. Employment status of parents (V10-V13)

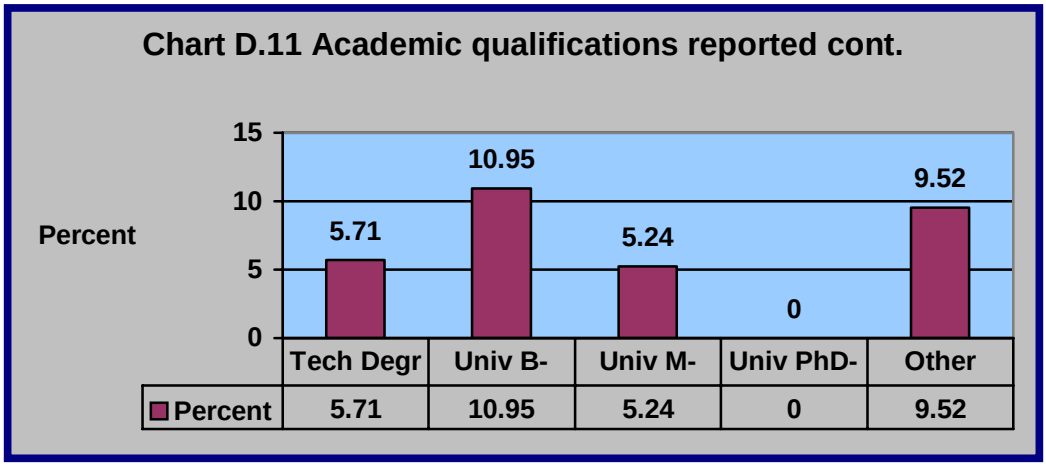


- *Father worked*
- *Father self-employed*
- *Mother worked*
- *Mother self-employed*

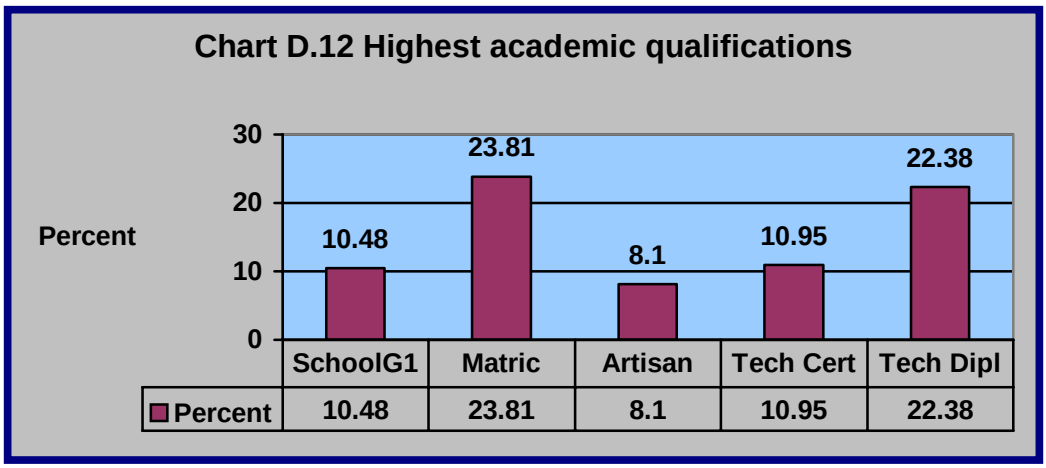
1.1.10. Academic qualifications (V14-V23)



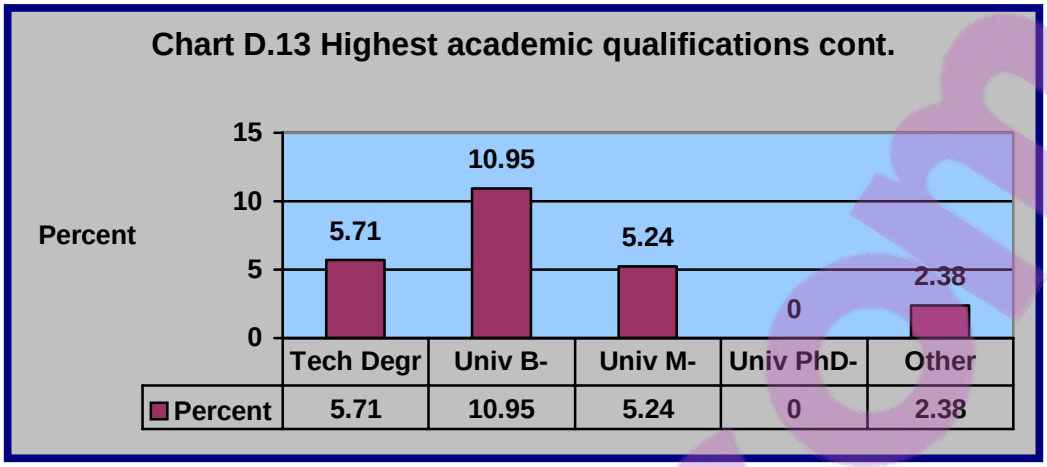
- *School grade 11*
- *School grade 12*
- *Artisan*
- *Technical College certificate*
- *Technikon diploma*



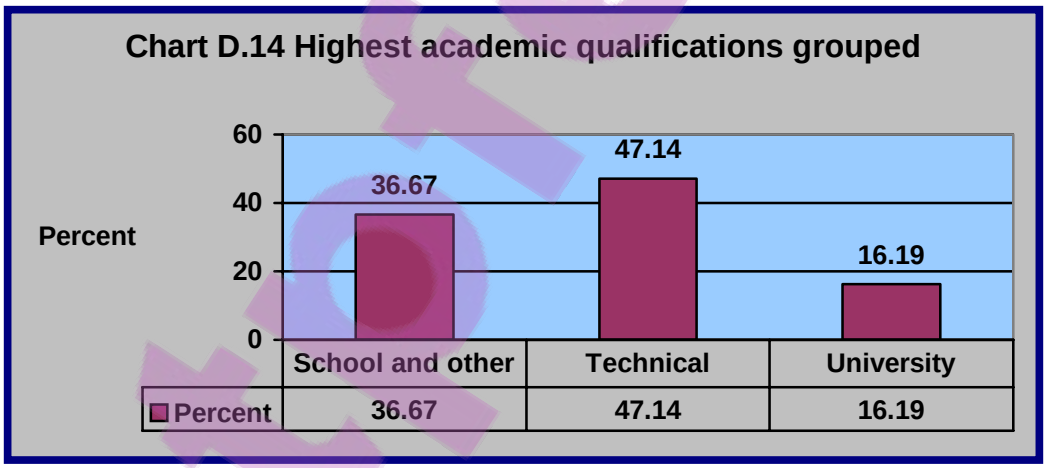
- *Technikon degree*
- *University B-degree*
- *University M-degree*
- *University PhD-degree*
- *Other*



- *School grade 11 (highest)*
- *School grade 12 (highest)*
- *Artisan (highest)*
- *Technical College certificate (highest)*
- *Technikon diploma (highest)*

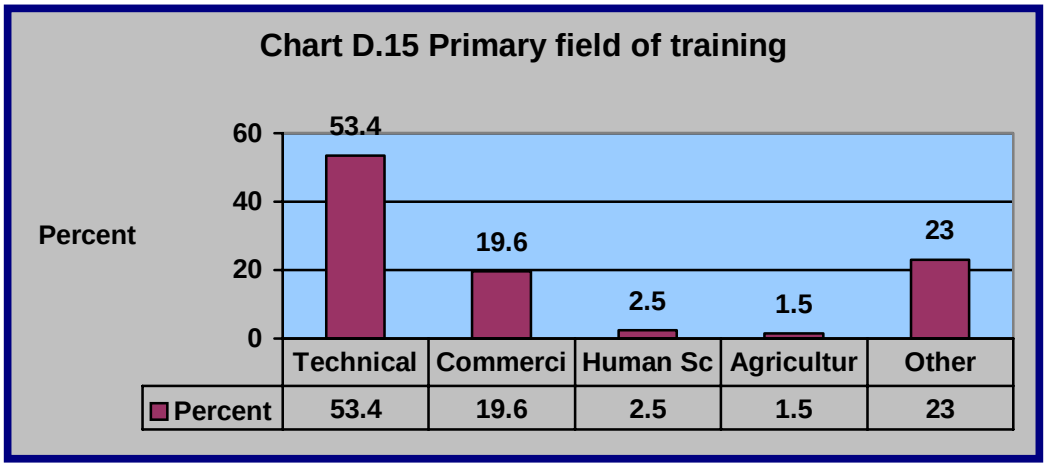


- *Technikon degree (highest)*
- *University B-degree (highest)*
- *University M-degree (highest)*
- *University PhD-degree (highest)*
- *Other (highest)*



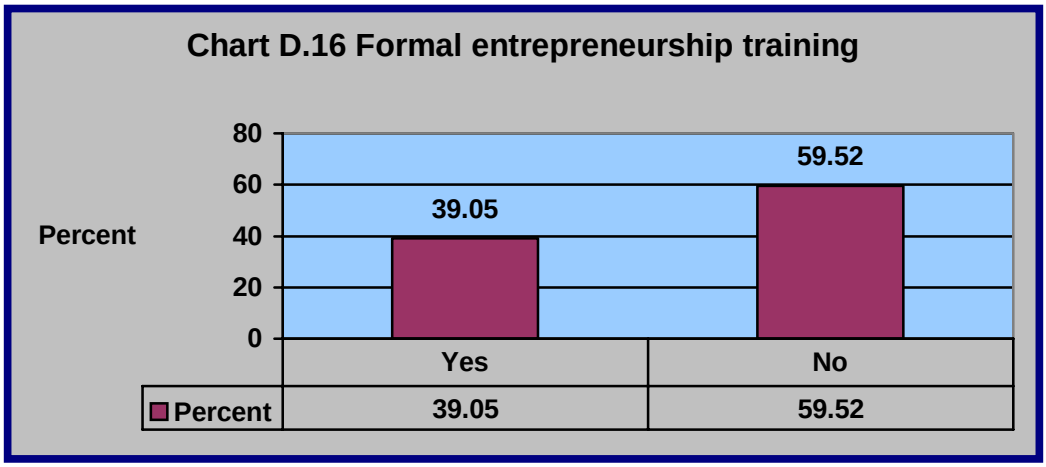
- *School and other: Grades 1-11, grade 12 and other*
- *Technical: Artisan, Technical College certificate, Technikon diploma and degree*
- *University: B-, M- and PhD-degrees*

1.1.11. Primary field of training (V24)

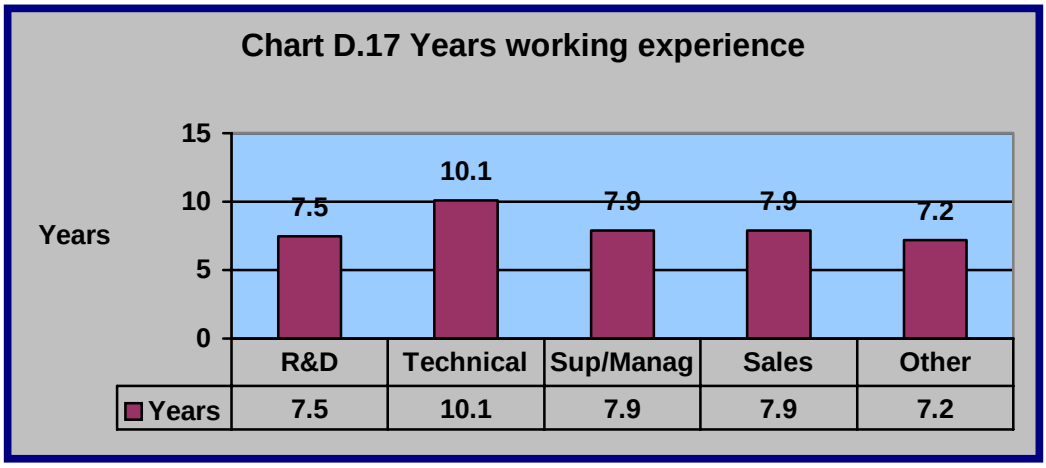


- *Technical*
- *Commercial*
- *Human science*
- *Agriculture*
- *Other*

1.1.12. Formal entrepreneurship training (V25)



1.1.13. Years experience (V26-V30)



Research and Development:

- Standard deviation: 8.7
- Minimum: 0
- Maximum: 30

Technical:

- Standard deviation: 6.8
- Minimum: 0
- Maximum: 30

Supervisory/Managerial:

- Standard deviation: 6.7
- Minimum: 0
- Maximum: 30

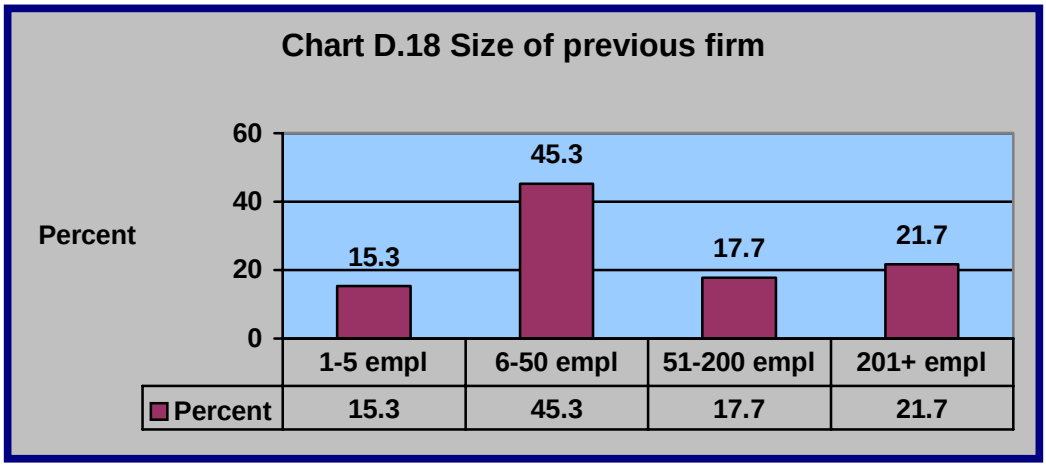
Sales:

- Standard deviation: 7.7
- Minimum: 0
- Maximum: 35

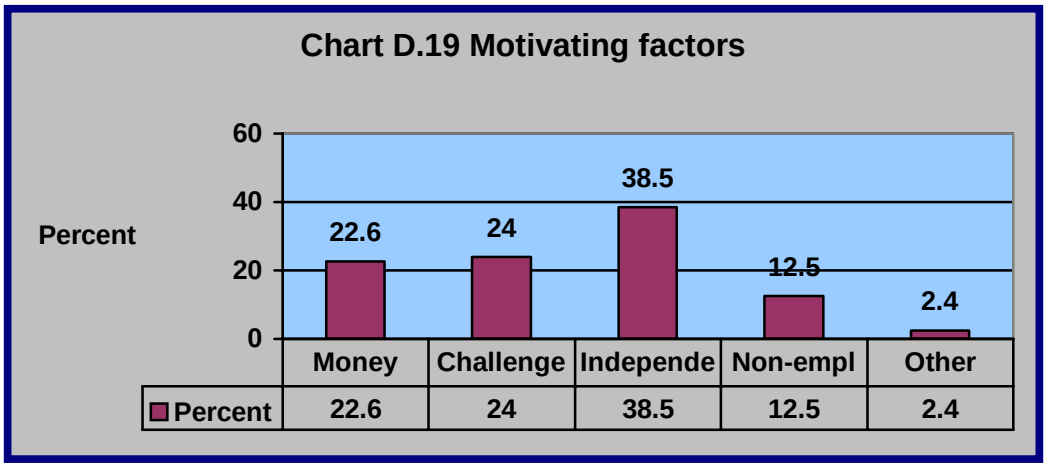
Other:

- Standard deviation: 6.3
- Minimum: 0
- Maximum: 30

1.1.14. Size of previous firm (V31)

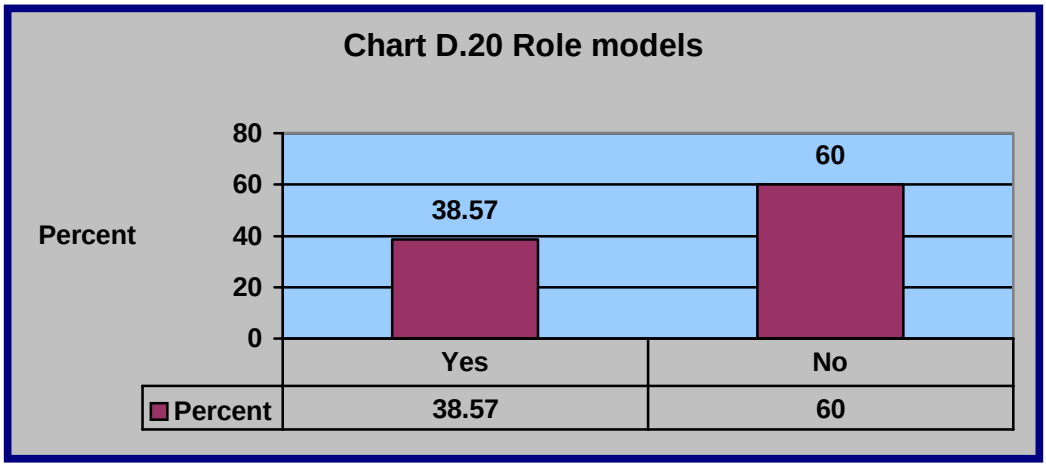


1.1.15. Motivating factors (V32)

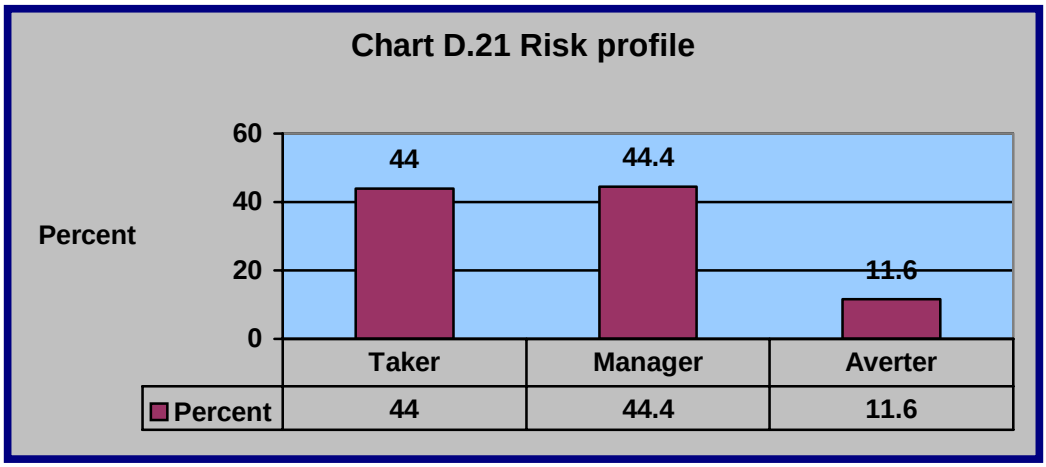


- *Money*
- *Challenge*
- *Independence*
- *Non-employment*
- *Other*

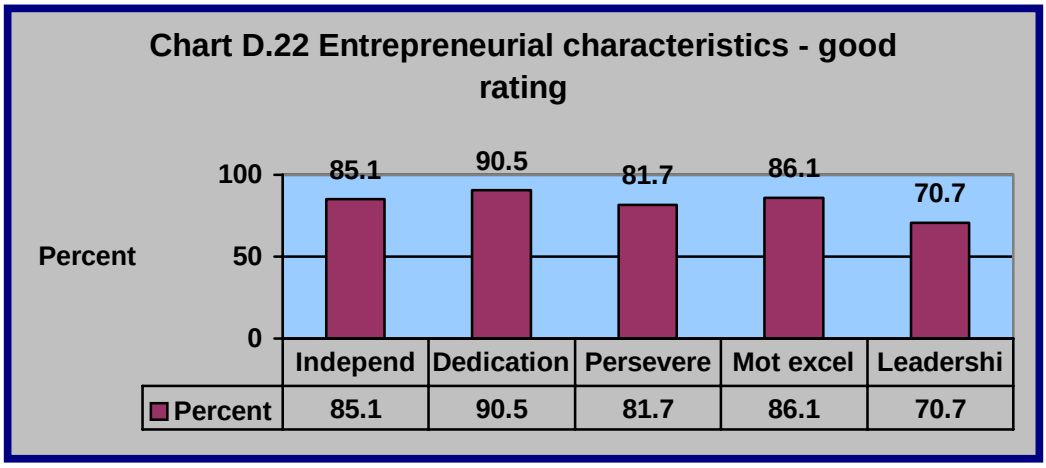
1.1.16. Role models (V33)



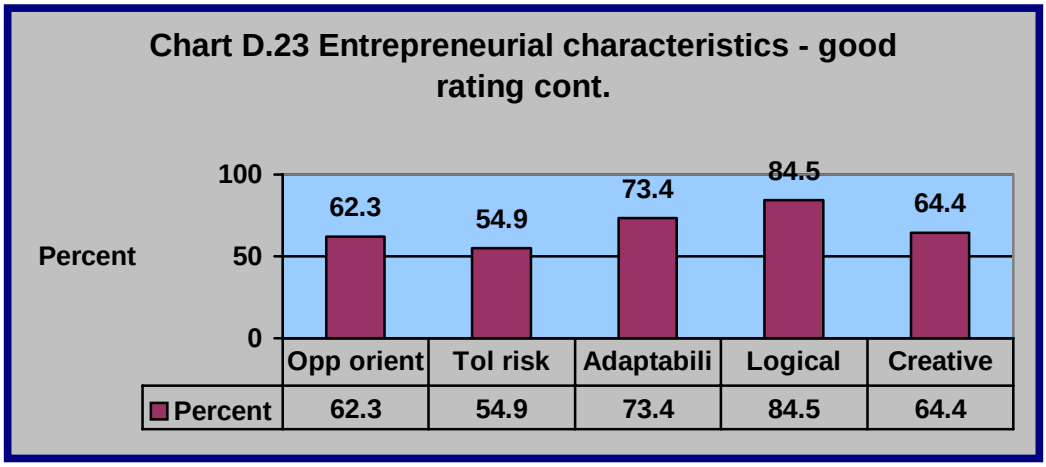
1.1.17. Risk profile (V34)



1.1.18. Entrepreneurial characteristics (V35-V44)

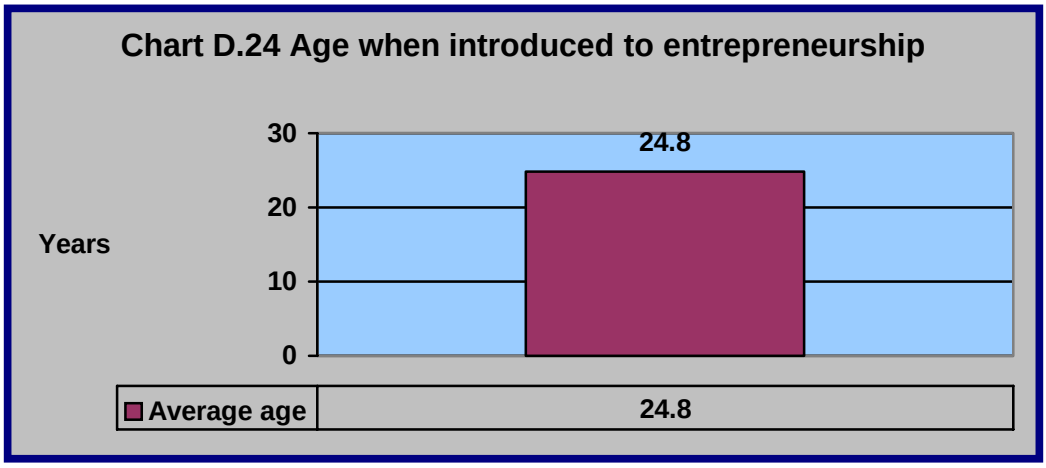


- *Independence*
- *Dedication*
- *Perseverance*
- *Motivation to excel*
- *Leadership*



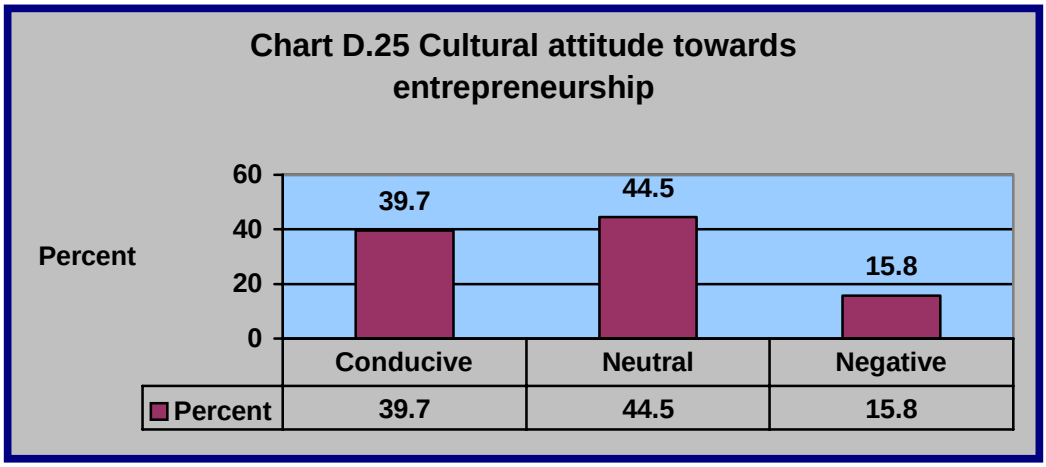
- *Opportunity orientated*
- *Tolerance of risk*
- *Adaptability*
- *Logical*
- *Creative*

1.1.19. Age when introduced to entrepreneurship (V45)



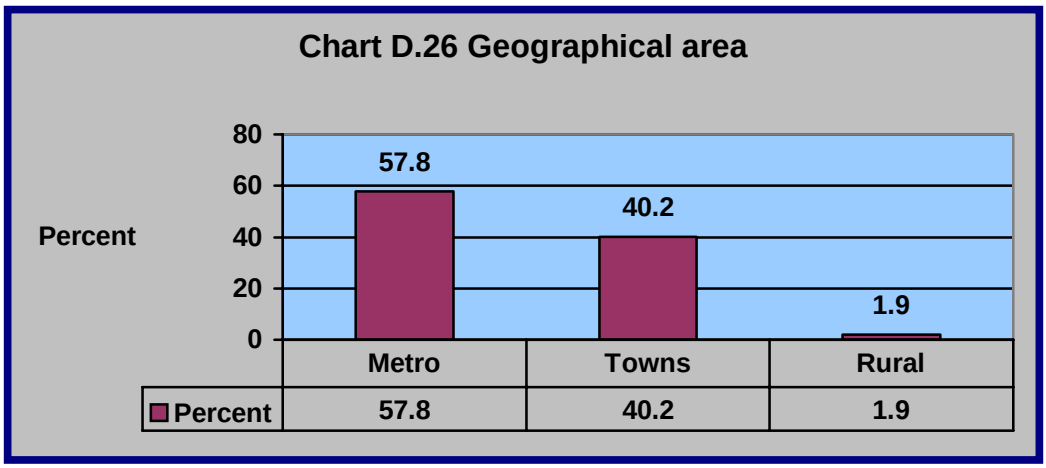
- Standard deviation: 8.0
- Minimum: 7
- Maximum: 55

1.1.20. Cultural attitude towards entrepreneurship (V46)

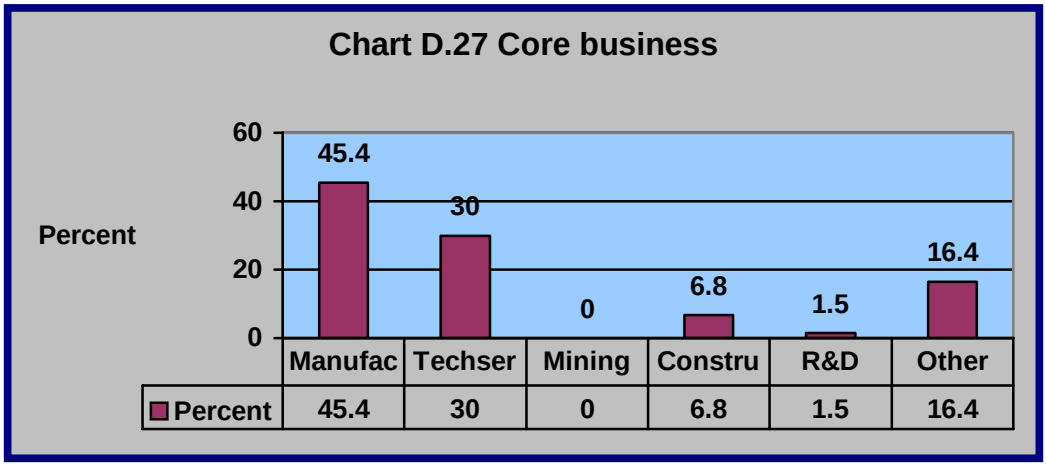


1.2. Enterprise detail

1.2.1. Geographical area (V47)

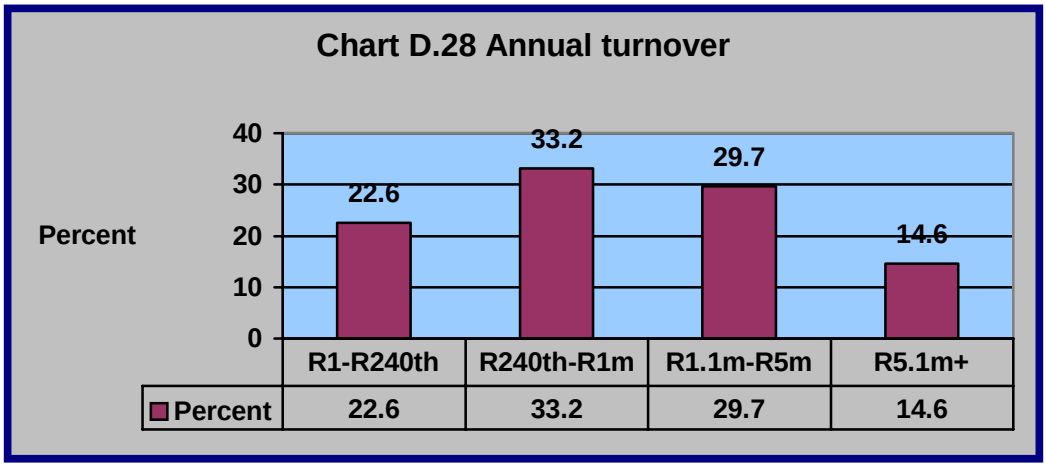


1.2.2. Core business (V48)

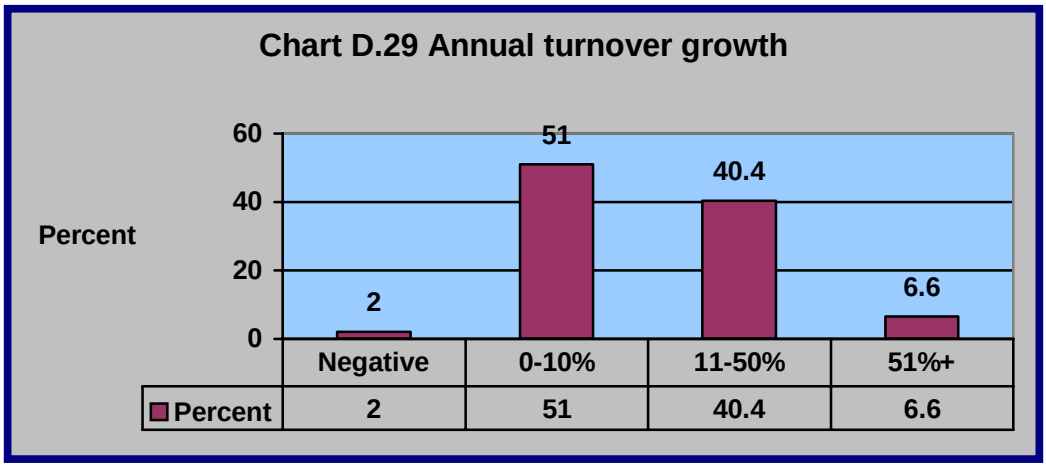


- *Manufacturing*
- *Technical services*
- *Mining*
- *Construction*
- *R & D*
- *Other*

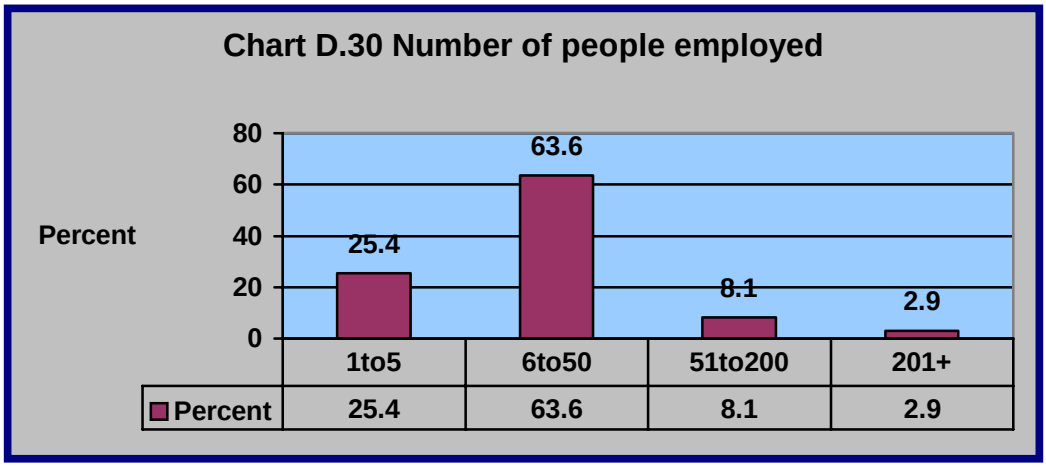
1.2.3. Annual turnover (V49)



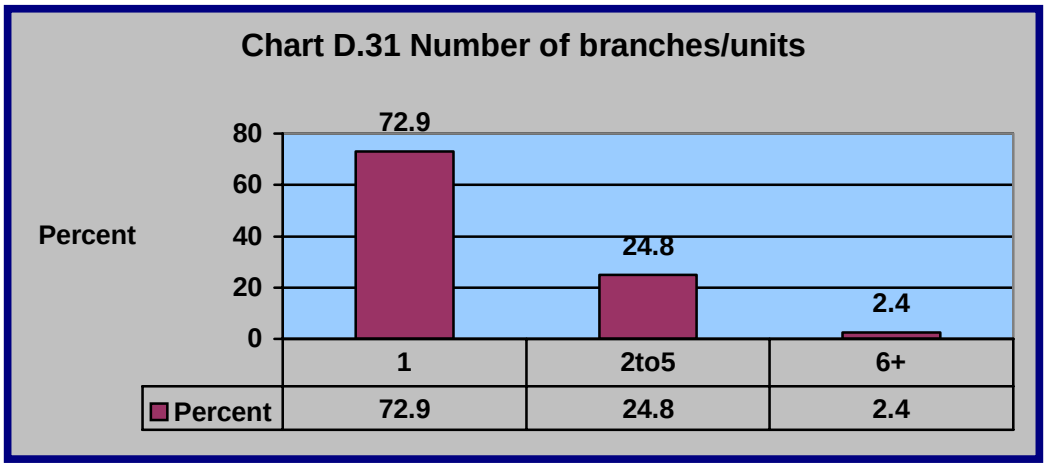
1.2.4. Annual turnover growth (V50)



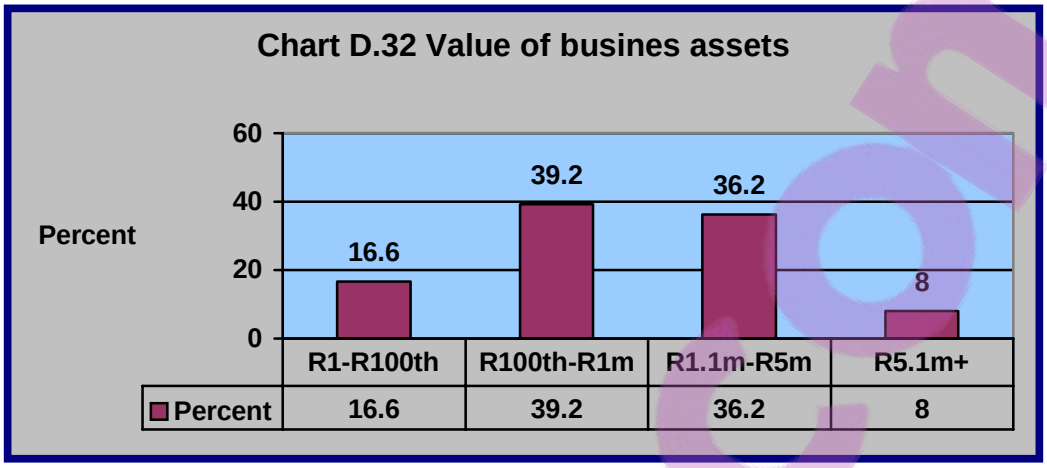
1.2.5. Number of people employed (V51)



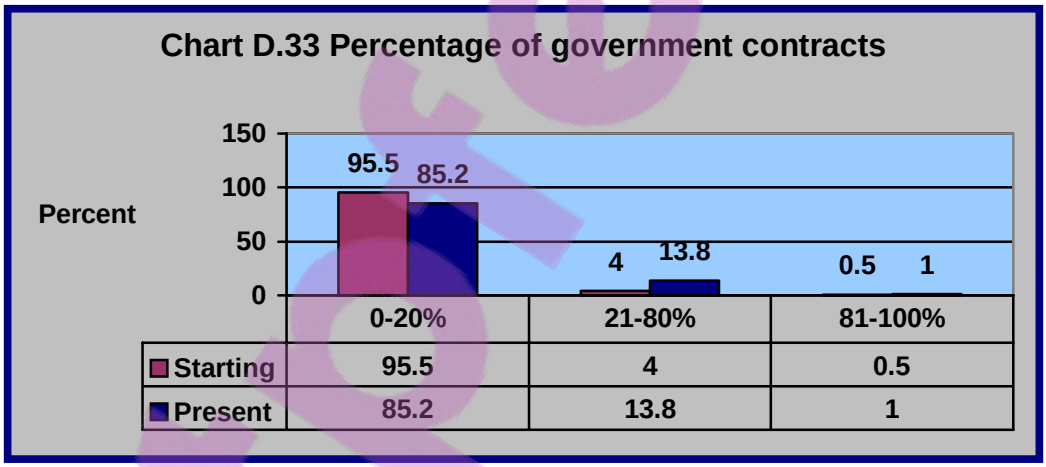
1.2.6. Number of branches/units (V52)



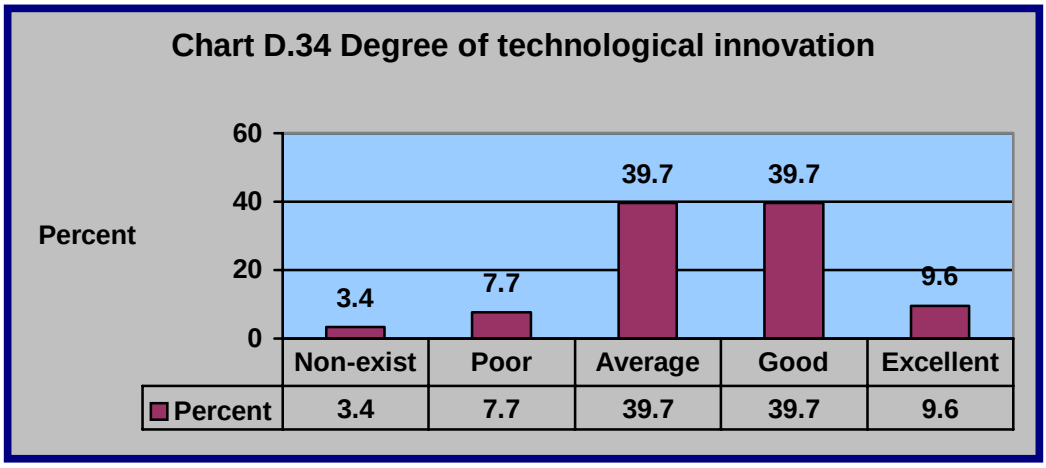
1.2.7. Value of business assets (V53)



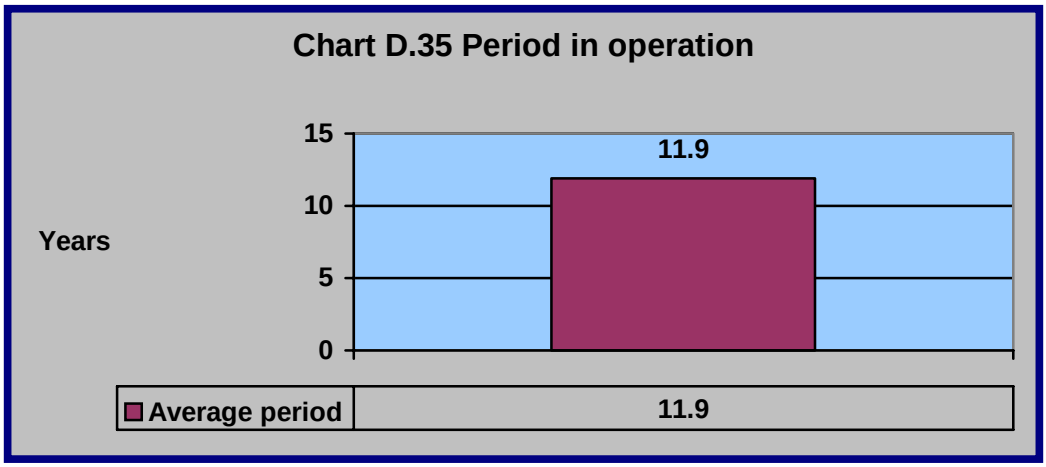
1.2.8. Percentage of Government contracts (V54-V55)



1.2.9. Degree of technological innovation (V56)

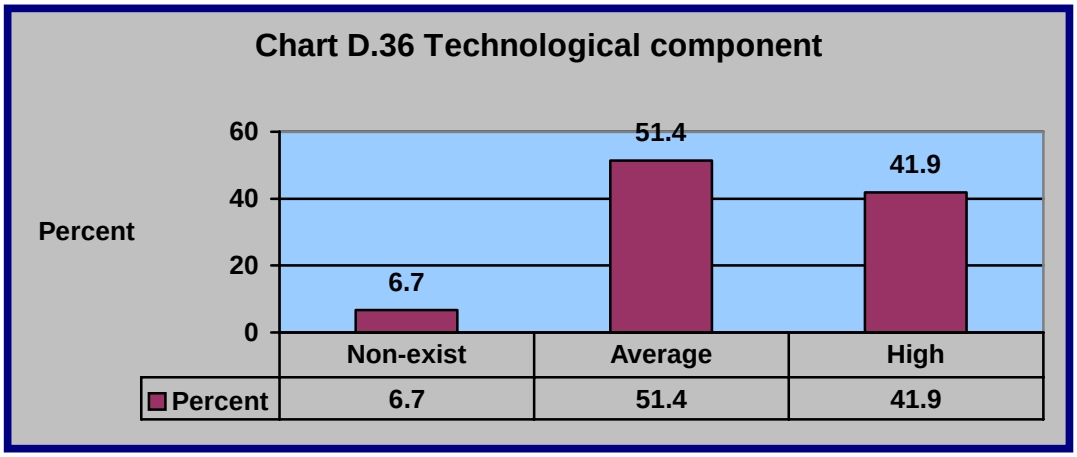


1.2.10. Period in operation (V57)



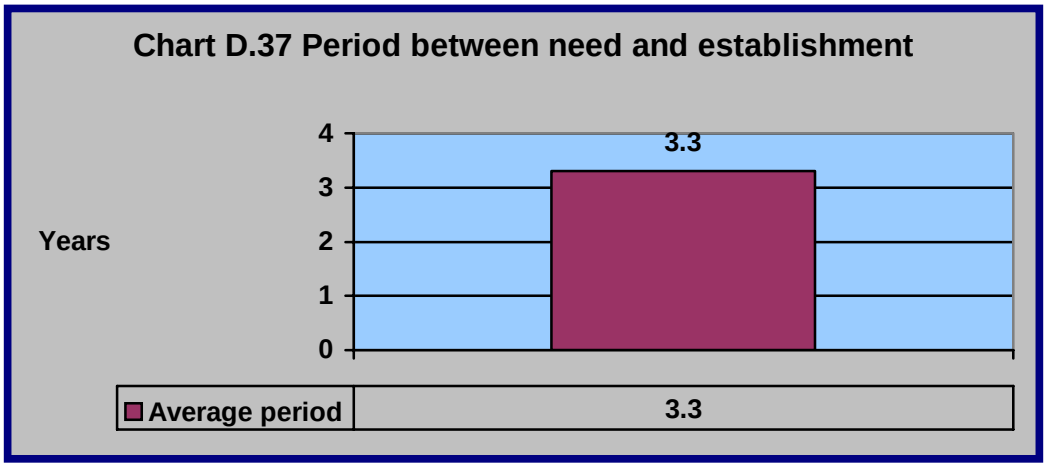
- Standard deviation: 9.4
- Minimum: 1
- Maximum: 57

1.2.11. Technological component (V58)



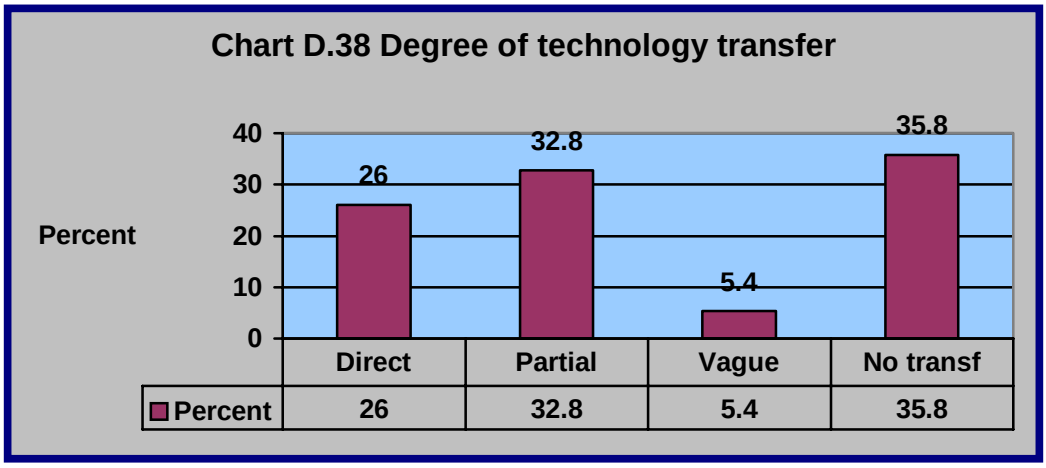
1.3. Formation of new enterprise

1.3.1. Period between need and establishment (V59)

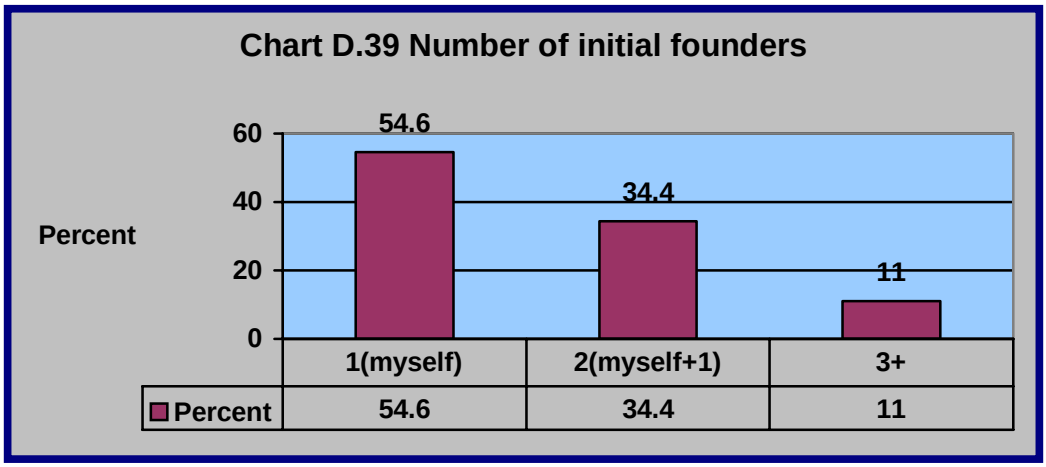


- Standard deviation: 4.0
- Minimum: 0
- Maximum: 25

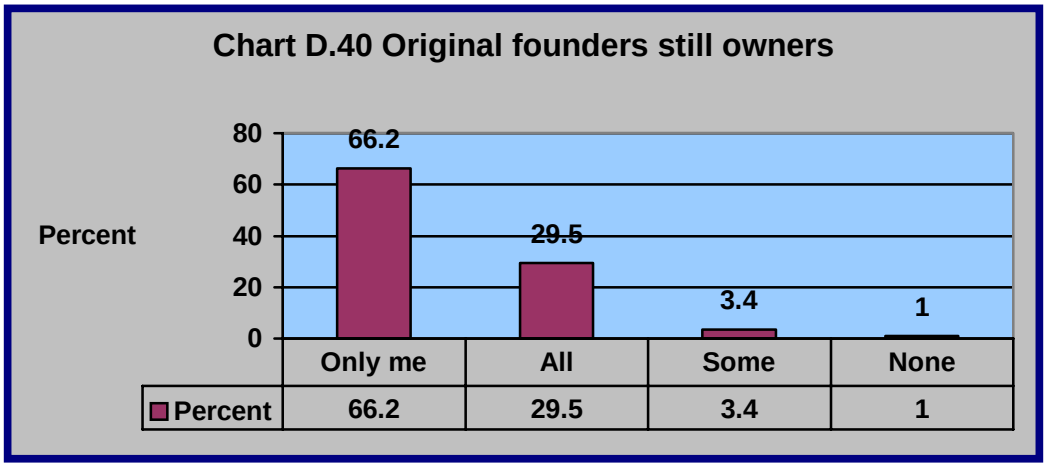
1.3.2. Degree of technology transfer (V60)



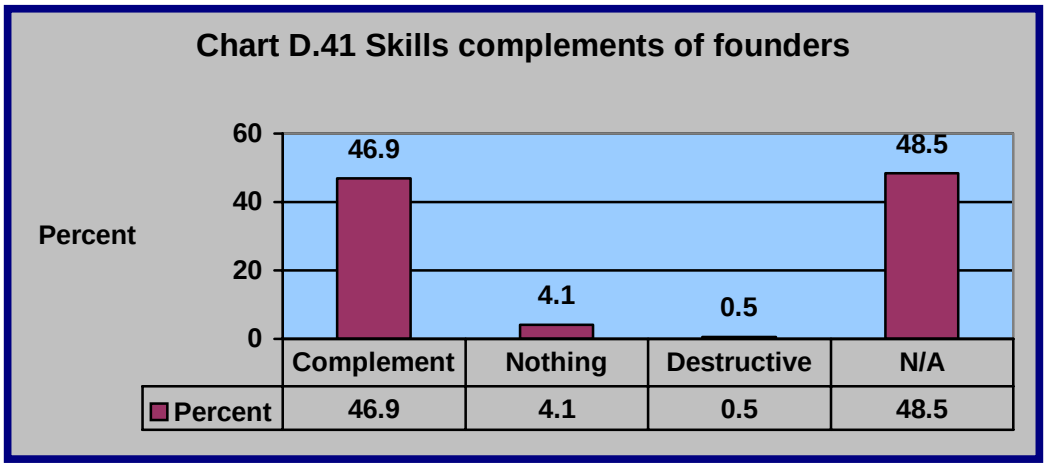
1.3.3. Number of initial founders (V61)



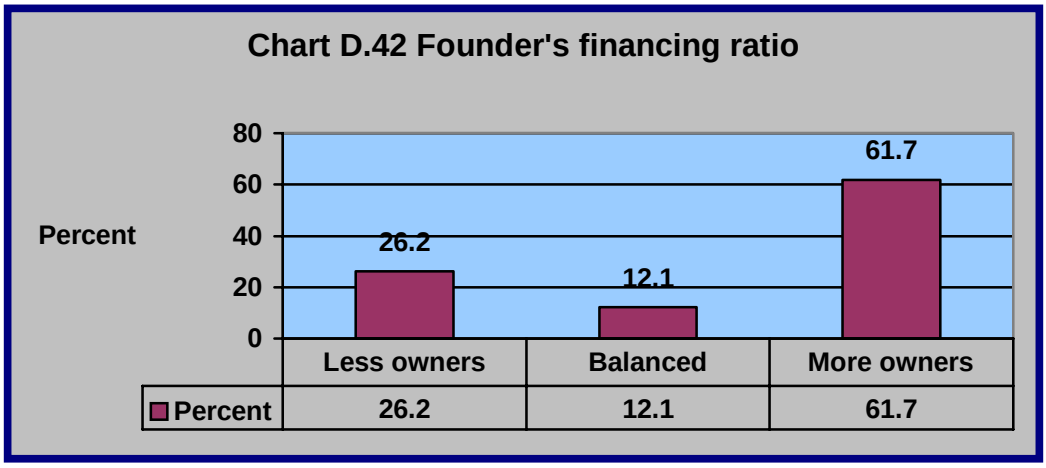
1.3.4. Original founders still owners (V62)



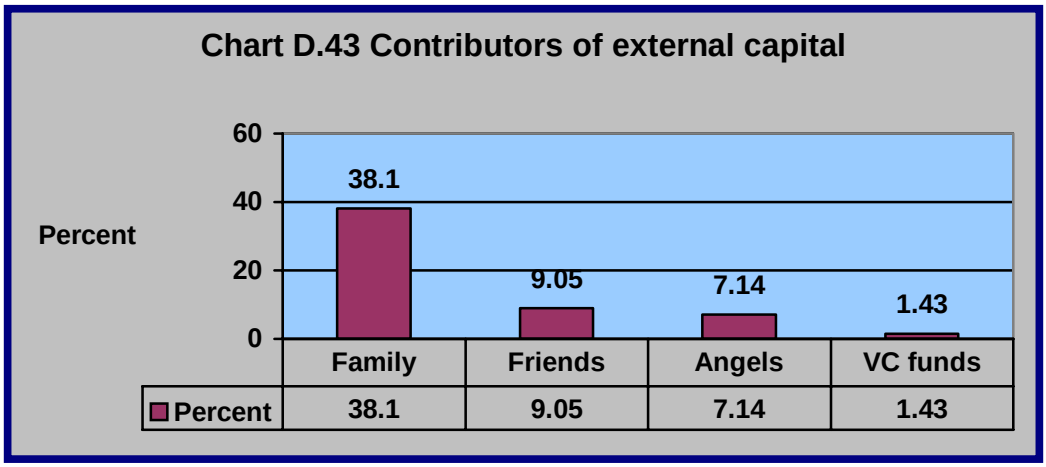
1.3.5. Skills complements of founders (V63)

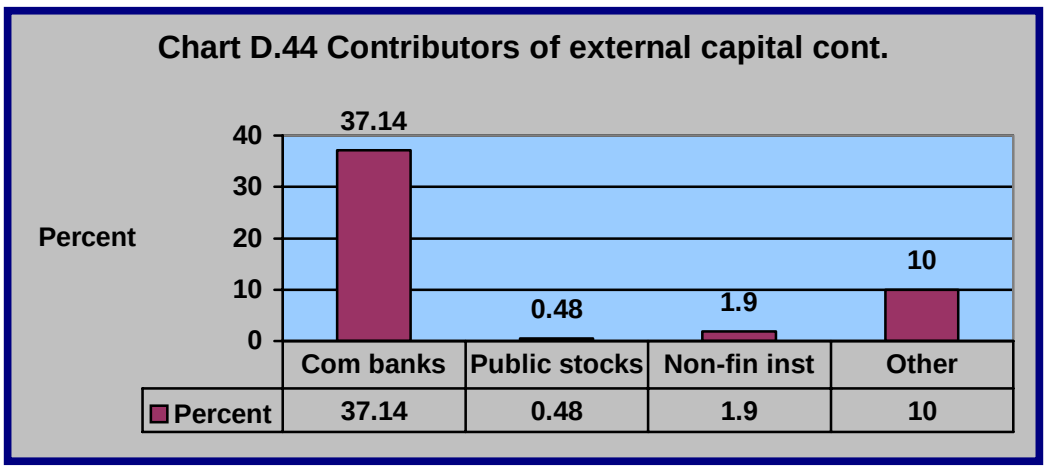


1.3.6. Founders' financing ratio (V64)

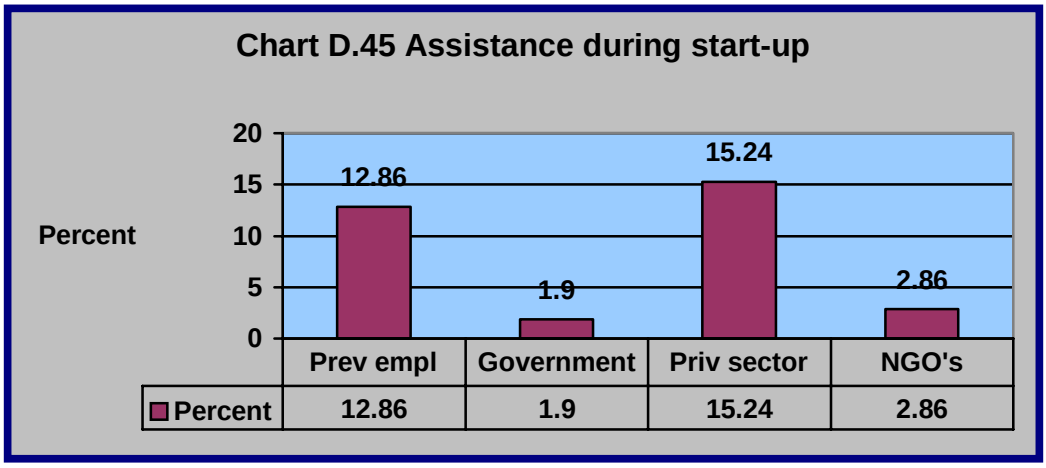


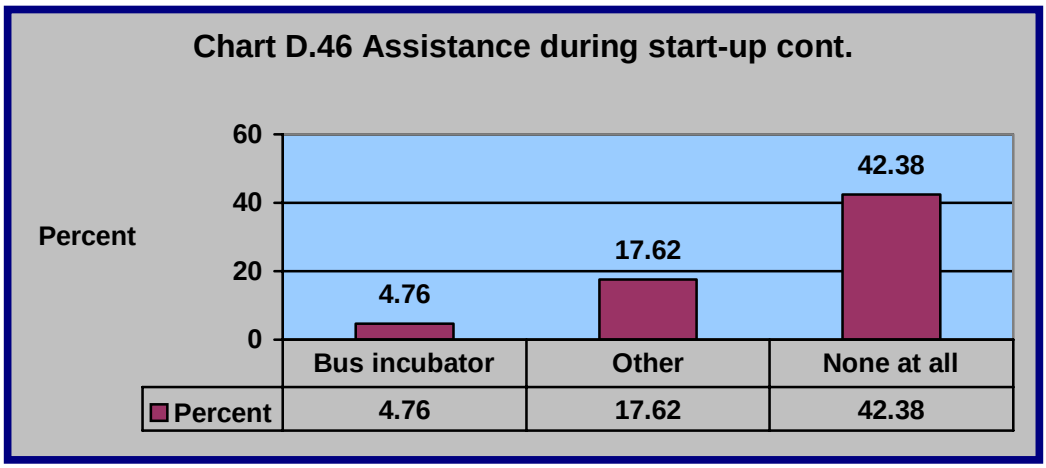
1.3.7. Contributors of external capital (V65-V72)



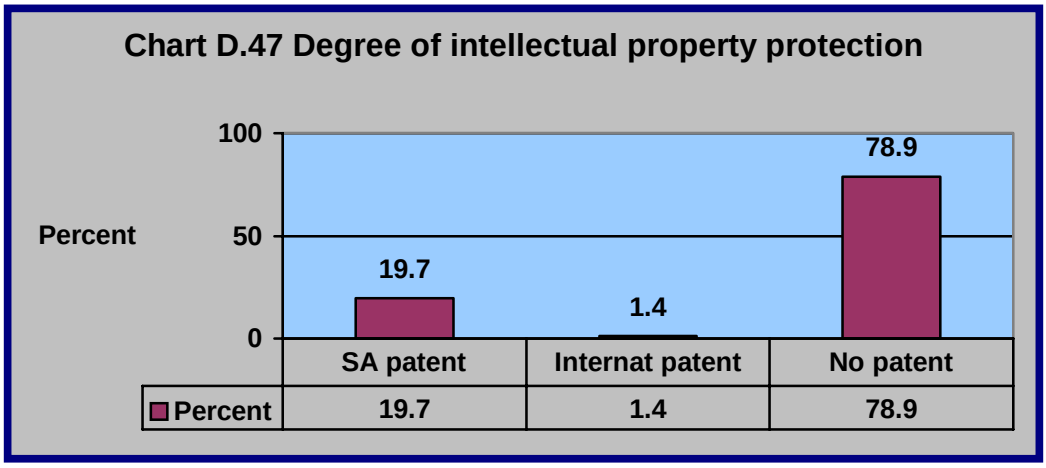


1.3.8. Assistance during start-up (V73-V790



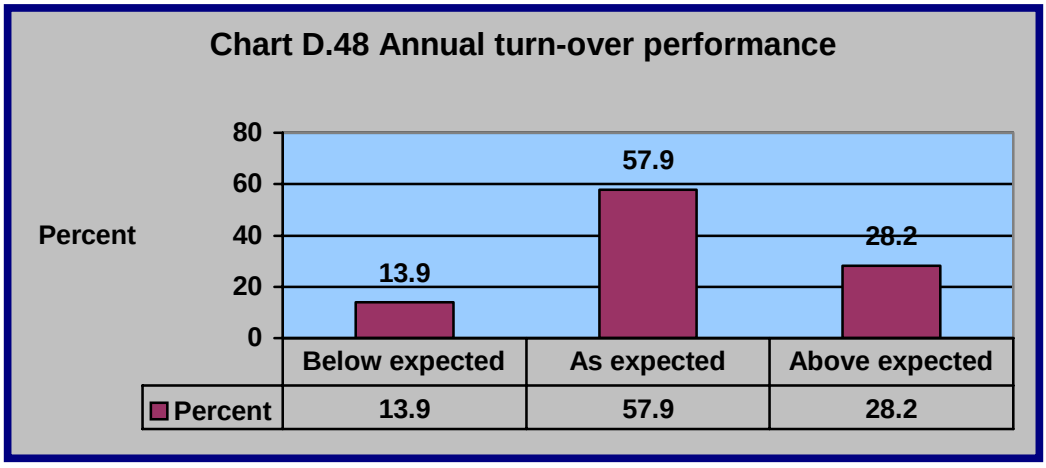


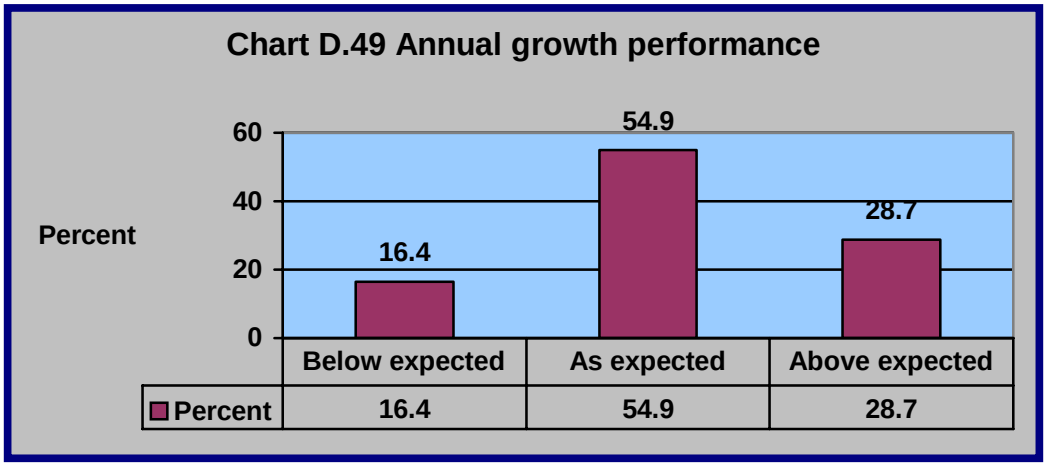
1.3.9. Degree of intellectual property protection (V80)

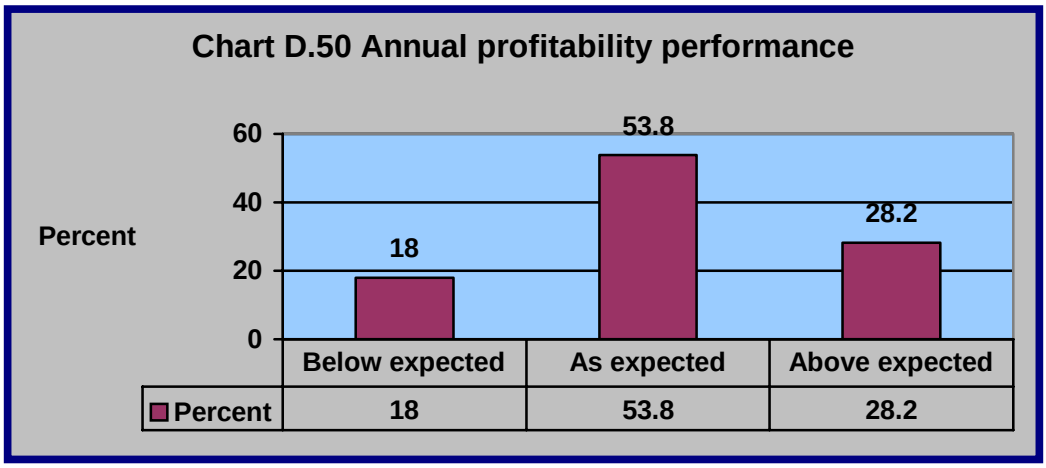


1.4. New enterprise success

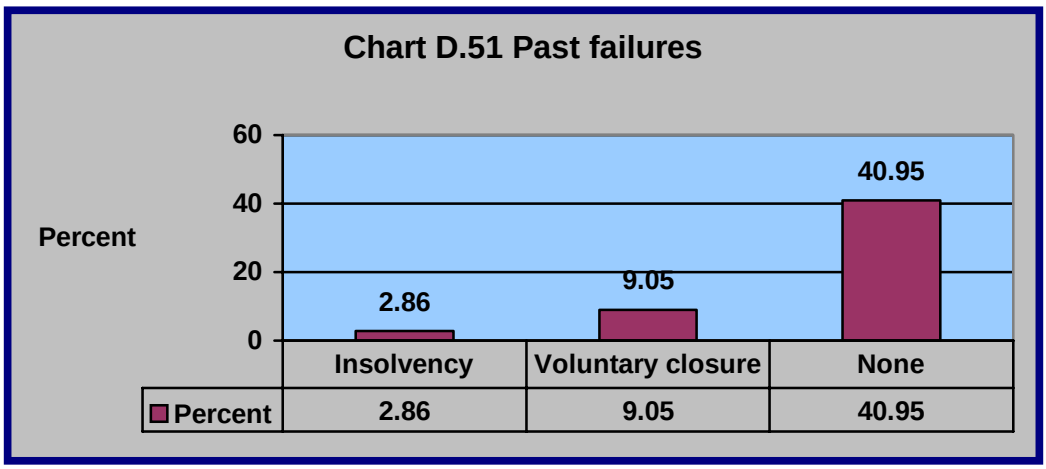
1.4.1. Performance against projections (V81-V83)



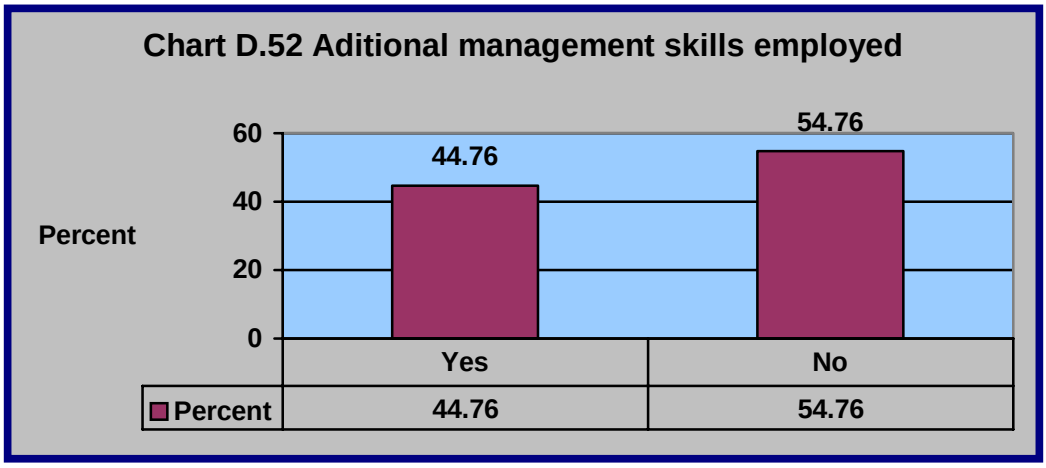




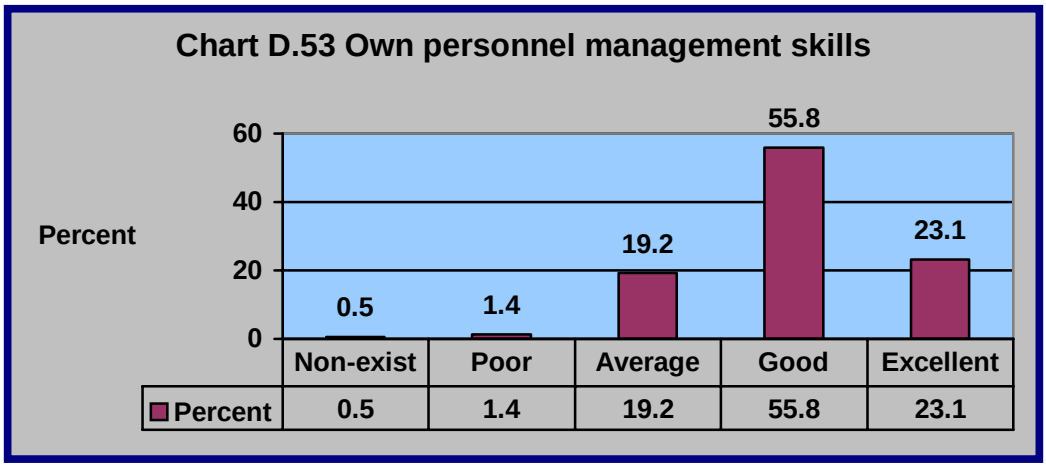
1.4.2. Past failures (V84-V86)



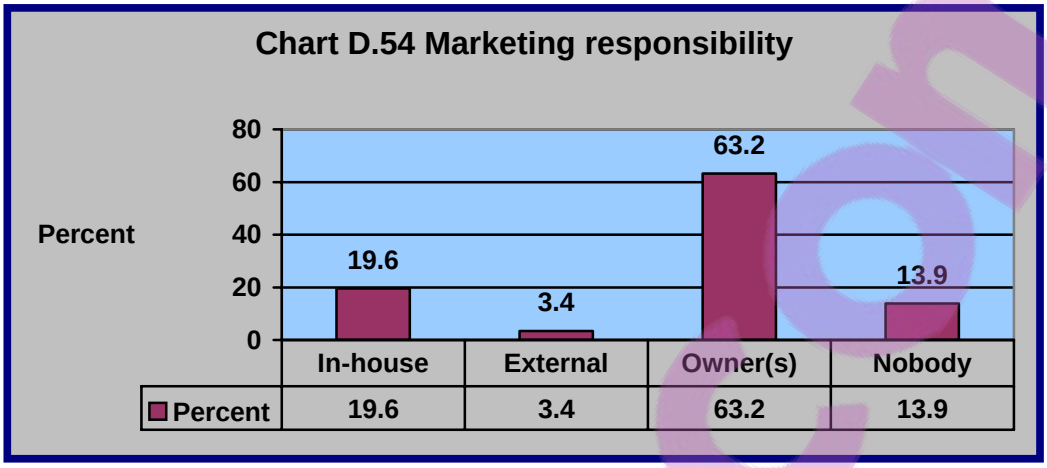
1.4.3. Additional management skills employed (V87)



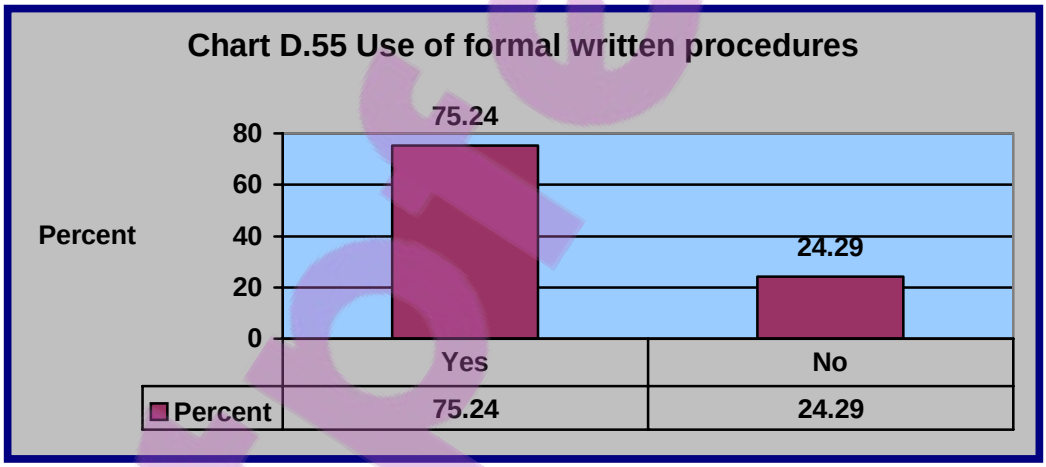
1.4.4. Own personnel management skills (V88)



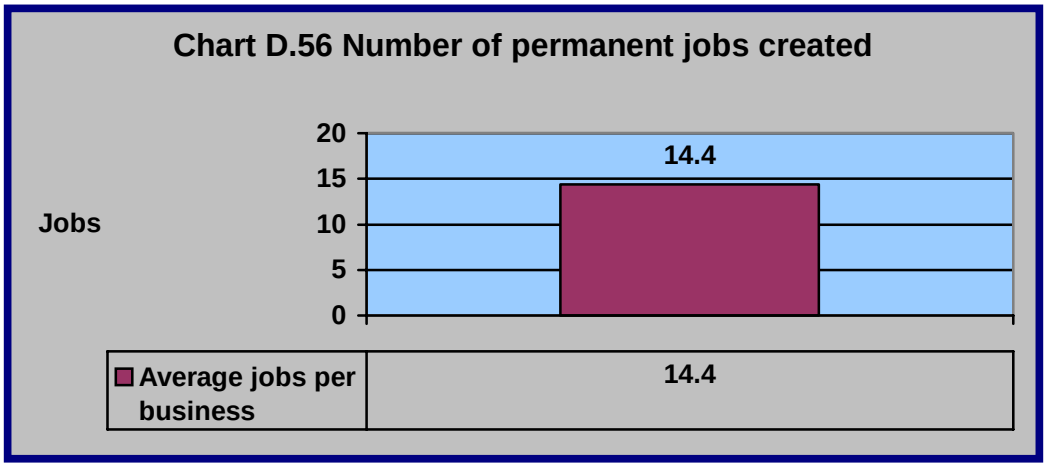
1.4.5. Marketing responsibility (V89)



1.4.6. Use of formal written procedures (V90)

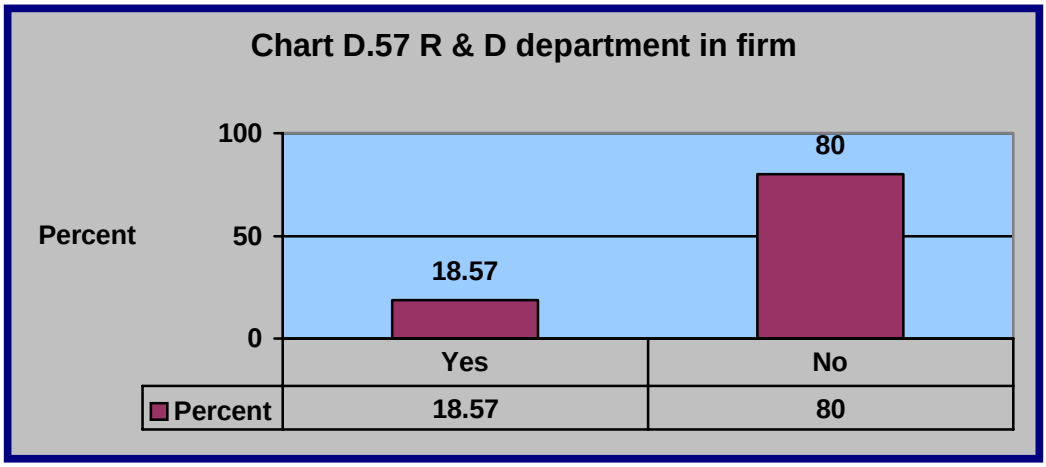


1.4.7. Number of permanent jobs created (V91)

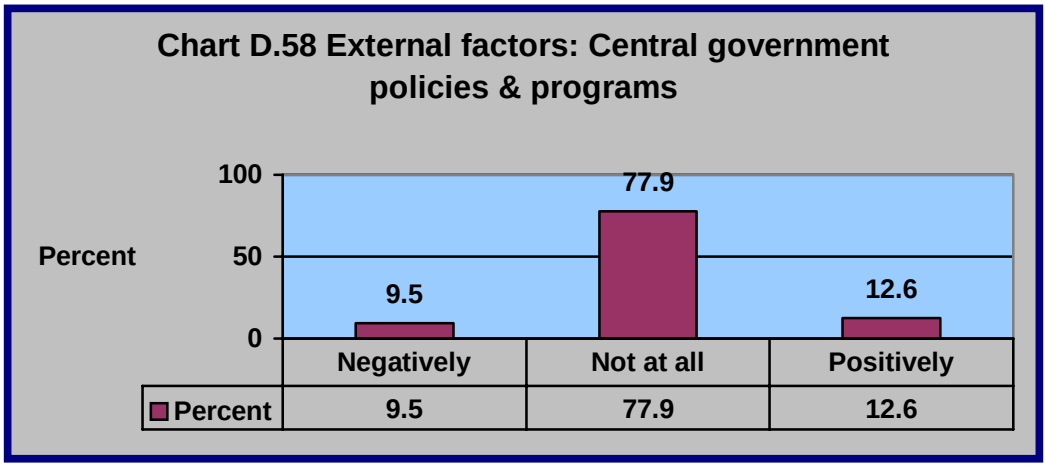


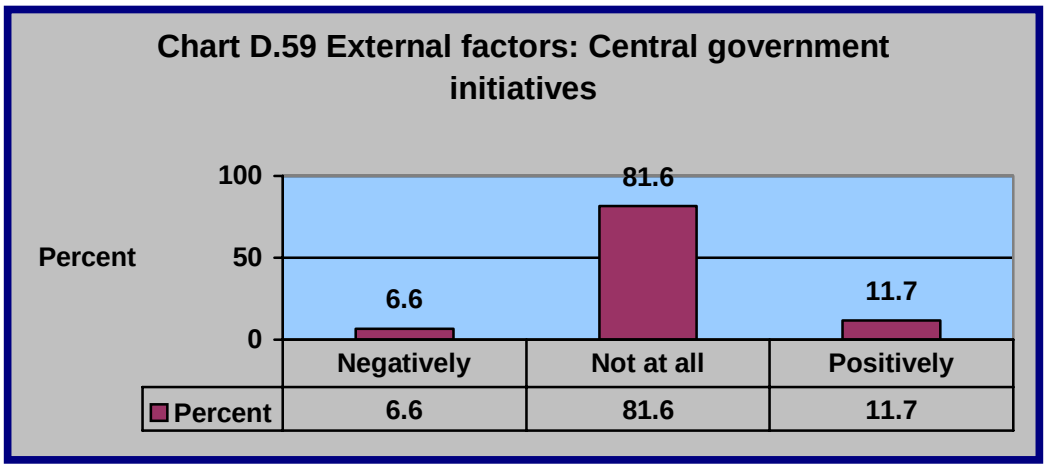
- Standard deviation: 71.6
- Minimum: 0
- Maximum: 1000

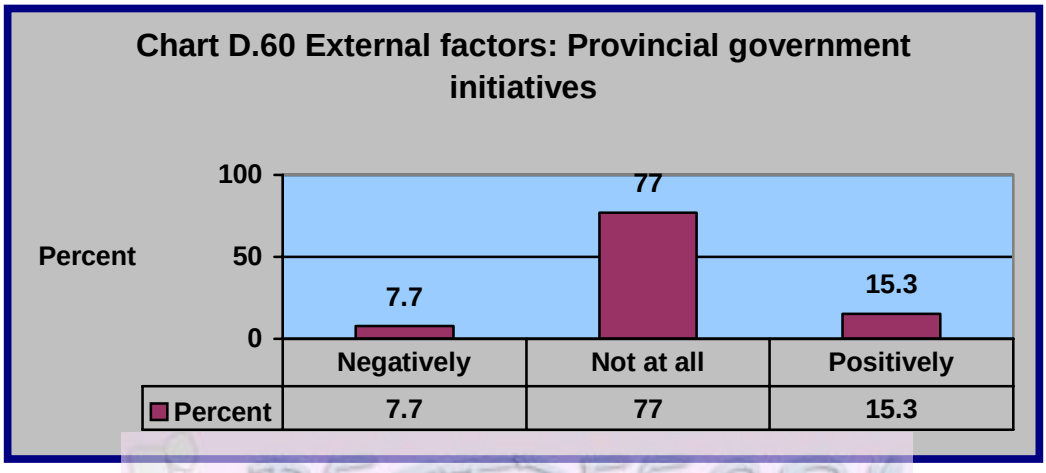
1.4.8. Research and development department in firm (V92)



1.4.9. External factors affecting new business success (V93-V102)







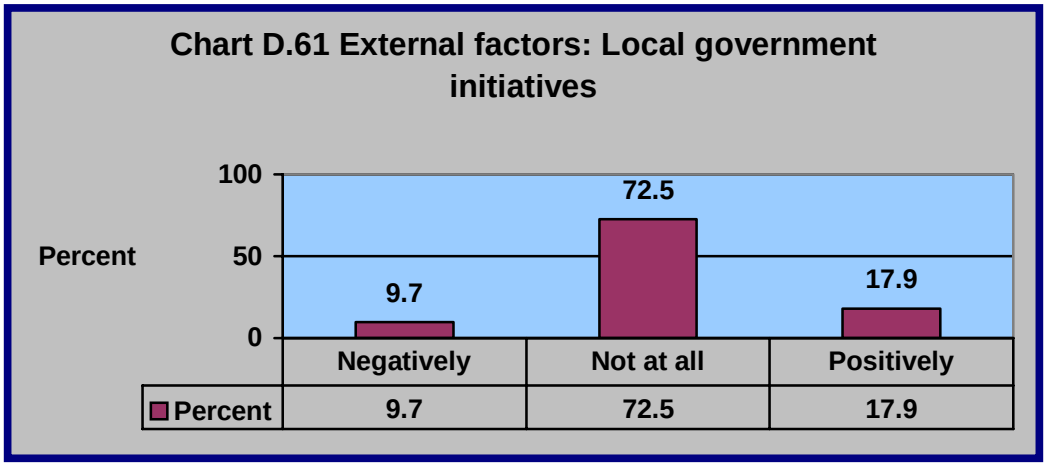


Chart D.61 External factors: Local government initiatives
Percent
100
50
0
9.7
72.5
17.9
Negatively
Not at all
Positively
Percent
9.7
72.5
17.9

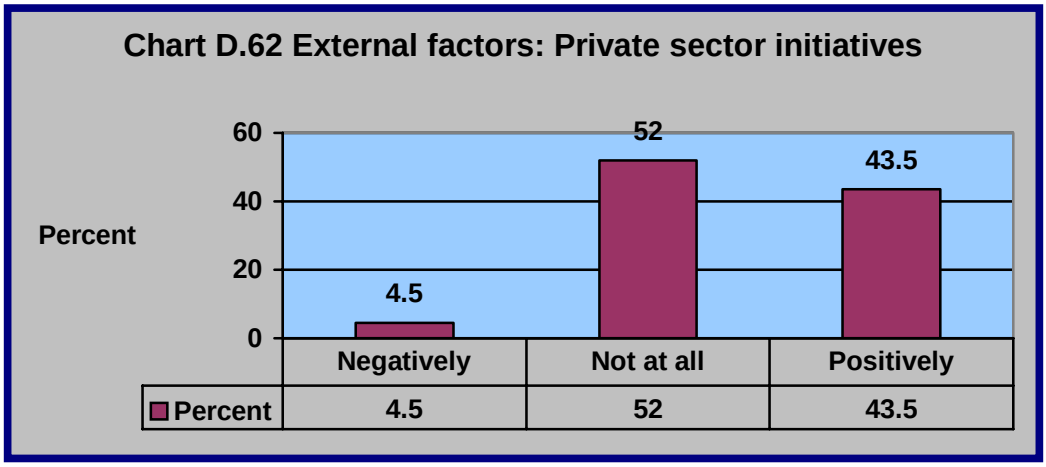


Chart D.62 External factors: Private sector initiatives
Percent
60
40
20
0
4.5
52
43.5
Negatively
Not at all
Positively
Percent
4.5
52
43.5

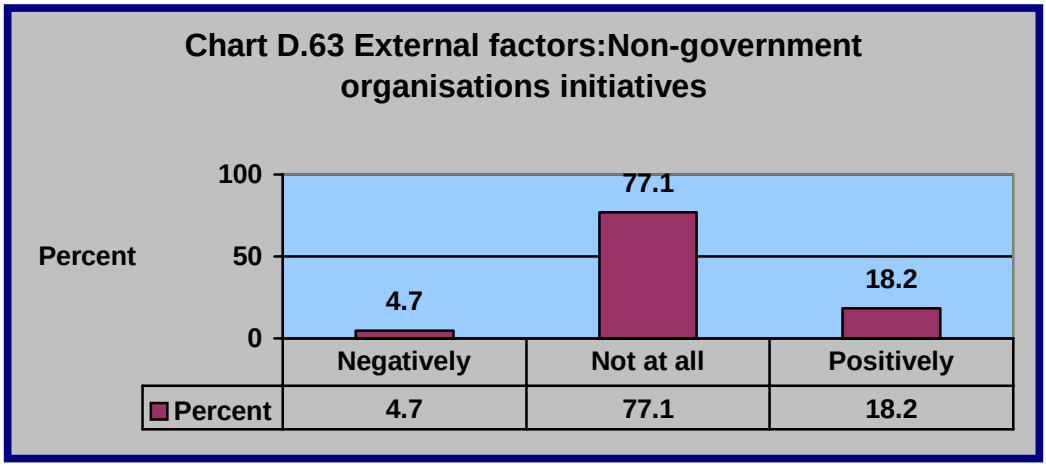


Chart D.63 External factors:Non-government organisations initiatives
Percent
100
50
0
4.7
77.1
18.2
Negatively
Not at all
Positively
Percent
4.7
77.1
18.2

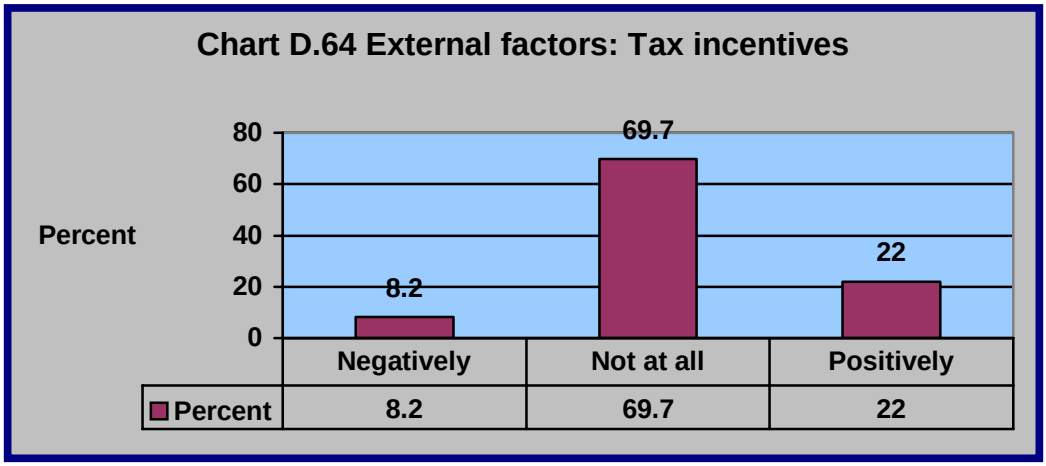


Chart D.64 External factors: Tax incentives
Percent
80
60
40
20
0
8.2
69.7
22
Negatively
Not at all
Positively
Percent
8.2
69.7
22

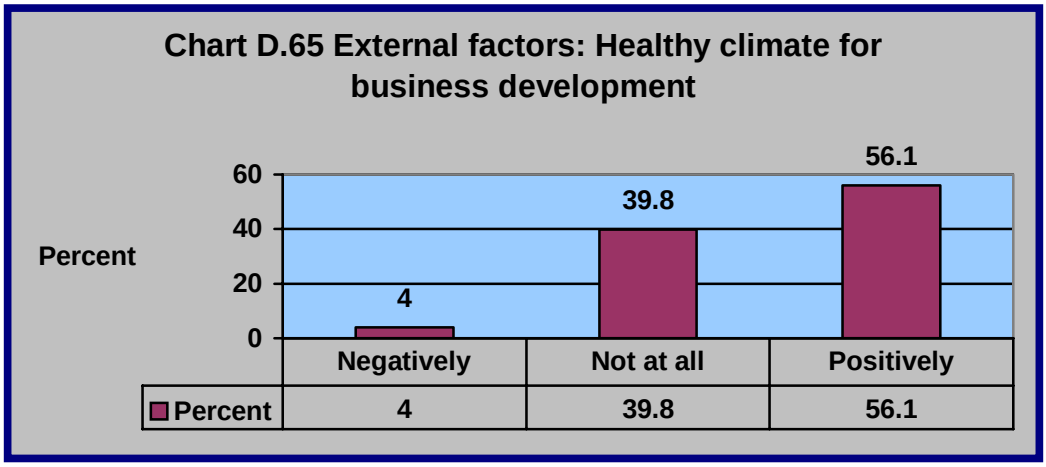


Chart D.65 External factors: Healthy climate for business development
Percent
60
40
20
0
4
39.8
56.1
Negatively
Not at all
Positively
Percent
4
39.8
56.1

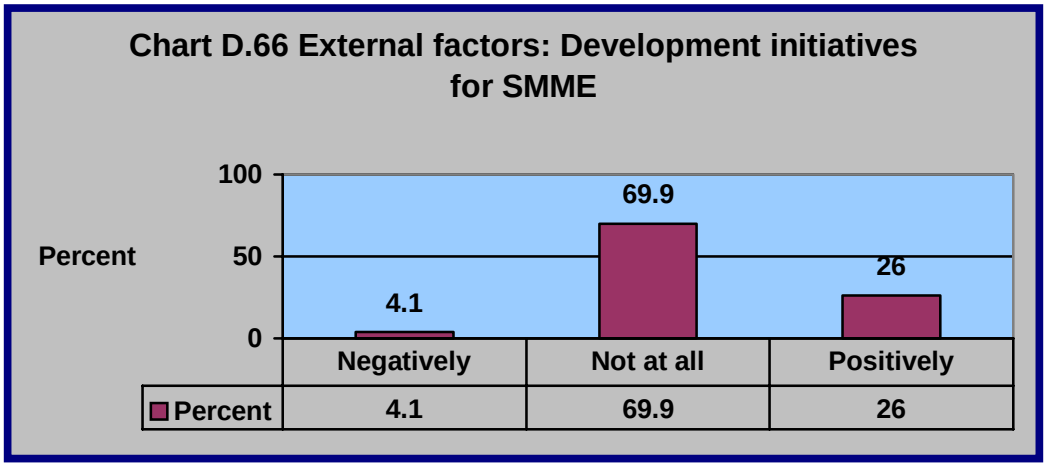


Chart D.66 External factors: Development initiatives for SMME
Percent
100
50
0
4.1
69.9
26
Negatively
Not at all
Positively
Percent
4.1
69.9
26

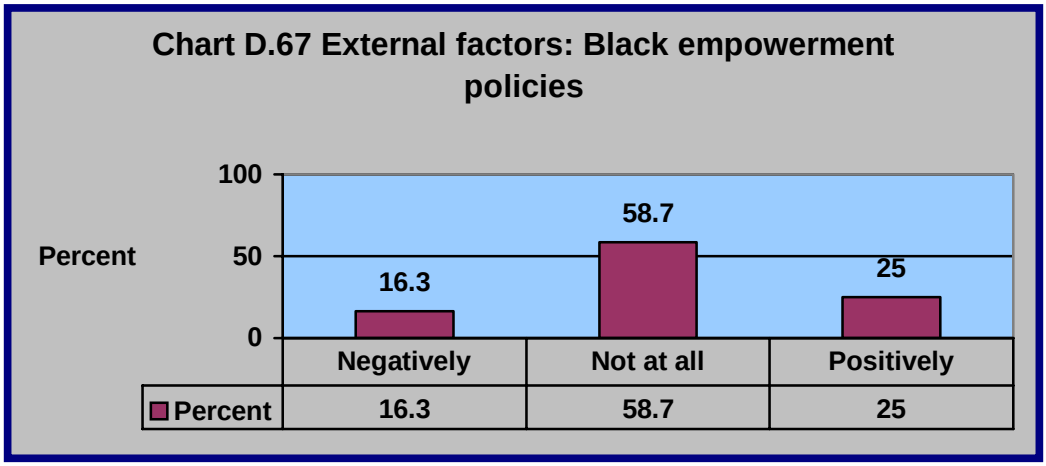
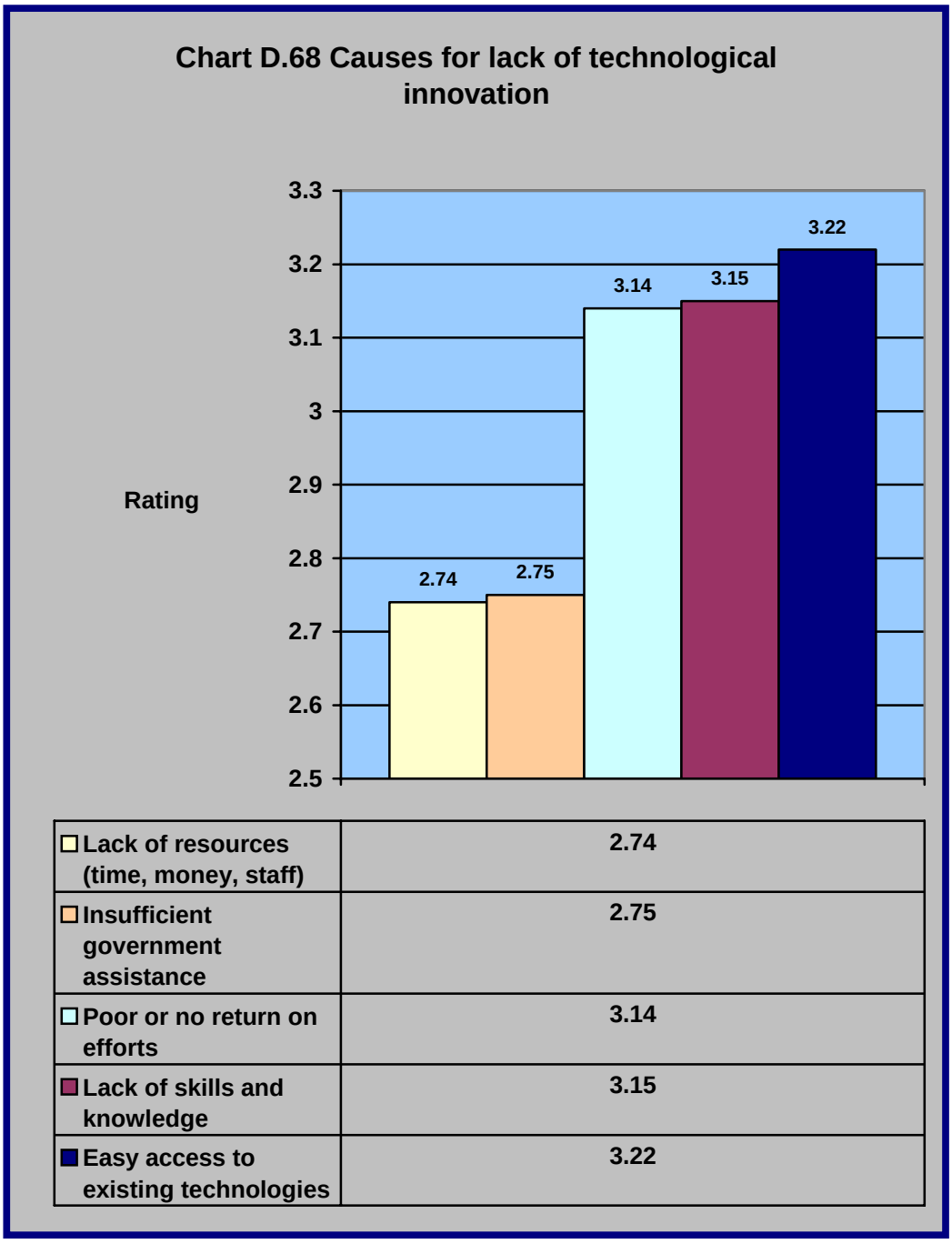


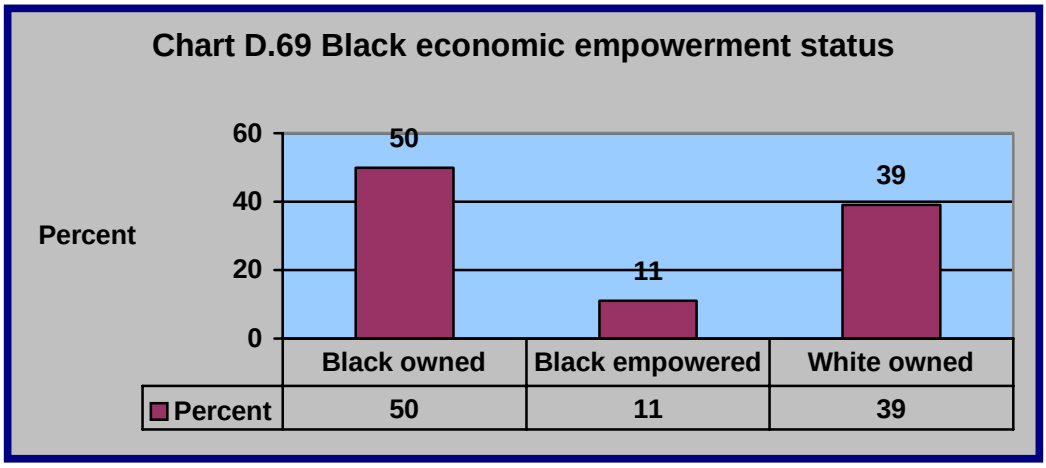
Chart D.67 External factors: Black empowerment policies
Percent
100
50
0
16.3
58.7
25
Negatively
Not at all
Positively
Percent
16.3
58.7
25

1.4.10. Causes for lack of technological innovation in SA firms (V103-V107)

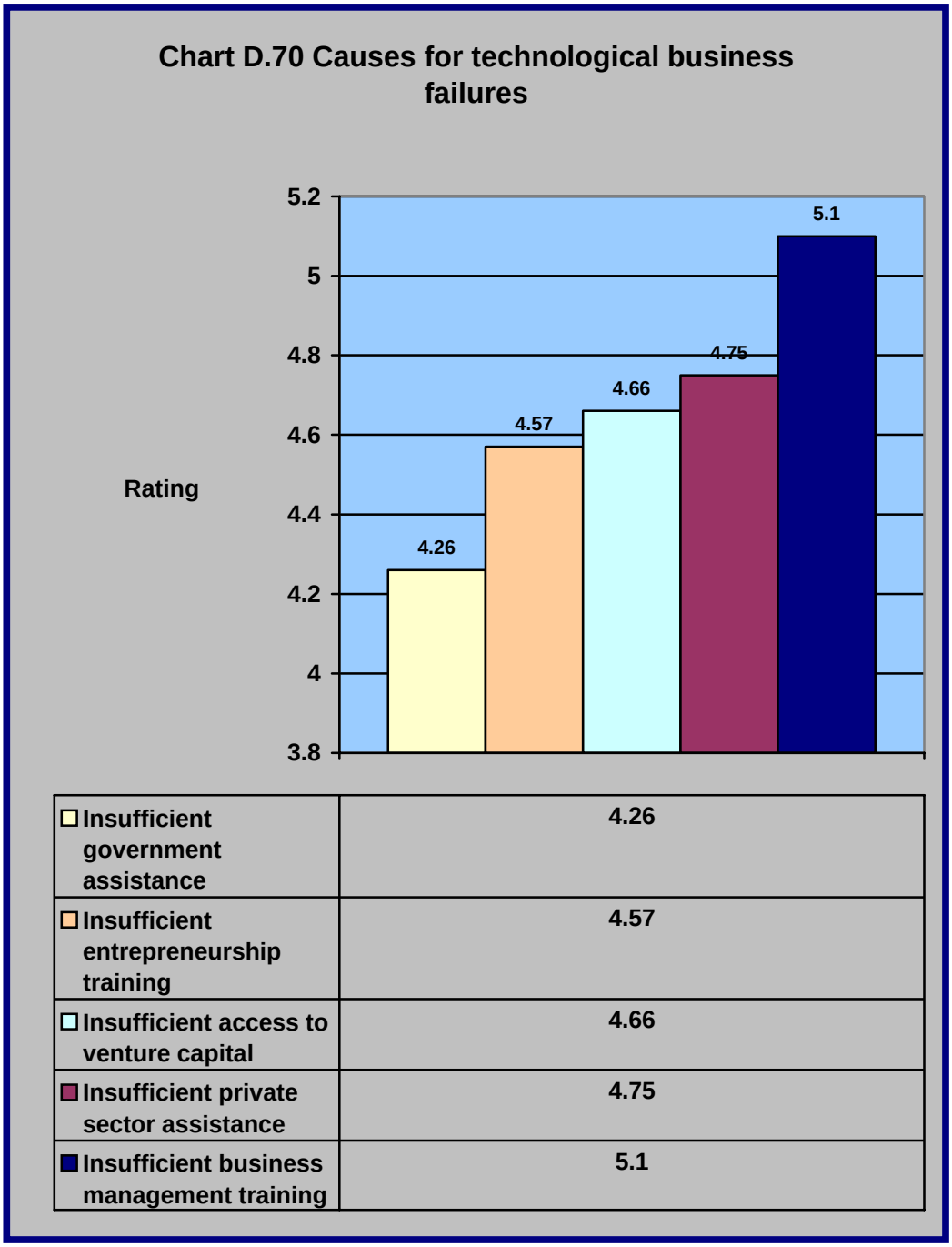


Lack of resources (time, money, staff)	2.74
Insufficient government assistance	2.75
Poor or no return on efforts	3.14
Lack of skills and knowledge	3.15
Easy access to existing technologies	3.22

1.4.11. Black economic empowerment status (V108)

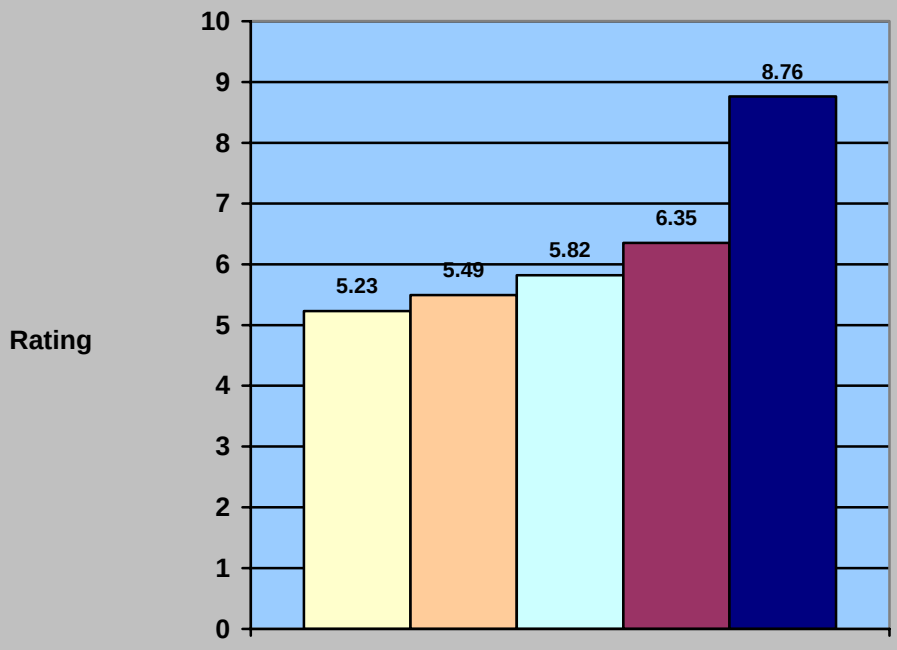


1.4.12. Causes for technological business failures (V109-V118)



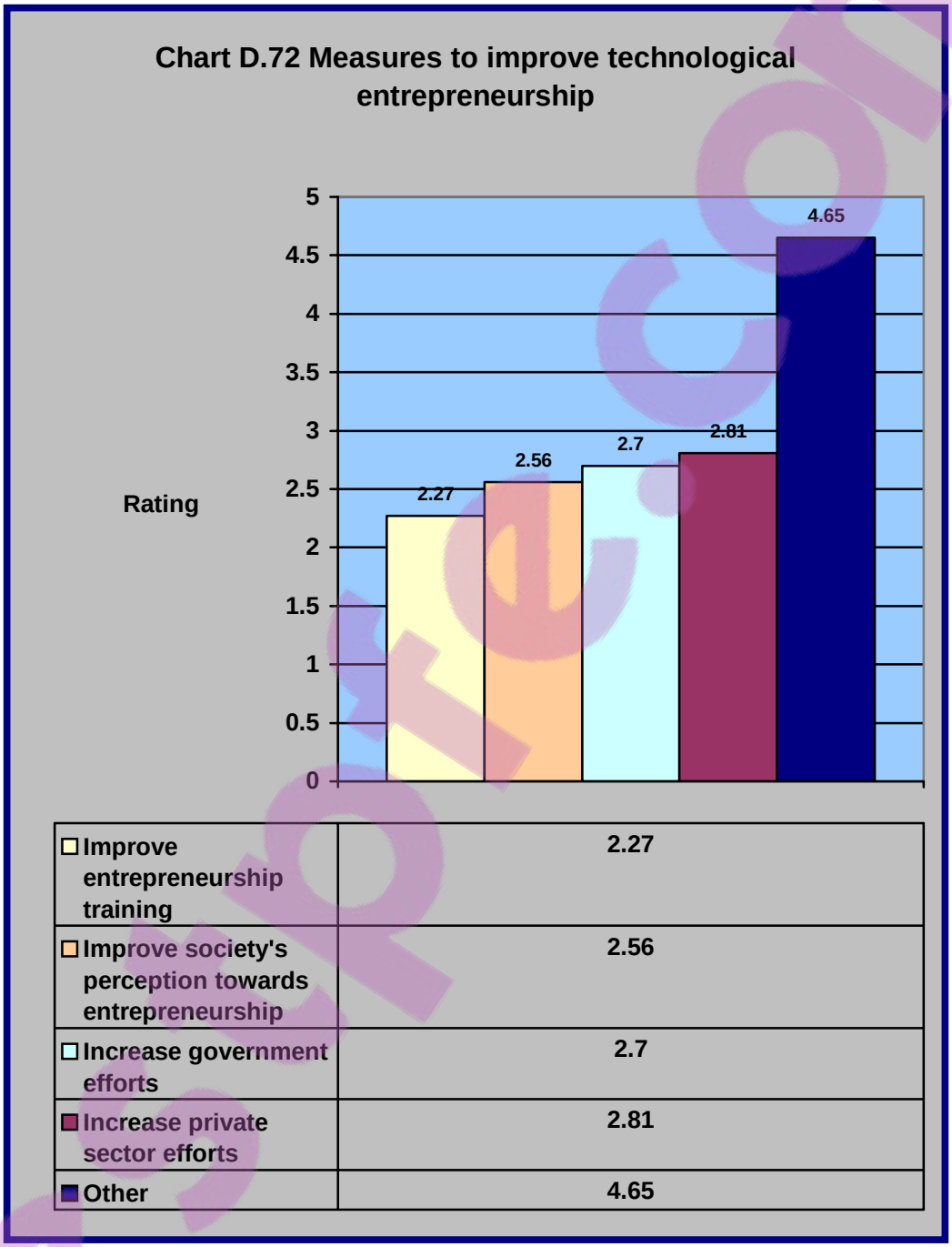
Insufficient government assistance	4.26
Insufficient entrepreneurship training	4.57
Insufficient access to venture capital	4.66
Insufficient private sector assistance	4.75
Insufficient business management training	5.1

Chart D.71 Causes for technological business failures continued



Non-sympathetic culture towards entrepreneurship	5.23
Insufficient availability of mentorship programs	5.49
Insufficient tax incentives	5.82
Racial and sexual discrimination	6.35
Other	8.76

1.4.13. Rating of measures to improve technological entrepreneurship (V124-V128)



Improve entrepreneurship training	2.27
Improve society's perception towards entrepreneurship	2.56
Increase government efforts	2.7
Increase private sector efforts	2.81
Other	4.65

2. CORRELATION ANALYSIS

The independent (predictor) variables listed in the tables below met the 0.2000 significance level for entry into the model, either in the model regression or logistic chi-square techniques.

Furthermore, the independent variables are ranked in order from most significant to least significant correlation i.e. lowest r-square values to highest r-square values.

2.1 Multiple regression results: Entrepreneur

2.1.1 Dependent variable: Age when started new venture (V3) – model linear regression

V-NO	VARIABLE	PARAMETER	PROBABILITY
-	Intercept	7.25	0.0028
V45	Age when introduced to entrepreneurship	0.49	0.0001
V2	Age	0.24	0.0001
vv24	Technical field of training	2.42	0.0081
V32B	Challenge as motivating factor	2.55	0.0412
vv33	Role model	-1.37	0.1679

2.1.2 Dependent variable: Formal training in entrepreneurship (V25) – logistic chi-square

V-NO	VARIABLE	CHI-SQUARE	PARAMETER	PROBABILITY
-	Intercept	1.51	-0.69	0.2198
vv14	Qualification group	6.20	0.54	0.0128
vv5	English language	2.92	-0.75	0.0875

2.1.3 Dependent variable: Motivating factors (V32) – logistic chi-square

V-NO	VARIABLE	CHI-SQUARE	PARAMETER	PROBABILITY
-	Intercept	0.03	0.07	0.8524
V34	Risk profile	10.73	-0.67	0.0011
vv24	Technical field of training	3.60	-0.52	0.0577

2.1.4 Dependent variable: Role model (V33) – logistic chi-square

V-NO	VARIABLE	CHI-SQUARE	PARAMETER	PROBABILITY
-	Intercept	4.28	1.55	0.0385
vv4	Gender	6.54	-1.58	0.0105
V46	Attitude of culture	4.72	-0.52	0.0299
vv11	Father and mother self-employed	4.26	0.74	0.0390
vv25	Formal training in entrepreneurship	1.83	0.44	0.1766

2.1.5 Dependent variable: Risk profile (V34) – model linear regression

V-NO	VARIABLE	PARAMETER	PROBABILITY
-	Intercept	1.53	0.0001
vv4	Gender	-0.26	0.0674
vv5	English language	0.34	0.1038
V7B	Indian race	-0.44	0.0328
V8	Position as child in the family	0.06	0.1001
vv11	Father and mother self-employed	0.19	0.1450
V6A	Christian religion	0.24	0.1370

2.1.6 Dependent variable: Entrepreneurial characteristics (V35-44) – model linear regression

V-NO	VARIABLE	PARAMETER	PROBABILITY
-	Intercept	2.62	0.0001
V7B	Indian race	0.07	0.1341
V6B	Hindu religion	-0.08	0.1341
vv4	Gender	0.09	0.1815

2.1.7 Dependent variable: Age introduced to entrepreneurship (V45) – model linear regression

V-NO	VARIABLE	PARAMETER	PROBABILITY
-	Intercept	11.84	0.0001
V2	Age	0.25	0.0001
vv11	Father and mother self-employed	-4.55	0.0001
V46	Attitude of culture	1.27	0.0915

2.1.8 Dependent variable: Attitude of culture (V46) – model linear regression

None of the independent variables met the 0.2000 significance level for entry into the model and therefore ***no correlation*** was found between attitude of culture and any of the independent variables chosen.

2.1.9. Scaling of variables: Entrepreneur

V-no	Predictor (X)	Scaling	Parameter	Predicted (Y)	Scaling
V45	Age introduced	1-75	0.50	**Age started V3**	**1-75**
V2	Age	1-75	0.24		
Vv24	Technical training	Other = 0 TT = 1	2.42		
V32B	Challenge	Other = 0 Chal = 1	2.55		
Vv33	Role model	No = 0 Yes = 1	-1.37		
Qual	Qualifications	Sch = 1 Tech = 2 Univ = 3	0.54	**Entrepreneur training V25**	**Yes = 1 No = 2**
Vv5	Language	Other = 0 Eng = 1	-0.74		

V34	Risk profile	Taker = 1 Mgr = 2 Avert = 3	-0.67	**Motivating factors V32**	**Money = 1 Chal = 2 Indep = 3 N-empl=4 Other = 5**
Vv24	Technical training	Other = 0 TT = 1	-0.52		
Vv4	Gender	Fem = 0 Male = 1	-1.58	**Role model V33**	**Yes = 1 No = 2**
V46	Cultural attitude	Cond = 1 Neutr = 2 Neg = 3	-0.52		
S/em	Father & Mother self-employed	No = 0 Yes = 1	0.74		
Vv25	Entrepreneurship training	Yes = 1 No = 0	0.44		
Vv4	Gender	Fem = 0 Male = 1	-0.26	**Risk profile V34**	**Taker = 1 Mgr = 2 Avert = 3**
Vv5	Language	Other = 0 Eng = 1	0.34		
V7B	Indian race	Other = 0 Indian =1	-0.44		
V8	Position in family	Eld = 1 2nd = 2 3rd = 3 4th = 4 5th = 5 Other = 5	0.06		
S/em	Father & Mother self-employed	No = 0 Yes = 1	0.18		
V6A	Hindu religion	Other = 0 Hindu = 1	0.24		
V7B	Indian race	Other = 0 Indian =1	0.07	**Entrepreneurial Characteristics V35 - 44**	**1 - 3**
V6B	Other religion	Ch/Hi = 0 Other = 1	-0.08		
Vv4	Gender	Fem = 0 Male = 1	0.09		
V2	Age	1 - 75	0.25	**Age introduced to entrepreneurship V45**	**1 - 75**
S/em	Father & Mother self-employed	No = 0 Yes = 1	-4.54		
V46	Cultural attitude	Cond = 1 Neut = 2 Neg = 3	1.27		

2.2 Multiple regression results: New venture creation

2.2.1 Dependent variable: Period between idea and start-up (V59) – model linear regression

V-NO	VARIABLE	PARAMETER	PROBABILITY
-	Intercept	3.16	0.1101
Qual	Qualifications	1.06	0.0287
V60	Technology transfer	-0.40	0.0441
Vv80	IP protection	1.34	0.0706
Vv58	Technological component	-1.59	0.0702
Vv5	Language	-1.99	0.0925
V8	Position in family	0.34	0.0717
V54	Government contracts at start-up	1.99	0.1058

2.2.2 Dependent variable: Technology transfer (V60) – model linear regression

V-NO	VARIABLE	PARAMETER	PROBABILITY
-	Intercept	2.58	0.0001
V32A	Money as motivator	0.50	0.0002
Vv24	Technical field of training	-0.65	0.0020
V46	Attitude of culture	0.22	0.0403
V59	Period between idea and start-up	-0.04	0.0526
V34	Risk profile	-0.24	0.1338
V32B	Challenge as motivator	-0.39	0.1259
Vv58	Technological component	0.31	0.1012

2.2.3 Dependent variable: Founder financing (V64) – logistic chi-square

V-NO	VARIABLE	CHI-SQUARE	PARAMETER	PROBABILITY
-	Intercept	9.80	-2.41	0.0017
S/em	Father and mother self-employed	3.33	0.67	0.0679
Vv24	Technical training	6.09	-0.86	0.0136
V6A	Hindu religion	5.87	-0.89	0.0154
V54	Government contracts at start-up	4.78	1.43	0.0288
Assist	Assistance during start-up	4.94	0.81	0.0263
Vv33	Role model	2.69	0.57	0.1011
V32B	Challenge as motivator	2.07	-0.60	0.1505

2.2.4 Dependent variable: External private financing (V65 – V67) – logistic chi-square

V-NO	VARIABLE	CHI-SQUARE	PARAMETER	PROBABILITY
-	Intercept	7.48	3.75	0.0062
S/em	Father and mother self-employed	7.10	1.09	0.0077
V7A	White race	5.72	-0.92	0.0168
Vv58	Technological component	4.63	-0.79	0.0314
Vv5	Language	5.04	-1.27	0.0248
Vv4	Gender	3.47	1.26	0.0624
V2	Age	3.02	-0.03	0.0825
Qual	Qualifications	2.27	-0.38	0.1319
Assist	Assistance during start-up	2.77	0.67	0.0963
Vv24	Technical training	1.94	-0.52	0.1638
V34	Risk profile	1.75	-0.35	0.1857

2.2.5 Dependent variable: External commercial financing (V68 - V72) – logistic chi-square

V-NO	VARIABLE	CHI-SQUARE	PARAMETER	PROBABILITY
-	Intercept	5.43	-3.53	0.0198
V7B	Indian race	2.97	-0.59	0.0850
Vv58	Technological component	5.76	-0.82	0.0164
V61	Number of founders	3.33	0.46	0.0681
V2	Age	6.20	0.04	0.0128
Vv9	Family income at 18 years	5.00	0.54	0.0254
V54	Government contracts at start-up	2.37	1.08	0.1240

2.2.6 Dependent variable: Previous employer assistance during start-up (V73) – logistic chi-square

V-NO	VARIABLE	CHI-SQUARE	PARAMETER	PROBABILITY
-	Intercept	3.05	2.11	0.0810
V46	Attitude of culture	4.45	-1.24	0.0349
Vv47	Metropolitan	5.49	-2.00	0.0191
Vv25	Entrepreneurship training	3.71	-1.76	0.0539
V48B	Technical services	2.53	1.21	0.1118

2.2.7 Dependent variable: Private sector assistance during start-up (V75) – logistic chi-square

V-NO	VARIABLE	CHI-SQUARE	PARAMETER	PROBABILITY
-	Intercept	8.23	-11.15	0.0041
V32A	Money as motivator	8.34	5.73	0.0039
V3	Age when started	3.53	0.11	0.0604
V32C	Independence as motivator	5.77	4.08	0.0163
Vv5	Language	4.18	2.69	0.0409
V61	Number of founders	3.47	1.18	0.0625
V32B	Challenge as motivator	2.81	2.86	0.0935
Priv	External private financing	3.71	1.52	0.0542
Vv33	Role model	2.97	-1.47	0.0849
Vv24	Technical training	3.28	1.60	0.0700
Vv4	Gender	2.59	-2.01	0.1073

2.2.8 Dependent variable: Business incubator assistance during start-up (V77) – logistic chi-square

V-NO	VARIABLE	CHI-SQUARE	PARAMETER	PROBABILITY
-	Intercept	7.28	-24.49	0.0070
V32A	Money as motivator	6.59	14.27	0.0102
V3	Age when started	6.89	0.65	0.0086
S/em	Father and mother self-employed	5.00	7.01	0.0254
V45	Age introduced to entrepreneurship	3.19	-0.19	0.0739

2.2.9 Dependent variable: Business failures reported (V84-85) – logistic chi-square

V-NO	VARIABLE	CHI-SQUARE	PARAMETER	PROBABILITY
-	Intercept	0.27	0.97	0.6043
Vv117	Insufficient tax incentives	8.15	-0.35	0.0043
V46	Attitude of culture	4.08	0.72	0.0434
V6A	Hindu religion	3.96	-1.23	0.0466
Vv33	Role model	4.02	1.09	0.0450
External	External factors during start-up	3.08	-1.36	0.0794
Vv24	Technical training	2.58	-0.89	0.1081
Vv111	Insufficient entrepreneurship training	2.05	0.17	0.1525

2.3.7. Scaling of variables: New venture creation

V-no	Predictor (X)	Scaling	Parameter	Predicted (Y)	Scaling
Qual	Qualifications	Sch = 1 Tech = 2 Univ = 3	1.06	**Period between idea and start-up V59**	**1-75**
V60	Technology transfer	Direct =1 Part = 2 Vague=3 None = 4	-0.40		
Vv80	IP protection	No = 0 Yes = 1	1.34		
Vv58	Technological component	Low = 1 High = 2	-1.59		
Vv5	Language	Other =0 Eng = 1	-1.99		
V8	Position in family	Eld = 1 2nd = 2 3rd = 3 4th = 4 5th = 5 Other =5	0.34		
V54	Government contracts at start-up	0-20%=1 21-100%=2	1.99		
V32A	Money as motivator	Other =0 Money=1	0.50	**Technology transfer V60**	**Direct =1 Part = 2**

					Vague=3 None = 4
Vv24	Technical field of training	Other =0 TT = 1	-0.65		
V46	Attitude of culture	Cond = 1 Neutr = 2 Neg = 3	0.22		
V59	Period between idea and start-up	1-75	-0.04		
V34	Risk profile	Taker =1 Mgr = 2 Avert = 3	-0.24		
V32B	Challenge as motivator	Other=0 Chal=1	-0.39		
Vv58	Technological component	Low = 0 High = 1	0.31		
S/em	Father and mother self-employed	No = 0 Yes = 1	0.67	**Founder financing V64**	**0-20%= 1 21-80%=2 81-100%=3**
Vv24	Technical training	Other =0 TT = 1	-0.86		
V6A	Hindu religion	Other =0 Hindu=1	-0.89		
V54	Government contracts at start-up	0-20%=1 21-100%=2	1.43		
Assist	Assistance during start-up	No = 0 Yes = 1	0.81		
Vv33	Role model	No = 0 Yes = 1	0.57		
V32B	Challenge as motivator	Other =0 Chal =1	-0.60		
S/em	Father and mother self-employed	No = 0 Yes = 1	1.09	**External private financing V65 – V67**	**Yes = 1 No = 2**
V7A	White race	Other =0 White =1	-0.92		
Vv58	Technological component	Low = 0 High = 1	-0.79		
Vv5	Language	Other =0 Eng = 1	-1.27		
Vv4	Gender	Fem = 0 Male =1	1.26		
V2	Age	1 - 75	-0.03		
Qual	Qualifications	Sch = 1 Tech = 2 Univ = 3	-0.38		
Assist	Assistance during start-up	No = 0 Yes = 1	0.67		
Vv24	Technical training	Other =0 TT = 1	-0.52		
V34	Risk profile	Taker =1 Mgr = 2 Avert = 3	-0.35		
V7B	Indian race	Other =0 Indian =1	-0.59	**External commercial financing V68 – V72**	**Yes = 1 No = 2**

Vv58	Technical component	Low = 0 High = 1	-0.82		
V61	Number of founders	One = 1 Two = 2 Three =3	0.46		
V2	Age	1 - 75	0.04		
Vv9	Family income at 18 years	<R1000=1 R1–R5=2 >R5000=3	0.54		
V54	Government contracts at start-up	0-20%=1 21-100%=2	1.08		
V46	Attitude of culture	Cond = 1 Neutr = 2 Neg = 3	-1.24	**Previous employer assistance during start-up V73**	**Yes = 1 No = 2**
Vv47	Metropolitan	Other =0 Metro =1	-2.00		
Vv25	Entrepreneurship training	No = 0 Yes = 1	-1.76		
V48B	Technical services	Other =0 TS = 1	1.21		
V32A	Money as motivator	Other =0 Money=1	5.73	**Private sector assistance during start-up V75**	**Yes = 1 No = 2**
V3	Age when started	1 - 75	0.11		
V32C	Independence as motivator	Other =0 Ind = 1	4.08		
Vv5	Language	Other =0 Eng = 1	2.69		
V61	Number of founders	One = 1 Two = 2 Three =3	1.18		
V32B	Challenge as motivator	Other =0 Chal = 1	2.86		
Priv	External private financing	Yes = 1 No = 2	1.52		
Vv33	Role model	No = 0 Yes = 1	-1.47		
Vv24	Technical training	Other =0 TT = 1	1.60		
Vv4	Gender	Fem = 0 Male = 1	-2.01		
V32A	Money as motivator	Other =0 Money=1	14.27	**Business incubator assistance during start-up V77**	**Yes = 1 No = 2**
V3	Age when started	1 - 75	0.65		
S/em	Father and mother self-employed	No = 0 Yes = 1	7.01		
V45	Age introduced to entrepreneurship	1 - 75	-0.19		
Vv117	Insufficient tax incentives	No =0 Yes = 1	-0.35	**Business failures reported V84-85**	**Yes = 1 No = 2**
V46	Attitude of culture	Cond = 1 Neutr = 2 Neg = 3	0.72		

V6A	Hindu religion	Other =0 Hindu =1	-1.23		
Vv33	Role model	No = 0 Yes = 1	1.09		
External	External factors during start-up	Neg = 1 None = 2 Pos = 3	-1.36		
Vv24	Technical training	Other =0 TT = 1	-0.89		
Vv111	Insufficient entrepreneurship training	No =0 Yes = 1	0.17		

2.3 Multiple regression results: Mature business

2.3.1 Dependent variable: Annual turn-over (V49) – model linear regression

V-NO	VARIABLE	PARAMETER	PROBABILITY
-	Intercept	0.99	0.0143
V61	Number of founders	0.27	0.0100
V108	Black economic empowerment	0.22	0.0250
Vv25	Entrepreneurship training	-0.28	0.0756
V55	Government contracts at present	0.38	0.0518
Assist	Assistance during start-up	-0.33	0.0664
V48B	Technical services	-0.30	0.1179
V32D	Non-employment	-0.33	0.1487
V58	Technological component	0.19	0.1497

2.3.2 Dependent variable: Government contracts at present (V55) – logistic chi-square

V-NO	VARIABLE	CHI-SQUARE	PARAMETER	PROBABILITY
-	Intercept	0.11	-0.34	0.7343
V2	Age	3.42	0.04	0.0641
V6B	Other religion	3.62	2.29	0.0571
V48A	Manufacturing	1.82	-0.60	0.1774
Vv5	Language	3.58	1.19	0.0584
V7B	Indian race	4.74	-1.65	0.0294
V6A	Hindu religion	1.93	0.98	0.1643

2.3.3 Dependent variable: Technological innovation (V56) – model linear regression

V-NO	VARIABLE	PARAMETER	PROBABILITY
-	Intercept	2.41	0.0001
V58	Technological component	13.77	0.0001
Vv24	Technical training	0.33	0.0088
V31	Size of previous firm	0.15	0.0320
Qual	Qualifications	-0.19	0.0297
Vv126	Increase efforts by private sector	-0.11	0.1036
V7B	Indian race	0.45	0.1849
V6A	Hindu religion	-0.39	0.0272

2.3.4 Dependent variable: Technological component (V58) – model linear regression

Warning: The sample frequency of this test is only 17. The validity of the model fit is questionable.

V-NO	VARIABLE	PARAMETER	PROBABILITY
-	Intercept	-0.64	0.1628
Qual	Qualifications	0.66	0.0399
Vv56	Technological innovation	0.52	0.0103
V48A	Manufacturing	-0.31	0.0043
Vv47	Metropolitan	-0.20	0.0922
V7A	White race	0.50	0.1899
Vv4	Gender	-0.55	0.0603
V26	R & D experience	-0.04	0.0659
V27	Technical experience	0.01	0.0975

2.3.5 Dependent variable: IP Protection (V80) – logistic chi-square

Warning: The sample frequency of this test is only 18. The validity of the model fit is questionable.

V-NO	VARIABLE	CHI-SQUARE	PARAMETER	PROBABILITY
-	Intercept	3.04	-3.89	0.0809
Vv58	Technological component	2.45	1.94	0.1172

2.3.6 Dependent variable: Number of jobs created (V91) – model linear regression

V-NO	VARIABLE	PARAMETER	PROBABILITY
-	Intercept	33.13	0.5644
V51	Number of people employed	35.73	0.0001
V52	Number of business units	46.77	0.0017
V46	Attitude of culture	-19.58	0.0775
Vv47	Geographical location	-25.19	0.0598
External	External factors during start-up	-33.00	0.0838
Vv80	IP protection	31.81	0.0850
V61	Number of initial founders	17.44	0.1260
V50	Annual turn-over growth	-15.93	0.1485
V64	Founder financing	9.78	0.1381
V34	Risk profile	-13.35	0.1974
V60	Technology transfer	-6.82	0.1832

2.3.7 Dependent variable: R & D department (V92) – logistic chi-square

Warning: The sample frequency of this test is only 21. The validity of the model fit is questionable.

V-NO	VARIABLE	CHI-SQUARE	PARAMETER	PROBABILITY
-	Intercept	3.61	-8.12	0.0573
V2	Age	5.32	0.27	0.0211
V60	Technology transfer	3.59	-3.52	0.0582

2.3.8. Scaling of variables: Mature business

V-no	Predictor (X)	Scaling	Parameter	Predicted (Y)	Scaling
V61	Number of founders	One = 1 Two = 2 Three =3	0.27	**Annual turn over V49**	**0 to240=1 240to1m=2 1.1to5m =3 5m> = 4**
V108	Black economic empowerment	BO = 1 BE = 2 WO = 3	0.22		
Vv25	Entrepreneurship training	No = 0 Yes = 1	-0.28		
V55	Government contracts at present	0-20%= 1 21-80%=2 81-100%=3	0.38		
Assist	Assistance during start-up	No = 0 Yes = 1	-0.33		
V48B	Technical services	Other =0 TS = 1	-0.30		
V32D	Non-employment as motivator	Other = 0 N-emp=1	-0.33		
V58	Technological component	Low = 1 High = 2	0.19		
V2	Age	1 - 75	0.04	**Government contracts at present V55**	**0-20%= 1 21-100%=2**
V6B	Other religion	Ch/Hi = 0 Other = 1	2.29		
V48A	Manufacturing	Other =0 Man = 1	-0.60		
Vv5	Language	Other =0 English=1	1.19		
V7B	Indian race	Other =0 Indian =1	-1.65		
V6A	Hindu religion	Other =0 Hindu =1	0.98		
V58	Technological component	Low= 1 High = 2	13.77	**Technological innovation Vv56**	**Poor = 1 Aver = 2 Good = 3 Excel = 4**
Vv24	Technical training	Other =0 TT = 1	0.33		
V31	Size of previous firm	1 to 5 = 1 6 to 50 = 2 51to200=3	0.15		

		201> = 4			
Qual	Qualifications	Sch = 1 Tech = 2 Univ = 3	-0.19		
Vv126	Increase efforts by private sector	Other =0 Efforts =1	-0.11		
V7B	Indian race	Other =0 Indian =1	0.45		
V6A	Hindu religion	Other =0 Hindu =1	-0.39		
Qual	Qualifications	Sch = 1 Tech = 2 Univ = 3	0.66	**Technological component V58**	**Low = 1 High = 2**
Vv56	Technological innovation	Low = 1 Ave = 2 Good = 3 Excel = 4	0.52		
V48A	Manufacturing	Other = 0 Man = 1	-0.31		
Vv47	Metropolitan	Other = 0 Metro = 1	-0.20		
V7A	White race	Other = 0 White = 1	0.50		
Vv4	Gender	Fem = 0 Male = 1	-0.55		
V26	R & D experience	1 – 75	-0.04		
V27	Technical experience	1 - 75	0.01		
Vv58	Technological component	Low = 1 High = 2	1.94	**IP Protection V80**	**Yes= 1 No = 2**
V51	Number of people employed	1 - 1000	35.73	**Number of jobs created V91**	**1 - 1000**
V52	Number of business units	One = 1 2 to 5 =2 6 more=3	46.77		
V46	Attitude of culture	Cond = 1 Neutr = 2 Neg = 3	-19.58		
Vv47	Metropolitan	Other = 0 Metro = 1	-25.19		
External	External factors during start-up	Neg = 1 None = 2 Pos = 3	-33.00		
Vv80	IP protection	No = 0 Yes = 1	31.81		
V61	Number of initial founders	One = 1 Two = 2 Three =3	17.44		
V50	Annual turn-over growth	Neg = 1 1to10%=2 11-50%=3 51%> = 4	-15.93		
V64	Founder financing	0-20= 1 21-80=2 81-100%=3	9.78		
V34	Risk profile	Taker =1 Mgr = 2	-13.35		

		Avert = 3			
V60	Technology transfer	Direct =1 Part = 2 Vague=3 None = 4	-6.82		
V2	Age	1 – 75	0.27	**R & D department V92**	**Yes =1 No = 2**
V60	Technology transfer	Direct =1 Part = 2 Vague=3 None = 4	-3.52		

APPENDIX E

POSSIBLE CORRELATIONS:

ENTREPRENEUR

APPENDIX E

POSSIBLE CORRELATIONS: ENTREPRENEUR

CATEGORY	INDEPENDENT VARIABLE (PREDICTOR)	No	DEPENDENT VARIABLE (PREDICTED)	No
A1	Age	V2	**Age when started new business**	**V3**
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
	Position in family	V8		
	Level of income @ 18	V9		
	Father self-employed	V11		
	Mother self-employed	V13		
	Qualifications: ▪ School and other	V14, 15 & 23		
	Qualifications: ▪ Technical	V16, 17, 18, 19,		
	Qualifications: ▪ University	V20, 21 & 22		
	Primary field of training	V24		
	Formal training in entrepreneurship	V25		
	Motivating factors	V32		
	Role model	V33		
	Risk profile	V34		
	Age introduced to entrepreneurship	V45		
	Attitude of culture	V46		
A2	Age	V2	**Formal training in entrepreneurship**	**V25**
	Age when started new business	V3		
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
	Qualifications	V14-23		
	Primary field of training	V24		
	Age introduced to entrepreneurship	V45		
	Attitude of culture	V46		
A3	Age	V2	**Motivating factors**	**V32**
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
	Position in family	V8		
	Level of income @ 18	V9		
	Father self-employed	V11		

	Mother self-employed	V13		
	Qualifications: ▪ School and other	V14, 15 & 23		
	Qualifications: ▪ Technical	V16, 17, 18 & 19,		
	Qualifications: ▪ University	V20, 21 & 22		
	Primary field of training	V24		
	Formal training in entrepreneurship	V25		
	Size of last firm	V31		
	Role model	V33		
	Risk profile	V34		
	Age introduced to entrepreneurship	V45		
	Attitude of culture	V46		
A4	Age	V2	**Role model**	**V33**
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
	Position in family	V8		
	Level of income @ 18	V9		
	Father self-employed	V11		
	Mother self-employed	V13		
	Qualifications: ▪ School and other	V14, 15 & 23		
	Qualifications: ▪ Technical	V16, 17, 18 & 19,		
	Qualifications: ▪ University	V20, 21 & 22		
	Primary field of training	V24		
	Formal training in entrepreneurship	V25		
	Risk profile	V34		
	Age introduced to entrepreneurship	V45		
	Attitude of culture	V46		
A5	Age	V2	**Risk profile**	**V34**
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
	Position in family	V8		
	Level of income @ 18	V9		
	Father self-employed	V11		
	Mother self-employed	V13		
	Qualifications: ▪ School and other	V14, 15 & 23		
	Qualifications: ▪ Technical	V16, 17, 18 & 19,		
	Qualifications: ▪ University	V20, 21 & 22		
	Primary field of training	V24		
	Formal training in entrepreneurship	V25		

	Work experience (total number of years)	Sum of V26-30		
	Size of last firm	V31		
	Role model	V33		
	Age introduced to entrepreneurship	V45		
	Attitude of culture	V46		
A6	Age	V2	**Entrepreneurial characteristics**	**V35-44**
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
A7	Age	V2	**Age introduced to entrepreneurship**	**V45**
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
	Position in family	V8		
	Level of income @ 18	V9		
	Father self-employed	V11		
	Mother self-employed	V13		
	Qualifications: ▪ School and other	V14, 15 & 23		
	Qualifications: ▪ Technical	V16, 17, 18 & 19,		
	Qualifications: ▪ University	V20, 21 & 22		
	Primary field of training	V24		
	Formal training in entrepreneurship	V25		
	Attitude of culture	V46		
A8	Language	V5	**Attitude of culture**	**V46**
	Religion	V6		
	Race	V7		

APPENDIX F

POSSIBLE CORRELATIONS:

NEW VENTURE

CREATION

APPENDIX F

POSSIBLE CORRELATIONS: NEW VENTURE CREATION

CATEGORY	INDEPENDENT VARIABLE (PREDICTOR)	No	DEPENDENT VARIABLE (PREDICTED)	No
B1	Age	V2	**Period between idea and start-up**	**V59**
	Age when started	V3		
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
	Position in family	V8		
	Level of income @ 18	V9		
	Father self-employed	V11		
	Mother self-employed	V13		
	Qualifications: ▪ School and other	V14, 15 & 23		
	Qualifications: ▪ Technical	V16, 17, 18 & 19,		
	Qualifications: ▪ University	V20, 21 & 22		
	Primary field of training	V24		
	Formal training in entrepreneurship	V25		
	Work experience	V26-30		
	Size of last firm	V31		
	Motivating factors	V32		
	Role model	V33		
	Risk profile	V34		
	Age introduced to entrepreneurship	V45		
	Attitude of culture	V46		
	Government contracts at start-up	V54		
	Technological component	V58		
	Technology transfer	V60		
	Number of founders	V61		
	Initial finance	V64		
	External capital	V65-72		
	Assistance during start-up	V73-79		
	IP protection	V80		
B2	Age	V2	**Technology transfer**	**V60**
	Age when started	V3		
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
	Position in family	V8		
	Level of income @ 18	V9		
	Father self-employed	V11		
	Mother self-employed	V13		

	Qualifications: ▪ School and other	V14, 15 & 23		
	Qualifications: ▪ Technical	V16, 17, 18 & 19,		
	Qualifications: ▪ University	V20, 21 & 22		
	Primary field of training	V24		
	Formal training in entrepreneurship	V25		
	Work experience	V26-30		
	Size of last firm	V31		
	Motivating factors	V32		
	Role model	V33		
	Risk profile	V34		
	Age introduced to entrepreneurship	V45		
	Attitude of culture	V46		
	Geographical location	V47		
	Core business	V48		
	Government contracts at start-up	V54		
	Technological component	V58		
	Period between idea and start-up	V59		
	Number of founders	V61		
	Initial finance	V64		
	External capital	V65-72		
	Assistance during start-up	V73-79		
	IP protection	V80		
B3	Age	V2	**Initial financing**	**V64**
	Age when started	V3		
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
	Position in family	V8		
	Level of income @ 18	V9		
	Father self-employed	V11		
	Mother self-employed	V13		
	Qualifications: ▪ School and other	V14, 15 & 23		
	Qualifications: ▪ Technical	V16, 17, 18 & 19,		
	Qualifications: ▪ University	V20, 21 & 22		
	Primary field of training	V24		
	Formal training in entrepreneurship	V25		
	Motivating factors	V32		
	Role model	V33		
	Risk profile	V34		
	Age introduced to entrepreneurship	V45		
	Attitude of culture	V46		
	Government contracts at start-up	V54		
	Technology transfer	V60		

	Number of founders	V61		
	Assistance during start-up	V73-79		
B4	Age	V2	**External financing**	**V65-72**
	Age when started	V3		
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
	Position in family	V8		
	Level of income @ 18	V9		
	Father self-employed	V11		
	Mother self-employed	V13		
	Qualifications: ▪ School and other	V14, 15 & 23		
	Qualifications: ▪ Technical	V16, 17, 18 & 19,		
	Qualifications: ▪ University	V20, 21 & 22		
	Primary field of training	V24		
	Formal training in entrepreneurship	V25		
	Risk profile	V34		
	Age introduced to entrepreneurship	V45		
	Attitude of culture	V46		
	Government contracts at start-up	V54		
	Technological component	V58		
	Number of founders	V61		
	Assistance during start-up	V73-79		
B5	Age	V2	**Start-up assistance**	**V73-79**
	Age when started	V3		
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
	Position in family	V8		
	Level of income @ 18	V9		
	Father self-employed	V11		
	Mother self-employed	V13		
	Qualifications: ▪ School and other	V14, 15 & 23		
	Qualifications: ▪ Technical	V16, 17, 18 & 19,		
	Qualifications: ▪ University	V20, 21 & 22		
	Primary field of training	V24		
	Formal training in entrepreneurship	V25		
	Motivating factors	V32		
	Role model	V33		
	Risk profile	V34		
	Age introduced to entrepreneurship	V45		
	Attitude of culture	V46		
	Geographical location	V47		

	Core business	V48		
	Government contracts at start-up	V54		
	Technological component	V58		
	Technology transfer	V60		
	Number of founders	V61		
	Initial financing	V64		
	External capital	V65-72		
B6	Age	V2	**Business failures reported**	**Yes for V84 & 85**
	Age when started	V3		
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
	Position in family	V8		
	Level of income @ 18	V9		
	Father self-employed	V11		
	Mother self-employed	V13		
	Qualifications: ▪ School and other	V14, 15 & 23		
	Qualifications: ▪ Technical	V16, 17, 18 & 19,		
	Qualifications: ▪ University	V20, 21 & 22		
	Primary field of training	V24		
	Formal training in entrepreneurship	V25		
	Work experience	V26-30		
	Size of last firm	V31		
	Motivating factors	V32		
	Role model	V33		
	Risk profile	V34		
	Age introduced to entrepreneurship	V45		
	Attitude of culture	V46		
	External factors during initial years	V93-102		
	Causes for failures	V109-118		

APPENDIX G

POSSIBLE CORRELATIONS:

MATURE

BUSINESS

APPENDIX G

POSSIBLE CORRELATIONS: MATURE BUSINESS

CATEGORY	INDEPENDENT VARIABLE (PREDICTOR)	No	DEPENDENT VARIABLE (PREDICTED)	No
C1	Formal training in entrepreneurship	V25	**Annual turn over**	**V49**
	Size of last firm	V31		
	Motivating factors	V32		
	Role model	V33		
	Risk profile	V34		
	Age introduced to entrepreneurship	V45		
	Attitude of culture	V46		
	Geographical location	V47		
	Core business	V48		
	Government contracts at present	V55		
	Technological innovation	V56		
	Technological component	V58		
	Technology transfer	V60		
	Number of founders	V61		
	Foreign capital	V65-72		
	Assistance during start-up	V73-79		
	IP protection	V80		
	External factors during initial years	V93-102		
	Black economic empowerment	V108		
C2	Age	V2	**Government contracts at present**	**V55**
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
	Geographical location	V47		
	Core business	V48		
C3	Age	V2	**Technological innovation**	**V56**
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
	Qualifications	V14-23		
	Primary field of training	V24		
	Formal training in entrepreneurship	V25		
	Work experience	V26-30		
	Size of last firm	V31		
	Age introduced to entrepreneurship	V45		
	Attitude of culture	V46		
	Geographical location	V47		
	Core business	V48		

	Technological component	V58		
	IP protection	V80		
	Causes for lack of technological innovation	V103-107		
	Measures to improve technological entrepreneurship	V124-128		
C4	Age	V2	**Technological component**	**V58**
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
	Qualifications: ▪ School and other	V14, 15 & 23		
	Qualifications: ▪ Technical	V16, 17, 18 & 19,		
	Qualifications: ▪ University	V20, 21 & 22		
	Primary field of training	V24		
	Work experience: ▪ R & D	V26		
	Work experience: ▪ Technical	V27		
	Geographical location	V47		
	Core business	V48		
	Technological innovation	V56		
	Technology transfer	V60		
C5	Age	V2	**IP Protection**	**V80**
	Sex	V4		
	Language	V5		
	Religion	V6		
	Race	V7		
	Qualifications: ▪ School and other	V14, 15 & 23		
	Qualifications: ▪ Technical	V16, 17, 18 & 19,		
	Qualifications: ▪ University	V20, 21 & 22		
	Primary field of training	V24		
	Formal training in entrepreneurship	V25		
	Work experience: ▪ R & D	V26		
	Work experience: ▪ Technical	V27		
	Geographical location	V47		
	Core business	V48		
	Technological innovation	V56		
	Technological component	V58		
	Technology transfer	V60		
C6	Age when started	V3	**Number of jobs created**	**V91**
	Race	V7		
	Primary field of training	V24		
	Formal training in	V25		

	entrepreneurship			
	Motivating factors	V32		
	Risk profile	V34		
	Age when introduced	V45		
	Attitude of culture	V46		
	Geographical location	V47		
	Core business	V48		
	Annual turn over	V49		
	Annual turn over growth	V50		
	Number of people employed	V51		
	Number of branches	V52		
	Value of assets	V53		
	Government contracts at start-up	V54		
	Government contracts at present	V55		
	Technological innovation	V56		
	Period in operation	V57		
	Technological component	V58		
	Technology transfer	V60		
	Initial founders	V61		
	Initial financing	V64		
	External capital	V65-72		
	Assistance during start-up	V73-79		
	IP protection	V80		
	External factors	V93-102		
	Black economic empowerment	V108		
C7	Age	V2	**Research & development department**	**V92**
	Age when started	V3		
	Working experience: ▪ Research & development	V26		
	Technological innovation	V56		
	Years in operation	V57		
	Technological component	V58		
	Technology transfer	V60		
	IP protection	V80		
	Black economic empowerment	V108		