

# **CHAPTER FIVE**

## **RESULTS: DATA COLLECTION AND ANALYSIS**

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### 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:

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:

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):

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

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:

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**

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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:

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

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:

$$Y' = a + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_kX_k \quad [5 - 2]$$

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.

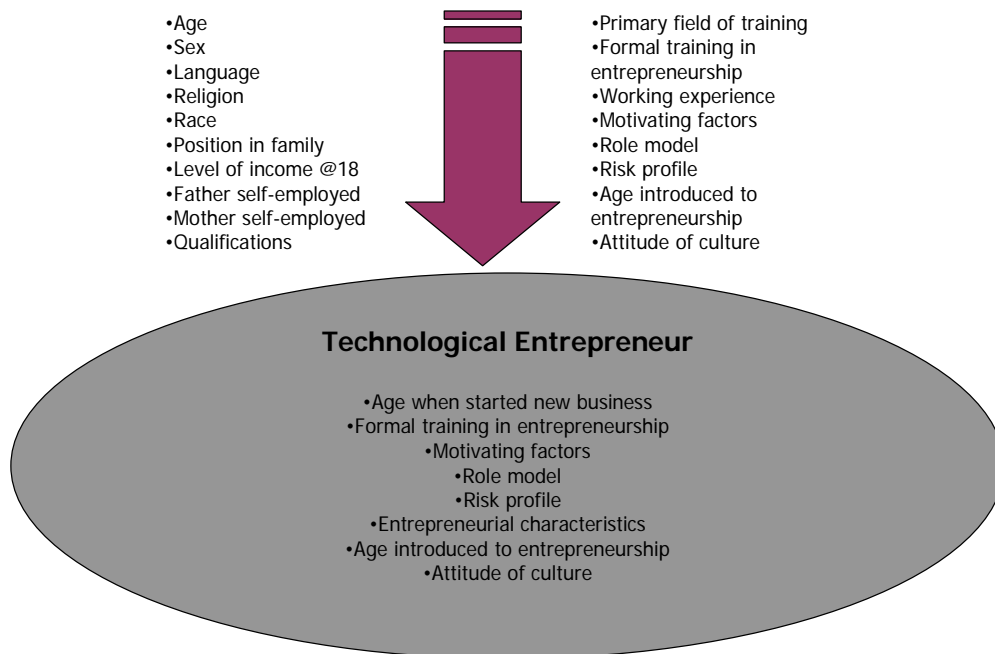


Figure 5.1 Comprehensive model elements with most predictor and selected predicted variables: Technological Entrepreneur

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.

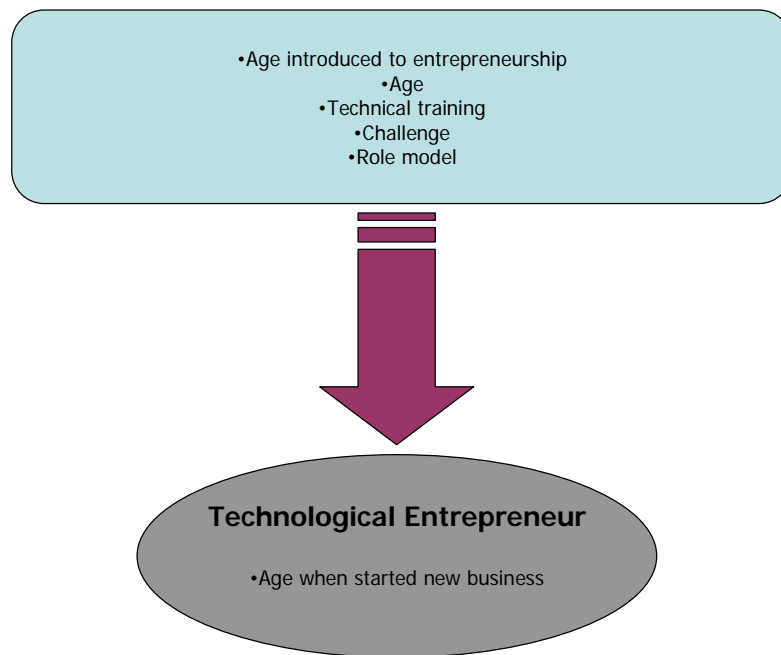


Figure 5.2 Correlations with age when started new business

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. <i>Parameter = 0.49; Probability = 0.0001</i>
2	*Younger entrepreneurs tend to start their new businesses earlier than their older counterparts. <i>Parameter = 0.24; Probability = 0.0001</i>
3	*Entrepreneurs with other than technical training, tend to start their businesses earlier than those with technical training. <i>Parameter = 2.42; Probability = 0.0081</i>
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. <i>Parameter = 2.55; Probability = 0.0412</i>
5	Entrepreneurs who have a role model tend to start their businesses earlier than those without a role model. <i>Parameter = -1.37; Probability = 0.1679</i>

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

$$Y'em = Aem + Bem_1Xem_1 + ..... + Bem_5Xem_5 \quad [5 - 3]$$

Where:

- Y'em*            Age when new business was started
- Aem*            Y-intercept = 7.25
- Bem<sub>1</sub> – Bem<sub>5</sub>* Parameters in Table 5.6
- Xem<sub>1</sub>*          Age when introduced to entrepreneurship
- Xem<sub>2</sub>*          Age
- Xem<sub>3</sub>*          Technical field of training
- Xem<sub>4</sub>*          Challenge as motivating factor
- Xem<sub>5</sub>*          Role model

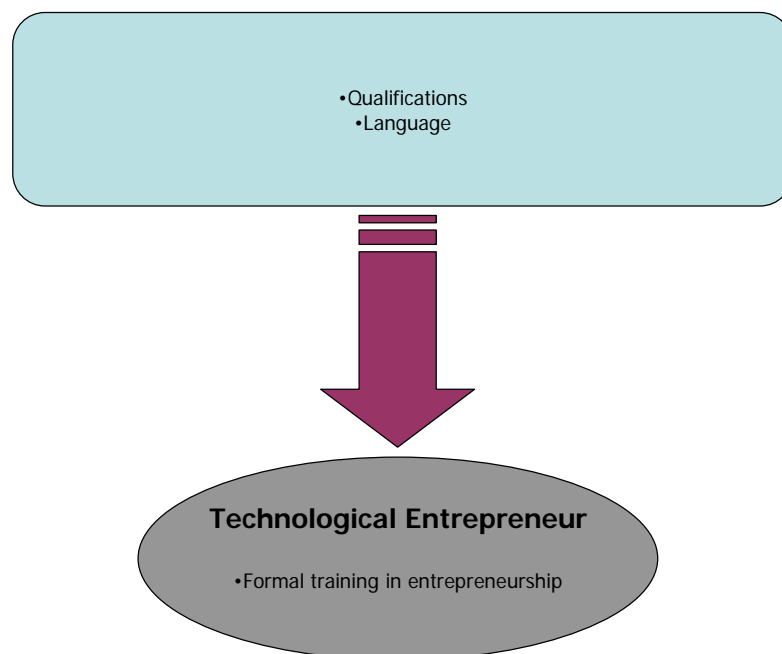


Figure 5.3 Correlations with formal training in entrepreneurship



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). <i>Chi-square = 6.20; Parameter = 0.54; Probability = 0.0128</i>
2	English speaking entrepreneurs tend to receive more formal training in entrepreneurship than those speaking other languages such as Zulu, Xhosa or Afrikaans. <i>Chi-square = 2.92; Parameter = -0.75; Probability = 0.0875</i>

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

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

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

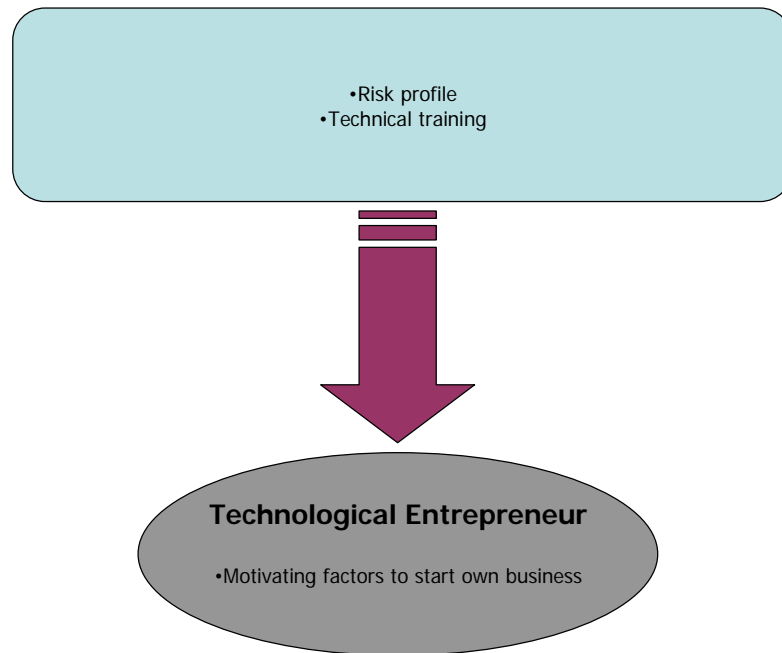


Figure 5.4 Correlations with motivating factors to start own business

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. <i>Chi-square = 10.73; Parameter = -0.67; Probability = 0.0011</i>
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. <i>Chi-square = 3.60; Parameter = -0.52; Probability = 0.0577</i>

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

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

Where:

- $Y'_{ep}$  Motivating factors to start own business
- $A_{ep}$  Y-intercept = 0.07
- $B_{ep1} - B_{ep2}$  Parameters in Table 5.8
- $X_{ep1}$  Risk profile
- $X_{ep2}$  Technical training

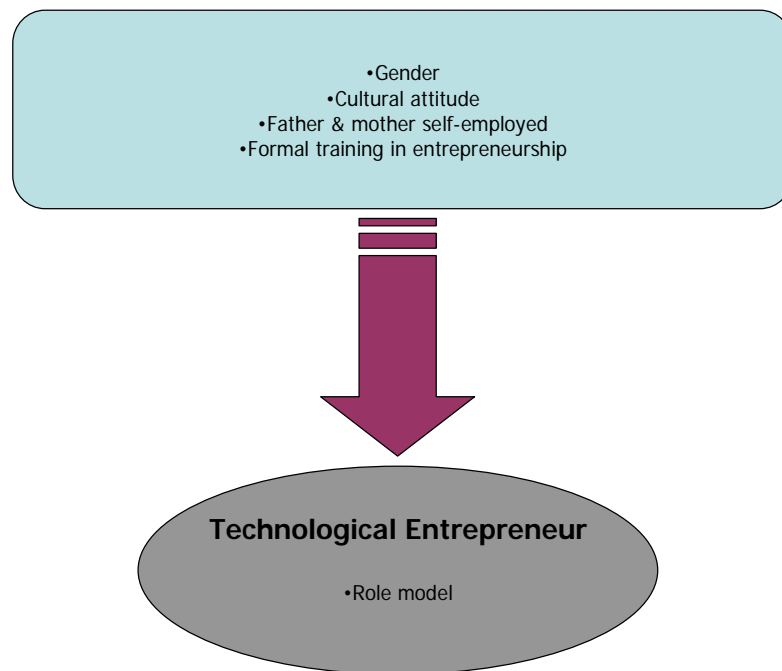


Figure 5.5 Correlations with role model

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. <i>Chi-square = 6.54; Parameter = -1.58; Probability = 0.0105</i>
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. <i>Chi-square = 4.72; Parameter = -0.52; Probability = 0.0299</i>
3	*Entrepreneurs whose father & mother were not self-employed tend to have more role models than those who come from self-employed families. <i>Chi-square = 4.26; Parameter = 0.74; Probability = 0.0390</i>
4	Those entrepreneurs with little or no formal training in entrepreneurship tend to have more role models than entrepreneurs with formal entrepreneurship training. <i>Chi-square = 1.83; Parameter = 0.44; Probability = 0.1766</i>

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

$$Y'_{eq} = A_{eq} + B_{eq1}X_{eq1} + \dots + B_{eq4}X_{eq4} \quad [5 - 6]$$

Where:

$Y'_{eq}$	Role models
$A_{eq}$	Y-intercept = 1.55
$B_{eq1} - B_{eq4}$	Parameters in Table 5.9
$X_{eq1}$	Gender
$X_{eq2}$	Attitude of culture towards entrepreneurship
$X_{eq3}$	Self-employment status of parents
$X_{eq4}$	Training in entrepreneurship

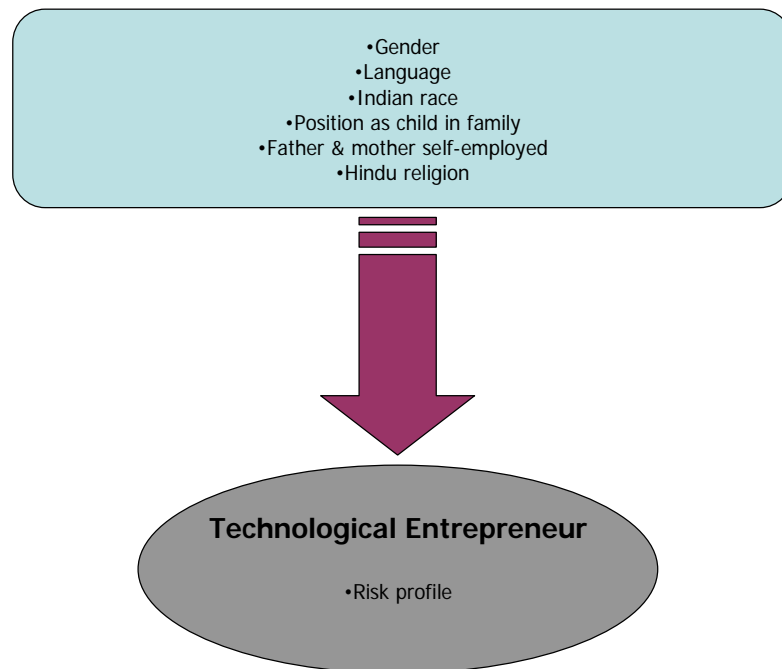


Figure 5.6 Correlations with risk profile

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. <i>Parameter = -0.26; Probability = 0.0674</i>
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. <i>Parameter = 0.34; Probability = 0.1038</i>
3	*Indian entrepreneurs tend to be more risk takers than entrepreneurs from other races who are more risk averters. <i>Parameter = -0.44; Probability = 0.0328</i>
4	Entrepreneurs who are the eldest child in the family tend to be more risk takers than those who are the youngest child. <i>Parameter = 0.06; Probability = 0.1001</i>
5	Entrepreneurs whose parents were not self-employed tend to be greater risk takers than those with self-employed parents. <i>Parameter = 0.19; Probability = 0.1450</i>
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. <i>Parameter = 0.24; Probability = 0.1370</i>

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

$$Y'er = A_{er} + B_{er1}X_{er1} + \dots + B_{er6}X_{er6} \quad [5 - 7]$$

Where:

- $Y'er$  Risk profile
- $A_{er}$  Y-intercept = 1.53
- $B_{er1} - B_{er6}$  Parameters in Table 5.10
- $X_{er1}$  Gender
- $X_{er2}$  English language
- $X_{er3}$  Indian race
- $X_{er4}$  Position as child in family
- $X_{er5}$  Self-employed status of parents
- $X_{er6}$  Christian religion

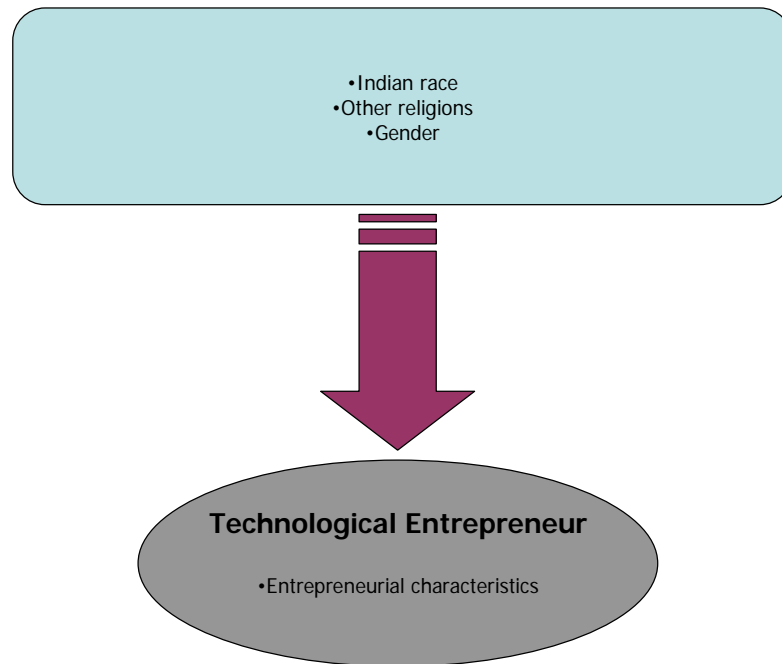


Figure 5.7 Correlations with entrepreneurial characteristics

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. <i>Parameter = 0.07; Probability = 0.1341</i>
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. <i>Parameter = -0.08; Probability = 0.1341</i>
3	Male entrepreneurs tend to rate their entrepreneurial characteristics higher against the proposed profile than females. <i>Parameter = 0.09; Probability = 0.1851</i>

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

$$Y'es = Aes + Bes_1Xes_1 + ..... + Bes_3Xes_3 \quad [5 - 8]$$

Where:

$Y'es$	Entrepreneurial characteristics
$Aes$	Y-intercept = 2.62
$Bes_1 - Bes_3$	Parameters in Table 5.11
$Xes_1$	Indian race
$Xes_2$	Hindu religion
$Xes_3$	Gender

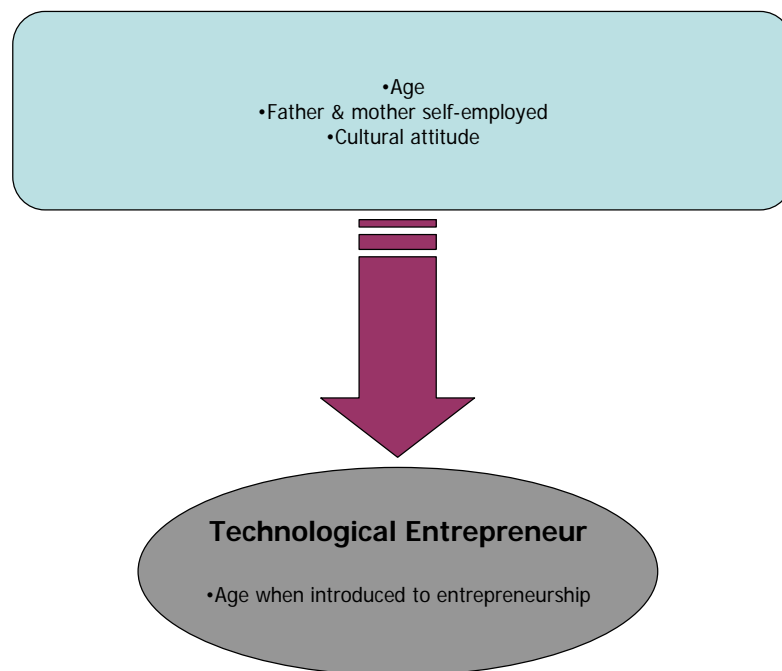


Figure 5.8 Correlations with age when introduced to entrepreneurship

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. <i>Parameter = 0.25; Probability = 0.0001</i>
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. <i>Parameter = -4.55; Probability = 0.0001</i>
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. <i>Parameter = 1.27; Probability = 0.0915</i>

---

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

$$Y'_{et} = A_{et} + B_{et1}X_{et1} + \dots + B_{et3}X_{et3} \quad [5 - 9]$$

Where:

$Y'_{et}$	Age when introduced to entrepreneurship
$A_{et}$	Y-intercept = 11.84
$B_{et1} - B_{et3}$	Parameters in Table 5.12
$X_{et1}$	Age
$X_{et2}$	Self-employed status of parents
$X_{et3}$	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*.



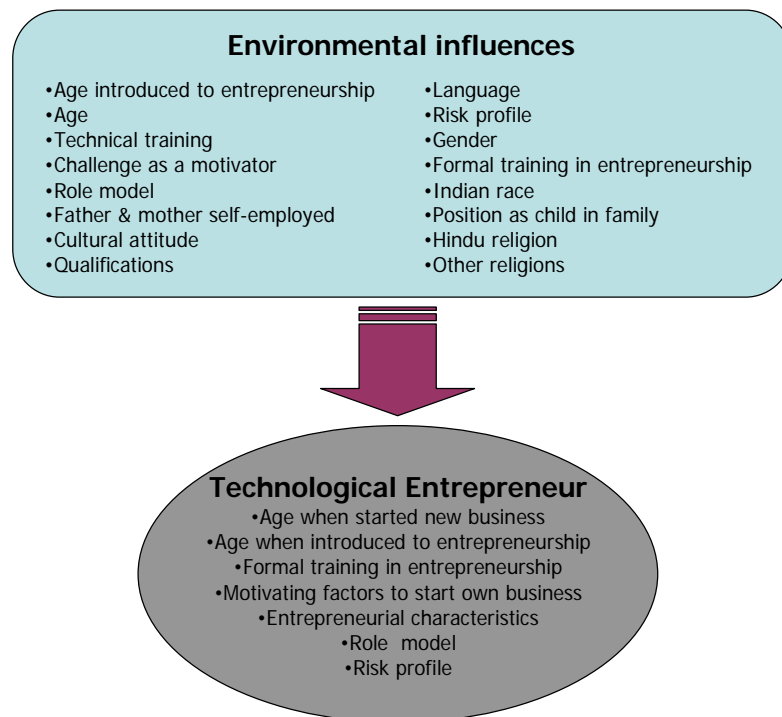


Figure 5.9 Framework of all correlations with entrepreneur

### 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.

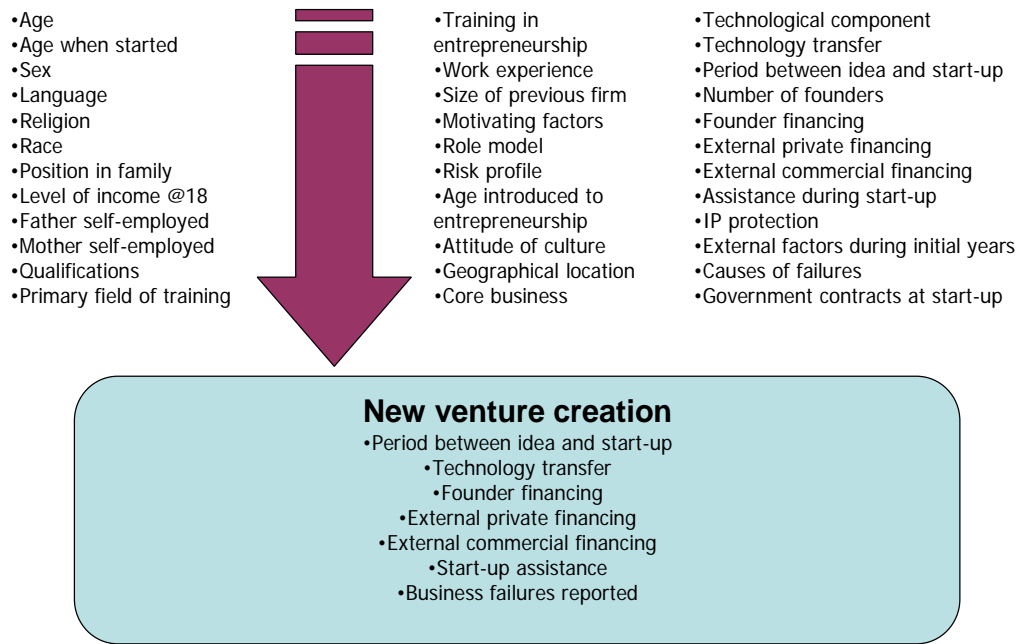


Figure 5.10 Comprehensive model elements with most predictor and selected predicted variables: New Venture Creation

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.

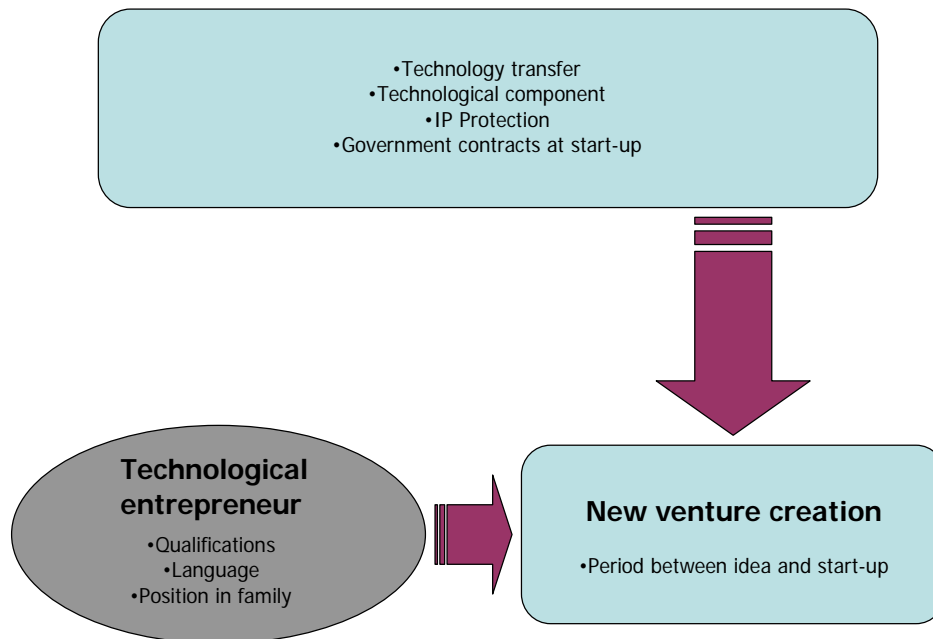


Figure 5.11 Correlations with period between idea and start-up

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. <i>Parameter = 1.06; Probability = 0.0287</i>
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. <i>Parameter = -0.40; Probability = 0.0441</i>
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. <i>Parameter = 1.34; Probability = 0.0706</i>
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. <i>Parameter = -1.59; Probability = 0.0702</i>
5	English-speaking entrepreneurs tend to start their new businesses earlier after idea formation than non-English speaking entrepreneurs. <i>Parameter = -1.99; Probability = 0.0925</i>
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. <i>Parameter = 0.34; Probability = 0.0717</i>
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. <i>Parameter = 1.99; Probability = 0.1058</i>

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

$$Y'_{vm} = A_{vm} + B_{vm1}X_{vm1} + \dots + B_{vm7}X_{vm7} \quad [5 - 10]$$

Where:

$Y'_{vm}$	Period between idea and start-up
$A_{vm}$	Y-intercept = 3.16
$B_{vm1} - B_{vm7}$	Parameters in Table 5.13
$X_{vm1}$	Qualifications
$X_{vm2}$	Technology transfer
$X_{vm3}$	IP protection
$X_{vm4}$	Technological component
$X_{vm5}$	Language
$X_{vm6}$	Position as child in family
$X_{vm7}$	Government contracts at start-up

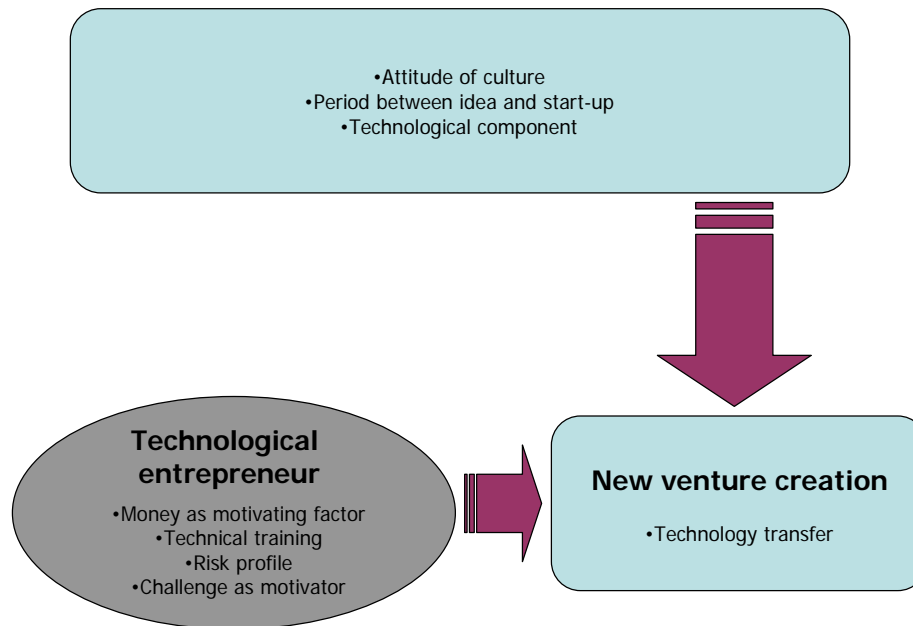


Figure 5.12 Correlations with technology transfer

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. <i>Parameter = 0.50; Probability = 0.0002</i>
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. <i>Parameter = -0.65; Probability = 0.0020</i>
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. <i>Parameter = 0.22; Probability = 0.0403</i>
4	Technology tends to be transferred more directly when the period between the idea and the actual start-up is longer. <i>Parameter = -0.04; Probability = 0.0526</i>
5	Entrepreneurs classified as risk-averters tend to transfer technology more directly than their risk-taker counterparts. <i>Parameter = -0.24; Probability = 0.1338</i>
6	Entrepreneurs with challenge as their primary motivator tend to establish businesses with direct technology transfer during start-up. <i>Parameter = -0.39; Probability = 0.1259</i>
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. <i>Parameter = 0.31; Probability = 0.1012</i>

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

$$Y'_{vn} = A_{vn} + B_{vn1}X_{vn1} + \dots + B_{vn7}X_{vn7} \quad [5 - 11]$$

Where:

$Y'_{vn}$	Technology transfer
$A_{vn}$	Y-intercept = 2.58
$B_{vn1} - B_{vn7}$	Parameters in Table 5.14
$X_{vn1}$	Money as motivator to start own business
$X_{vn2}$	Technical training
$X_{vn3}$	Attitude of culture towards entrepreneurship
$X_{vn4}$	Period between idea and start-up
$X_{vn5}$	Risk profile
$X_{vn6}$	Challenge as motivator to start business
$X_{vn7}$	Technological component

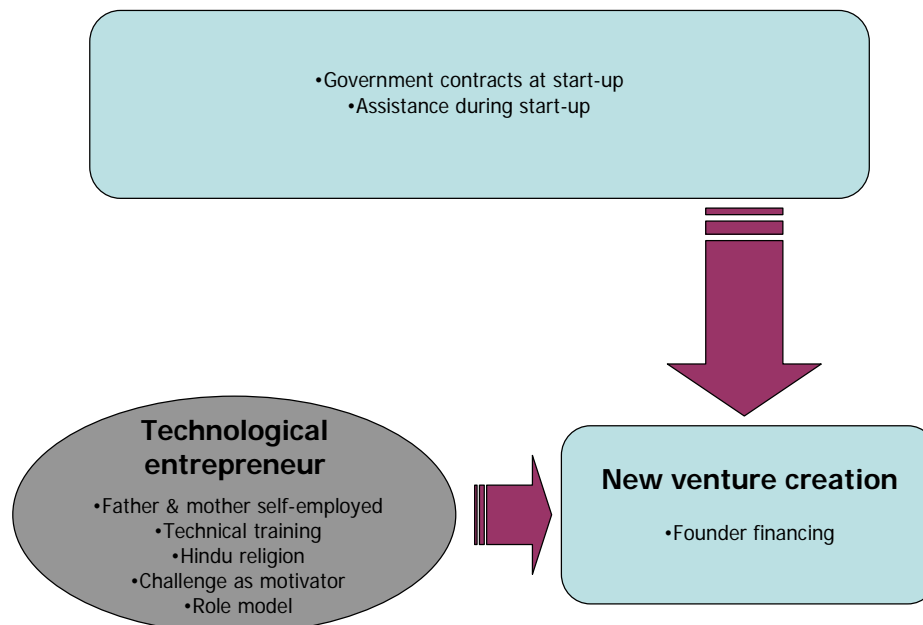


Figure 5.13 Correlations with founder financing

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. <i>Chi-square</i> = 3.33; <i>Parameter</i> = 0.67; <i>Probability</i> = 0.0679
2	*Entrepreneurs who had technical training tend to finance their new ventures with less of their own and more external funds. <i>Chi-square</i> = 6.09; <i>Parameter</i> = -0.86; <i>Probability</i> = 0.0136
3	*Entrepreneurs from other religions tend to finance their new ventures more with own funds than entrepreneurs from the Hindu religion. <i>Chi-square</i> = 5.87; <i>Parameter</i> = -0.89; <i>Probability</i> = 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. <i>Chi-square</i> = 4.78; <i>Parameter</i> = 1.43; <i>Probability</i> = 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. <i>Chi-square</i> = 4.94; <i>Parameter</i> = 0.81; <i>Probability</i> = 0.0263
6	Entrepreneurs who have role models tend to finance their businesses more from own finances than those without role models. <i>Chi-square</i> = 2.69; <i>Parameter</i> = 0.57; <i>Probability</i> = 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. <i>Chi-square</i> = 2.07; <i>Parameter</i> = -0.60; <i>Probability</i> = 0.1505

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

$$Y'_{vp} = A_{vp} + B_{vp1}X_{vp1} + \dots + B_{vp7}X_{vp7} \quad [5 - 12]$$

Where:

$Y'_{vp}$	Founder financing
$A_{vp}$	Y-intercept = -2.41
$B_{vp1} - B_{vp7}$	Parameters in Table 5.15
$X_{vp1}$	Self-employed status of parents
$X_{vp2}$	Technical training
$X_{vp3}$	Hindu religion
$X_{vp4}$	Government contracts at start-up
$X_{vp5}$	Assistance during start-up
$X_{vp6}$	Role model
$X_{vp7}$	Challenge as motivator to start own business

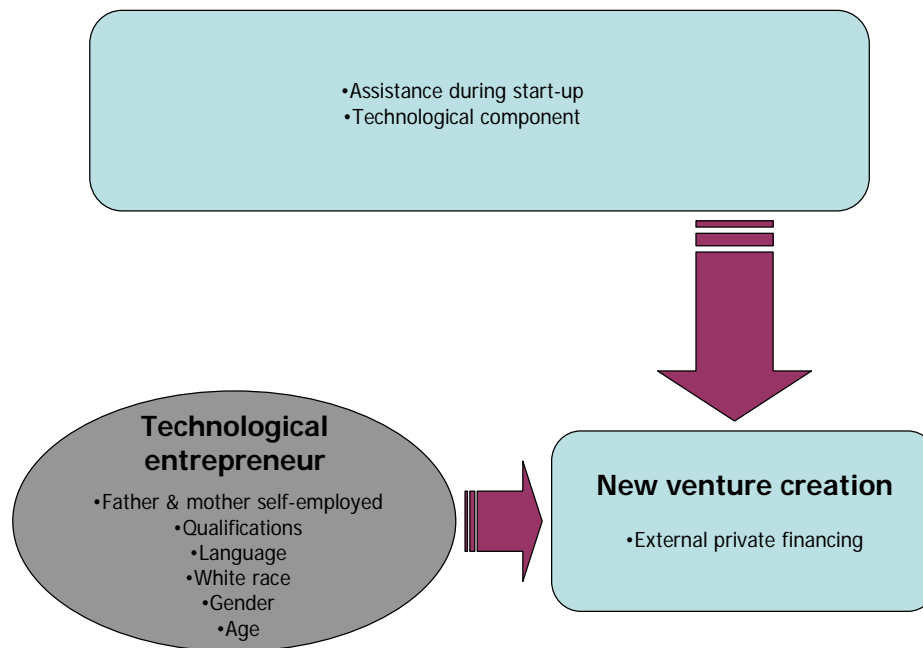


Figure 5.14 Correlations with external private financing

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. <i>Chi-square = 7.10; Parameter = 1.09; Probability = 0.0077</i>
2	*When external financing is done, white entrepreneurs tend to make more use of private financing than entrepreneurs from other races. <i>Chi-square = 5.72; Parameter = -0.92; Probability = 0.0168</i>
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. <i>Chi-square = 4.63; Parameter = -0.79; Probability = 0.0314</i>
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. <i>Chi-square = 5.04; Parameter = -1.27; Probability = 0.0248</i>
5	When external financing is done, female entrepreneurs tend to use more private financing than their male counterparts. <i>Chi-square = 3.47; Parameter = 1.26; Probability = 0.0624</i>
6	When external financing is done, older entrepreneurs tend to make more use of private financing than younger entrepreneurs. <i>Chi-square = 3.02; Parameter = -0.03; Probability = 0.0825</i>
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. <i>Chi-square = 2.27; Parameter = -0.38; Probability = 0.1319</i>



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. <i>Chi-square = 2.27; Parameter = 0.67; Probability = 0.0963</i>
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 from other training disciplines. <i>Chi-square = 1.94; Parameter = -0.52; Probability = 0.1638</i>
10	When external financing is done, entrepreneurs with a high risk averse profile tend to make more use of private funding than those with a high risk taker profile. <i>Chi-square = 1.75; Parameter = -0.35; Probability = 0.1857</i>

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

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

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

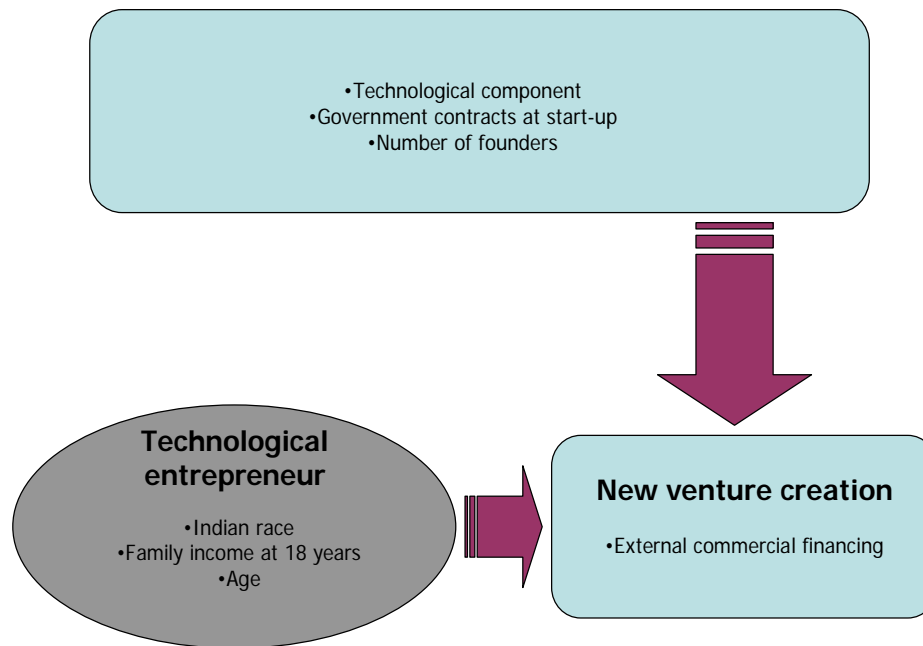


Figure 5.15 Correlations with external commercial financing

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. <i>Chi-square = 2.97; Parameter = -0.59; Probability = 0.0850</i>
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. <i>Chi-square = 5.76; Parameter = -0.82; Probability = 0.0164</i>
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. <i>Chi-square = 3.33; Parameter = 0.46; Probability = 0.0681</i>
4	*When external financing is done, younger entrepreneurs tend to make more use of commercial financing than older entrepreneurs. <i>Chi-square = 6.20; Parameter = 0.04; Probability = 0.0128</i>
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. <i>Chi-square = 5.00; Parameter = 0.54; Probability = 0.0254</i>
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. <i>Chi-square = 2.37; Parameter = 1.08; Probability = 0.1240</i>

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

$$Y'_{vr} = A_{vr} + B_{vr1}X_{vr1} + \dots + B_{vr6}X_{vr6} \quad [5 - 14]$$

Where:

$Y'_{vr}$	External commercial financing
$A_{vr}$	Y-intercept = -3.53
$B_{vr1} - B_{vr6}$	Parameters in Table 5.17
$X_{vr1}$	Indian race
$X_{vr2}$	Technological component
$X_{vr3}$	Number of founders
$X_{vr4}$	Age
$X_{vr5}$	Family income at age of 18
$X_{vr6}$	Government contracts at start-up

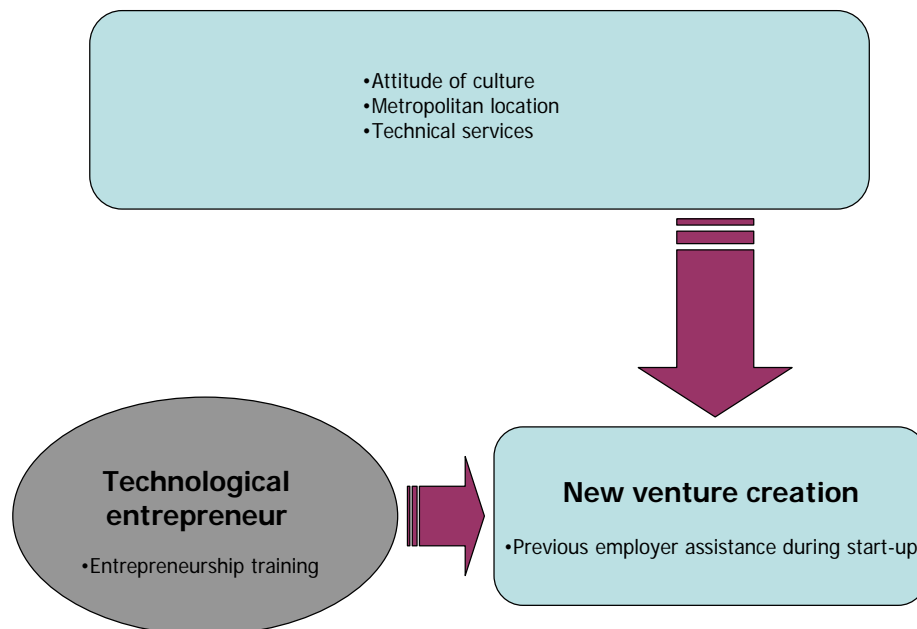


Figure 5.16 Correlations with previous employer assistance during start-up

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. <i>Chi-square = 4.45; Parameter = -1.24; Probability = 0.0349</i>
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. <i>Chi-square = 5.49; Parameter = -2.00; Probability = 0.0191</i>
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. <i>Chi-square = 3.71; Parameter = -1.76; Probability = 0.0539</i>
4	New businesses in the technical services sector tend to receive no direct assistance from their previous employer, while those from other sectors tend to receive direct assistance. <i>Chi-square = 2.53; Parameter = 1.21; Probability = 0.1118</i>

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

$$Y'vs = Avs + Bvs_1Xvs_1 + \dots + Bvs_4Xvs_4 \quad [5 - 15]$$

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

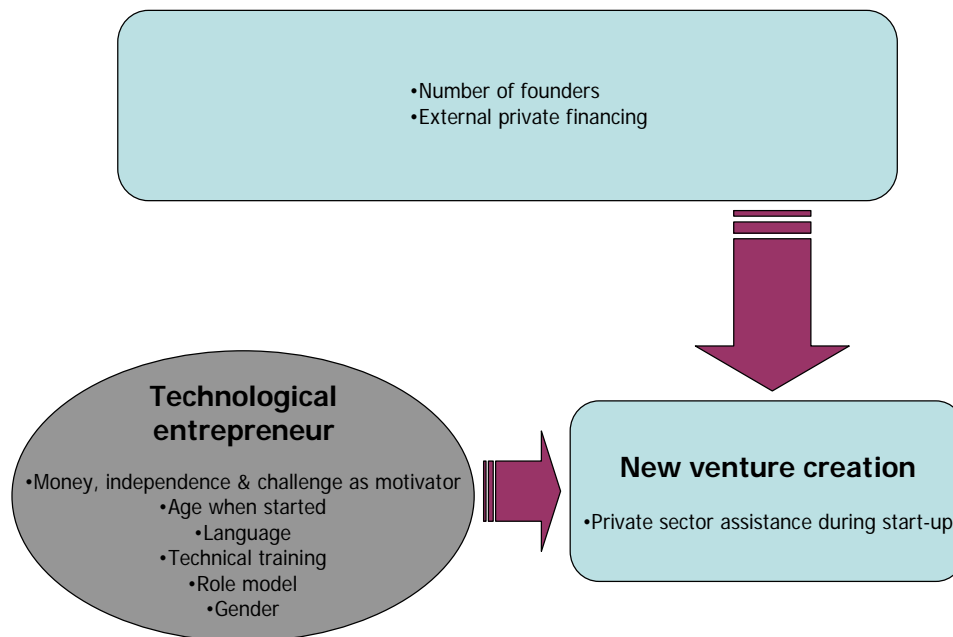


Figure 5.17 Correlations with private sector assistance during start-up

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. <i>Chi-square = 8.34; Parameter = 5.73; Probability = 0.0039</i>
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. <i>Chi-square = 3.53; Parameter = 0.11; Probability = 0.0604</i>
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. <i>Chi-square = 4.18; Parameter = 2.69; Probability = 0.0409</i>
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. <i>Chi-square = 3.47; Parameter = 1.18; Probability = 0.0625</i>
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. <i>Chi-square = 3.71; Parameter = 1.52; Probability = 0.0542</i>
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. <i>Chi-square = 2.97; Parameter = -1.47; Probability = 0.0849</i>
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. <i>Chi-square = 3.28; Parameter = 1.60; Probability = 0.0700</i>

8	Male entrepreneurs tend to be more directly assisted by the private sector than female entrepreneurs. <i>Chi-square = 2.59; Parameter = -2.01; Probability = 0.1073</i>
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The mathematical equation for *private sector assistance during start-up* is the following:

$$Y'_{vt} = A_{vt} + B_{vt1}X_{vt1} + \dots + B_{vt8}X_{vt8} \quad [5 - 16]$$

Where:

- $Y'_{vt}$  Private sector assistance during start-up
- $A_{vt}$  Y-intercept = -11.15
- $B_{vt1} - B_{vt8}$  Parameters in Table 5.19
- $X_{vt1}$  Money, independence or challenge as motivator to start own business
- $X_{vt2}$  Age when started new business
- $X_{vt3}$  Language
- $X_{vt4}$  Number of founders
- $X_{vt5}$  External private financing
- $X_{vt6}$  Role model
- $X_{vt7}$  Technical training
- $X_{vt8}$  Gender

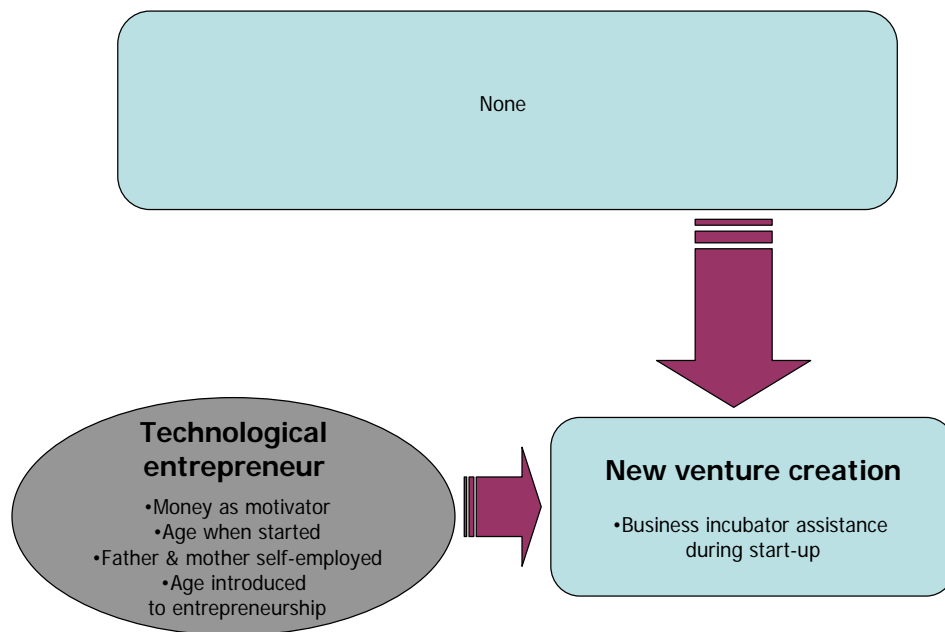


Figure 5.18 Correlations with business incubator assistance during start-up

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. <i>Chi-square = 6.59; Parameter = 14.27; Probability = 0.0102</i>
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. <i>Chi-square = 6.89; Parameter = 0.65; Probability = 0.0086</i>
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. <i>Chi-square = 5.00; Parameter = 7.01; Probability = 0.0254</i>
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. <i>Chi-square = 3.19; Parameter = -0.19; Probability = 0.0739</i>

The mathematical equation for *business incubator assistance during start-up* is the following:

$$Y'vu = Avu + Bvu_1Xvu_1 + \dots + Bvu_4Xvu_4 \quad [5 - 17]$$

Where:

- $Y'_{vu}$  Business incubator assistance during start-up
- $Avu$  Y-intercept = -24.49
- $Bvu_1 - Bvu_4$  Parameters in Table 5.20
- $Xvu_1$  Money as motivator to start own business
- $Xvu_2$  Age when started new business
- $Xvu_3$  Self-employed status of parents
- $Xvu_4$  Age when introduced to entrepreneurship

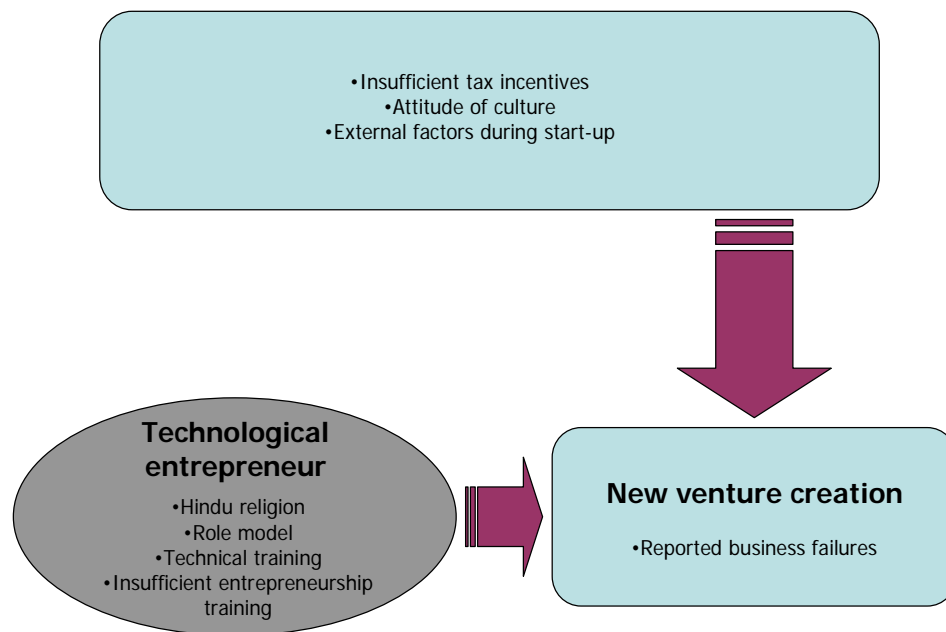


Figure 5.19 Correlations with reported business failures

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. <i>Chi-square = 8.15; Parameter = -0.35; Probability = 0.0043</i>
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. <i>Chi-square = 4.08; Parameter = 0.72; Probability = 0.0434</i>
3	*Entrepreneurs from the Hindu religion tend to have more business failures than those from other religions. <i>Chi-square = 3.96; Parameter = -1.23; Probability = 0.0466</i>
4	*Entrepreneurs who did not have a role model tend to have more business failures than those who had a role model. <i>Chi-square = 4.02; Parameter = 1.09; Probability = 0.0450</i>
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. <i>Chi-square = 3.08; Parameter = -1.36; Probability = 0.0794</i>
6	Entrepreneurs with technical training tend to have more business failures than those with non-technical training. <i>Chi-square = 2.58; Parameter = -0.89; Probability = 0.1081</i>
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. <i>Chi-square = 2.05; Parameter = 0.17; Probability = 0.1525</i>

The mathematical equation for *business failures reported* is the following:

$$Y'_{vv} = A_{vv} + B_{vv1}X_{vv1} + \dots + B_{vv7}X_{vv7} \quad [5 - 18]$$

Where:

- $Y'_{vv}$  Business failures reported
- $A_{vv}$  Y-intercept = 0.97
- $B_{vv1} - B_{vv7}$  Parameters in Table 5.21
- $X_{vv1}$  Insufficient tax incentives
- $X_{vv2}$  Attitude of culture towards entrepreneurship
- $X_{vv3}$  Hindu religion
- $X_{vv4}$  Role model
- $X_{vv5}$  External factors during start-up
- $X_{vv6}$  Technical training
- $X_{vv7}$  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*.

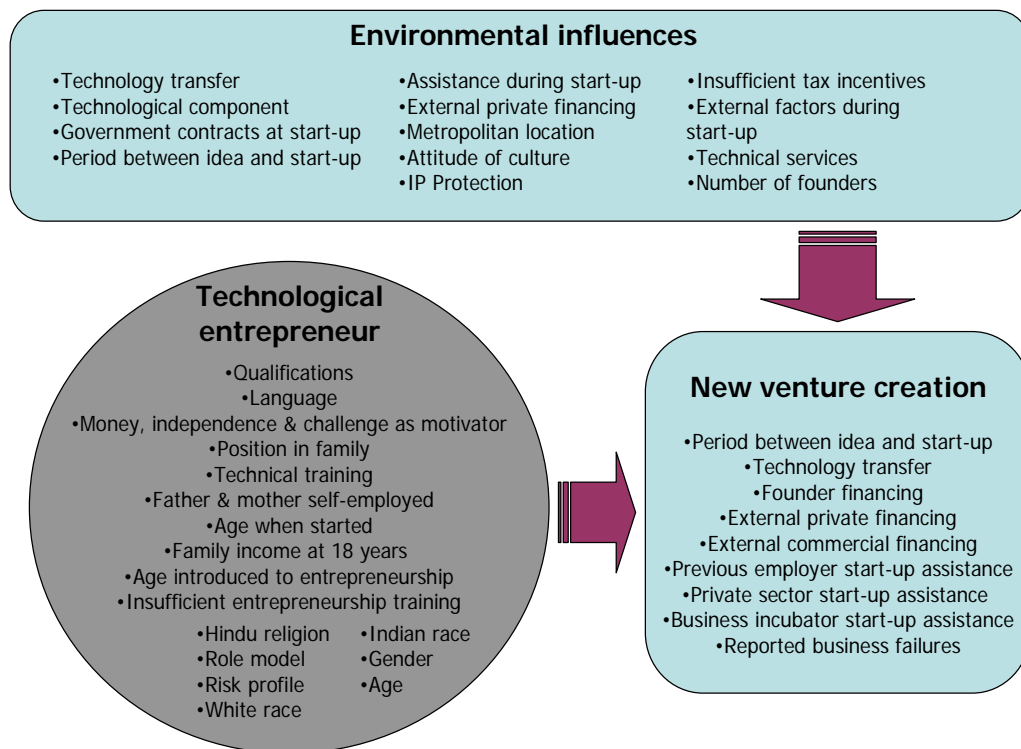


Figure 5.20 Framework of all correlations with new venture creation process

#### 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.

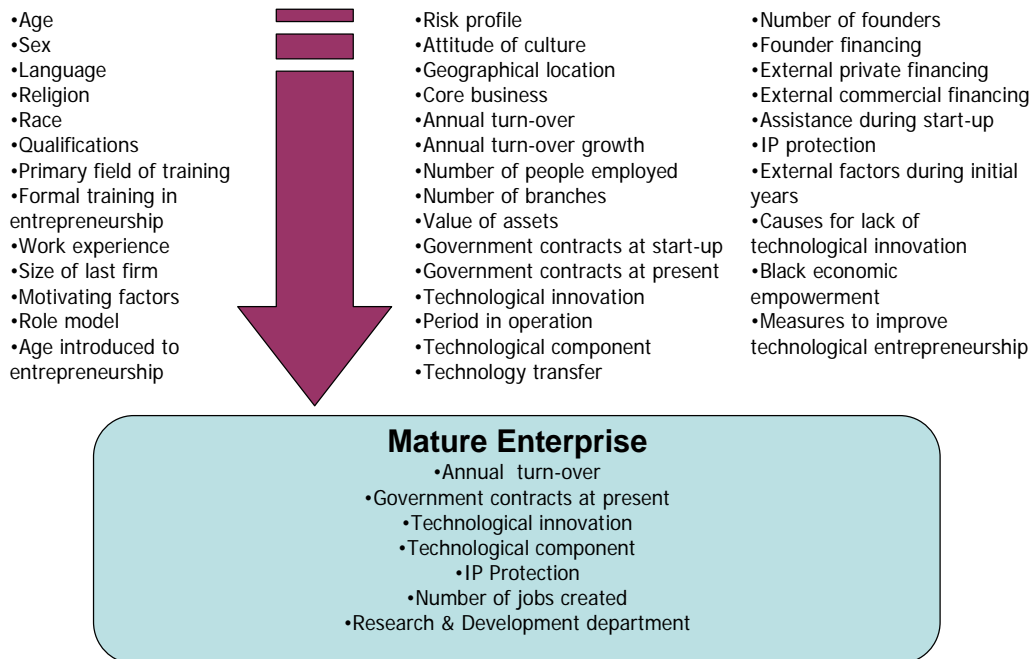


Figure 5.21 Comprehensive model elements with most predictor and selected predicted variables: Mature Enterprise

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.

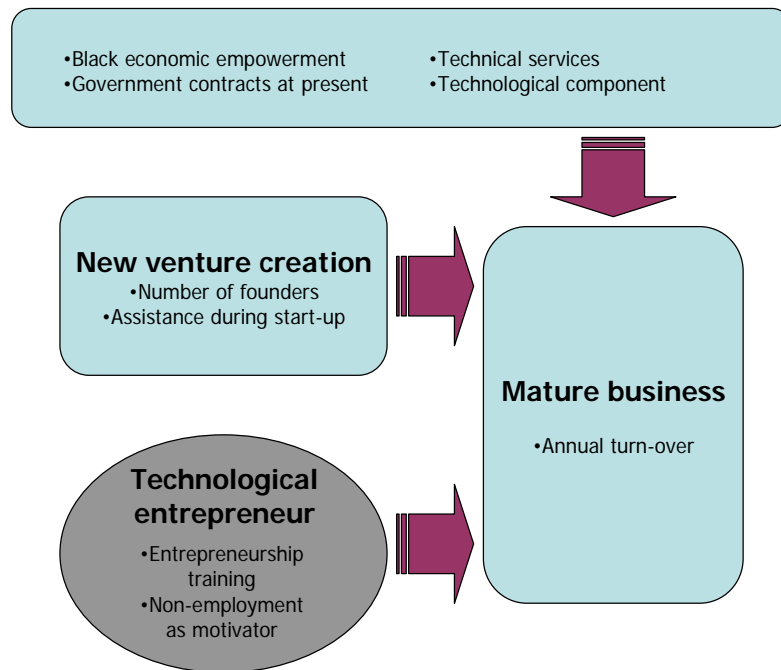


Figure 5.22 Correlations with annual turn-over

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. <i>Parameter = 0.27; Probability = 0.0100</i>
2	*Black owned businesses tend to have smaller annual turn-over than their white-owned counterparts. <i>Parameter = 0.22; Probability = 0.0250</i>
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. <i>Parameter = -0.28; Probability = 0.0756</i>
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. <i>Parameter = 0.38; Probability = 0.0518</i>
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. <i>Parameter = -0.33; Probability = 0.0664</i>
6	Businesses in the technical services sector tend to have smaller annual turn-over than those in the manufacturing or other sectors. <i>Parameter = -0.30; Probability = 0.1179</i>
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. <i>Parameter = -0.33; Probability = 0.1487</i>
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. <i>Parameter = 0.19; Probability = 0.1497</i>

---

The mathematical equation for *annual turn-over* is the following:

$$Y'_{mm} = A_{mm} + B_{mm1}X_{mm1} + \dots + B_{mm8}X_{mm8} \quad [5 - 19]$$

Where:

$Y'_{mm}$	Annual turn-over
$A_{mm}$	Y-intercept = 0.99
$B_{mm1} - B_{mm8}$	Parameters in Table 5.22
$X_{mm1}$	Number of founders
$X_{mm2}$	Black economic empowerment
$X_{mm3}$	Training in entrepreneurship
$X_{mm4}$	Government contracts at present
$X_{mm5}$	Assistance during start-up
$X_{mm6}$	Technical services
$X_{mm7}$	Non-employment as motivator to start own business
$X_{mm8}$	Technological component

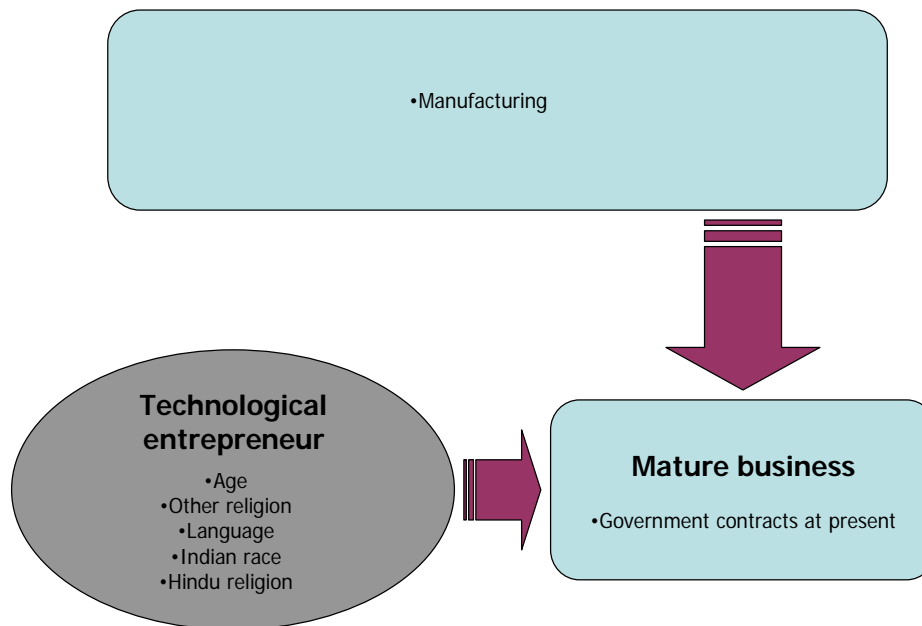


Figure 5.23 Correlations with Government contracts at present

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. <i>Chi-square = 3.42; Parameter = 0.04; Probability = 0.0641</i>
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. <i>Chi-square = 3.62; Parameter = 2.29; Probability = 0.0571</i>
3	Businesses in the manufacturing sector tend to have a lower percentage government contracts than those in the technical services or other sectors. <i>Chi-square = 1.82; Parameter = -0.60; Probability = 0.1774</i>
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. <i>Chi-square = 3.58; Parameter = 1.19; Probability = 0.0584</i>
5	*Businesses managed by Indian entrepreneurs tend to have a smaller percentage of government contracts than those managed by entrepreneurs from other race groups. <i>Chi-square = 4.74; Parameter = -1.65; Probability = 0.0294</i>

The mathematical equation for *government contracts at present* is the following:

$$Y'mn = Amn + Bmn_1Xmn_1 + \dots + Bmn_5Xmn_5 \quad [5 - 20]$$

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

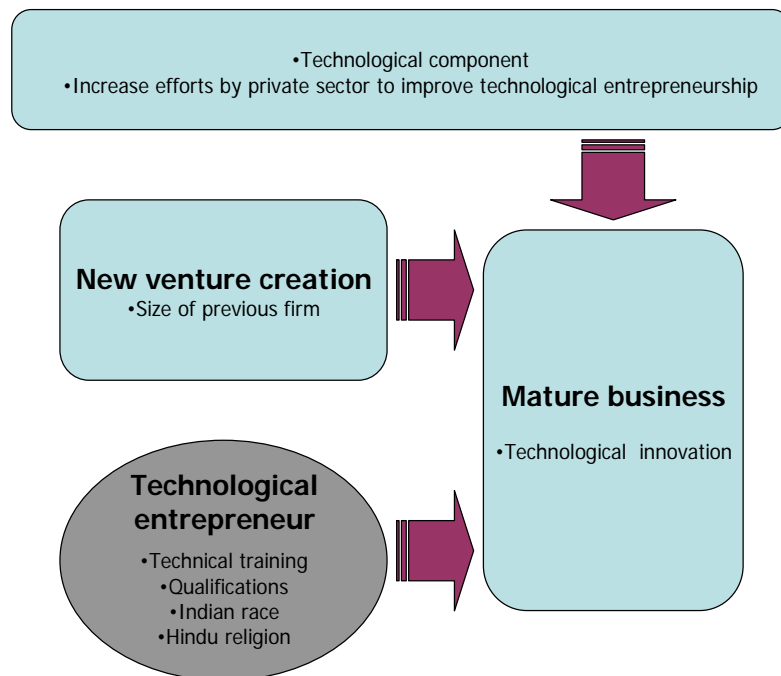


Figure 5.24 Correlations with technological innovation

The correlations with *technological innovation* are 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. <i>Parameter = 13.77; Probability = 0.0001</i>
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. <i>Parameter = 0.33; Probability = 0.0088</i>
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. <i>Parameter = 0.15; Probability = 0.0320</i>
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). <i>Parameter = -0.19; Probability = 0.0297</i>
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. <i>Parameter = -0.11; Probability = 0.1036</i>
6	Indian entrepreneurs tend to report higher technological innovation levels in their businesses than those from other races. <i>Parameter = 0.45; Probability = 0.1849</i>
7	*Entrepreneurs from the Hindu religion tend to report lower levels of technological innovation than those from other religions. <i>Parameter = -0.39; Probability = 0.0272</i>

The mathematical equation for *technological innovation* is the following:

$$Y'_{mp} = A_{mp} + B_{mp1}X_{mp1} + \dots + B_{mp7}X_{mp7} \quad [5 - 21]$$

Where:

- $Y'_{mp}$  Technological innovation
- $A_{mp}$  Y-intercept = 2.41
- $B_{mp1} - B_{mp7}$  Parameters in Table 5.24
- $X_{mp1}$  Technological component
- $X_{mp2}$  Technical training
- $X_{mp3}$  Size of previous firm
- $X_{mp4}$  Qualifications
- $X_{mp5}$  Increase efforts by private sector
- $X_{mp6}$  Indian race
- $X_{mp7}$  Hindu religion



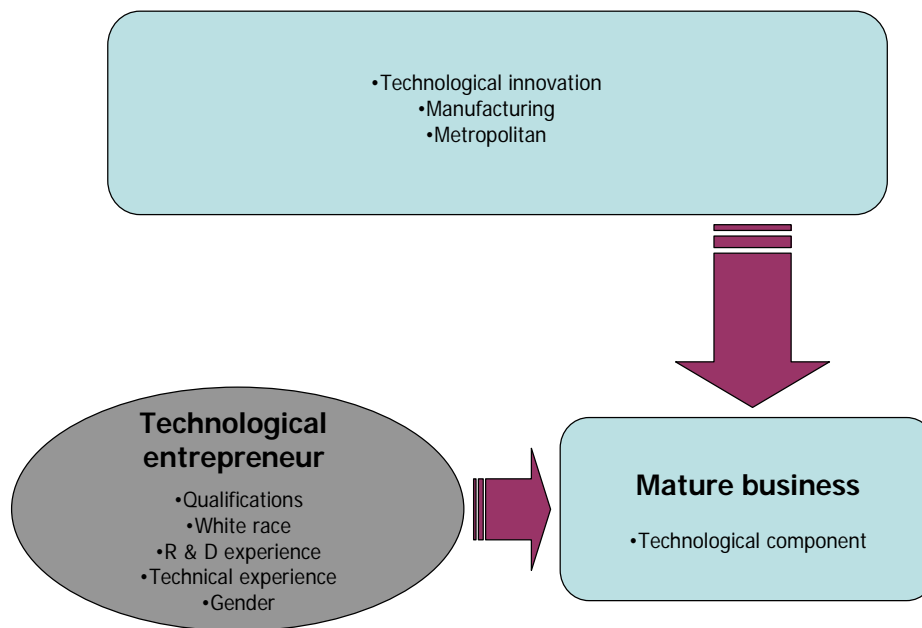


Figure 5.25 Correlations with technological component

*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. <i>Parameter = 0.66; Probability = 0.0399</i>
2	*Mature businesses that reported high levels of technological innovation tend to have a high technological component in their products or services. <i>Parameter = 0.52; Probability = 0.0103</i>
3	*Mature businesses in the manufacturing sector tend to have a lower technological component than businesses in other sectors. <i>Parameter = -0.31; Probability = 0.0043</i>
4	Mature businesses located in metropolitan areas tend to have a lower technological component than those located in towns or rural areas. <i>Parameter = -0.20; Probability = 0.0922</i>
5	Mature businesses managed by white entrepreneurs tend to have a higher technological component than those managed by entrepreneurs from other races. <i>Parameter = 0.50; Probability = 0.1899</i>
6	Mature businesses managed by female entrepreneurs tend to have a higher technological component than those managed by male entrepreneurs.

	<i>Parameter = -0.55; Probability = 0.0603</i>
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. <i>Parameter = -0.04; Probability = 0.0659</i>
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. <i>Parameter = 0.01; Probability = 0.0975</i>

The mathematical equation for *technological component* is the following:

$$Y'mq = Amq + Bmq_1Xmq_1 + \dots + Bmq_8Xmq_8 \quad [5 - 22]$$

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

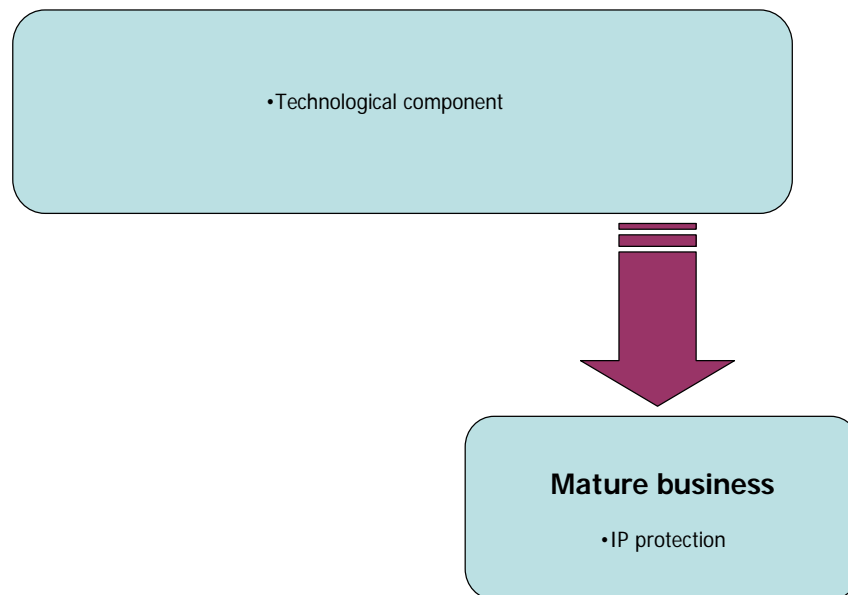


Figure 5.26 Correlations with intellectual property (IP) protection

*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. <i>Chi-square = 2.45; Parameter = 1.94; Probability = 0.1172</i>

The mathematical equation for *intellectual property protection* is the following:

$$Y'mr = Amr + Bmr_1Xmr_1 \quad [5 - 23]$$

Where:

$Y'mr$  Intellectual property protection

*Amr*                    Y-intercept = -3.89  
*Bmr<sub>1</sub>*                    Parameter in Table 5.26  
*Xmr<sub>1</sub>*                    Technological component

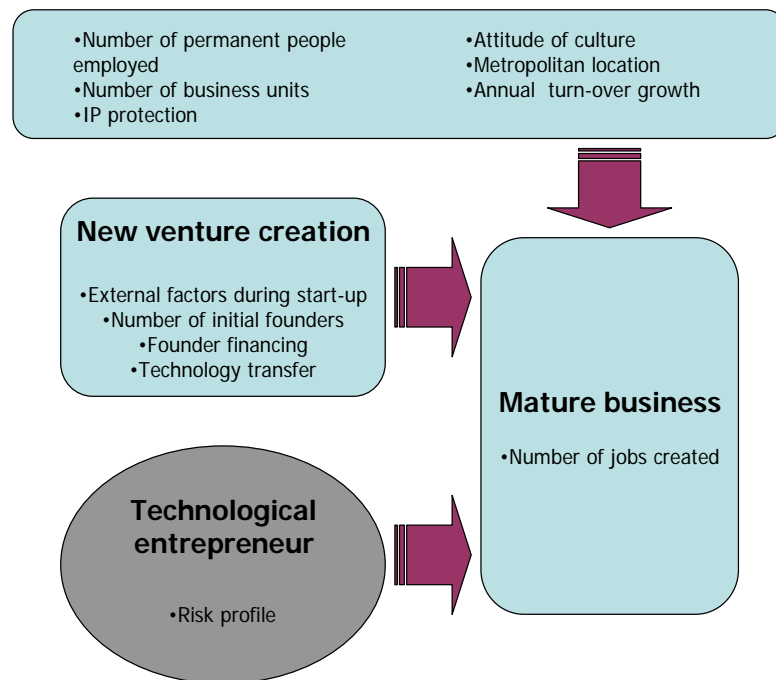


Figure 5.27 Correlations with number of jobs created

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. <i>Parameter = 35.73; Probability = 0.0001</i>
2	*Businesses with more business units or branches tend to create more jobs than those with fewer business units or branches. <i>Parameter = 46.77; Probability = 0.0017</i>
3	Entrepreneurs who come from cultures that are negative towards entrepreneurship tend to create less new jobs than those who come from conducive cultures. <i>Parameter = -19.58; Probability = 0.0775</i>
4	Businesses operating in the rural areas or towns tend to create more jobs than those in metropolitan areas. <i>Parameter = -25.19; Probability = 0.0598</i>
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.

	<i>Parameter = -33.00; Probability = 0.0838</i>
6	Businesses that protect their intellectual property through a patent (local or international) tend to create more jobs than those without IP protection. <i>Parameter = 31.81; Probability = 0.0850</i>
7	Businesses that were started by more than one founder tend to create more jobs than those that were started by one founder only. <i>Parameter = 17.44; Probability = 0.1260</i>
8	Businesses that reported high annual turn-over growth figures tend to create less new jobs than those that reported lower growth figures. <i>Parameter = -15.93; Probability = 0.1485</i>
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. <i>Parameter = 9.78; Probability = 0.1381</i>
10	Entrepreneurs with a risk averter profile tend to create less new jobs than those with a risk taker profile. <i>Parameter = -13.35; Probability = 0.1974</i>
11	Businesses that transferred technology more directly tend to create more jobs than those that reported no technology transfer. <i>Parameter = -6.82; Probability = 0.1832</i>

The mathematical equation for *number of jobs created* is the following:

$$Y'ms = Ams + Bms_1Xms_1 + ..... + Bms_{11}Xms_{11} \quad [5 - 24]$$

Where:

- Y'sm*                      Number of jobs created
- Ams*                        Y-intercept = 33.13
- Bms<sub>1</sub> – Bms<sub>11</sub>*        Parameters in Table 5.27
- Xms<sub>1</sub>*                      Number of people employed
- Xms<sub>2</sub>*                      Number of business units
- Xms<sub>3</sub>*                      Attitude of culture towards entrepreneurship
- Xms<sub>4</sub>*                      Geographical location
- Xms<sub>5</sub>*                      External factors during start-up
- Xms<sub>6</sub>*                      IP protection
- Xms<sub>7</sub>*                      Number of initial founders
- Xms<sub>8</sub>*                      Annual turn-over growth
- Xms<sub>9</sub>*                      Founder financing
- Xms<sub>10</sub>*                    Risk profile
- Xms<sub>11</sub>*                    Technology transfer

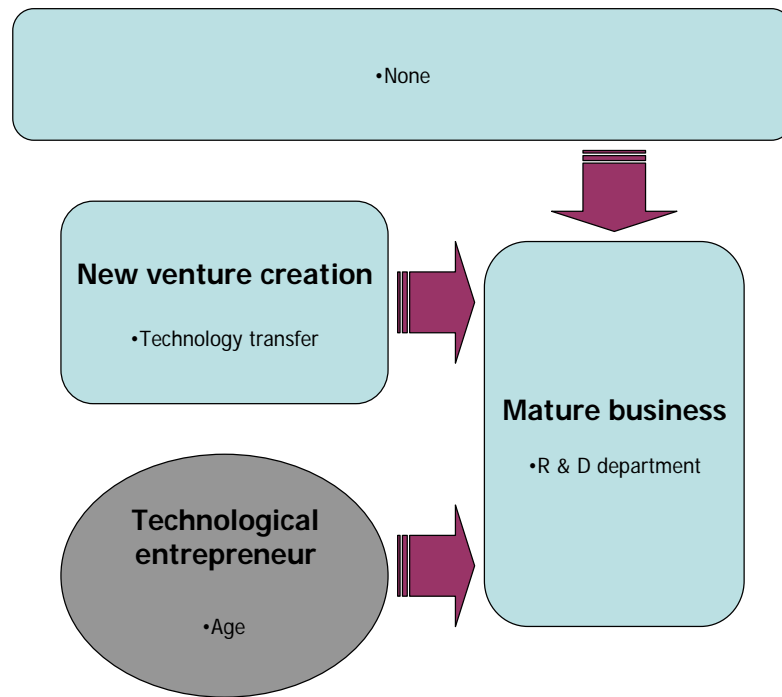


Figure 5.28 Correlations with R & D department

*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. <i>Chi-square = 5.32; Parameter = 0.27; Probability = 0.0211</i>
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. <i>Chi-square = 3.59; Parameter = -3.52; Probability = 0.0582</i>

The mathematical equation for *R & D department* is the following:

$$Y'mt = Amt + Bmt_1Xmt_1 + ..... + Bmt_2Xmt_2 \quad [5 - 25]$$

Where:

- $Y'_{mt}$  R & D department
- $A_{mt}$  Y-intercept = -8.21
- $B_{mt1} - B_{mt2}$  Parameters in Table 5.28
- $X_{mt1}$  Age
- $X_{mt2}$  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*.

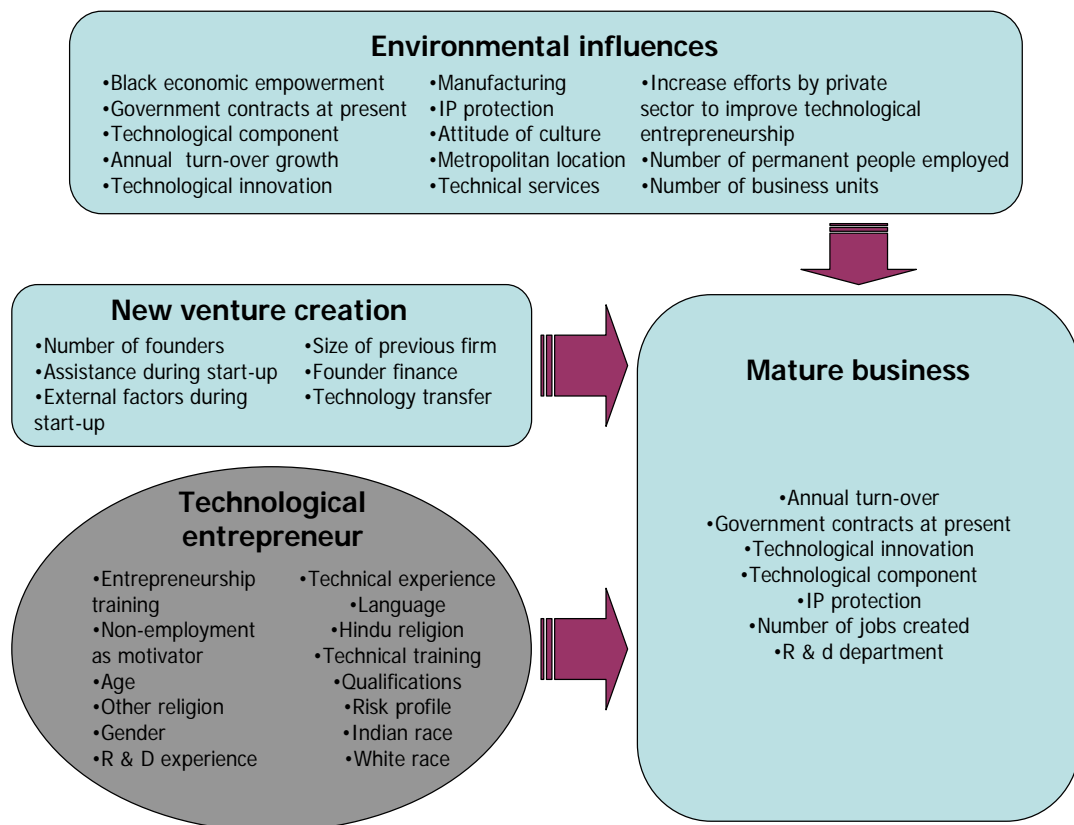


Figure 5.29 Framework of all correlations with mature business

## 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	<b>Family background</b> <ul style="list-style-type: none"> <li>▪ Position as child in the family</li> <li>▪ Self-employed status of parents</li> </ul>
2	<b>Personality traits</b> <ul style="list-style-type: none"> <li>▪ Challenge as a motivator to start new business</li> <li>▪ Risk profile of entrepreneur</li> </ul>
3	<b>Growing up experience</b> <ul style="list-style-type: none"> <li>▪ Age when introduced to entrepreneurship</li> <li>▪ Technical training</li> <li>▪ Role model</li> <li>▪ Formal qualifications</li> <li>▪ Training in entrepreneurship</li> </ul>
4	<b>Cultural influences</b> <ul style="list-style-type: none"> <li>▪ Hindu religion</li> <li>▪ Other religions</li> <li>▪ Indian entrepreneurs</li> <li>▪ Home language</li> <li>▪ Cultural attitude towards entrepreneurship</li> </ul>
5	<b>Physical traits</b> <ul style="list-style-type: none"> <li>▪ Age</li> <li>▪ Gender</li> </ul>

These environmental categories and their relationships with the technological entrepreneur constitute the first part of the model as presented in Figure 5.30.



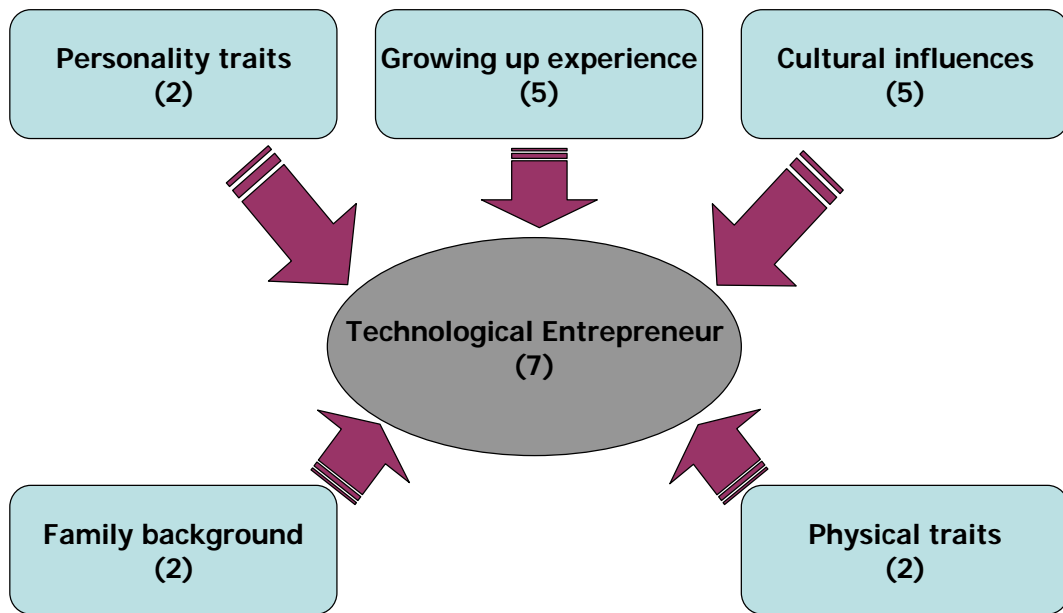


Figure 5.30 Proposed model of the technological entrepreneur part 1

In this part of the model the *technological entrepreneur* is represented by the equation:

$$Te = \sum_{i=m}^t Y'ei \quad [5 - 26]$$

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	<p><b>Technological entrepreneur</b></p> <ul style="list-style-type: none"> <li>▪ Qualifications</li> <li>▪ Language</li> <li>▪ Money as motivator</li> <li>▪ Independence as motivator</li> <li>▪ Challenge as motivator</li> <li>▪ Position as child in family</li> <li>▪ Technical training</li> <li>▪ Self-employed status of parents</li> <li>▪ Age when started first business</li> <li>▪ Family income at the age of 18 years</li> <li>▪ Age when introduced to entrepreneurship</li> <li>▪ Entrepreneurship training</li> <li>▪ Hindu religion</li> <li>▪ Role model</li> <li>▪ Risk profile</li> <li>▪ White entrepreneurs</li> <li>▪ Indian entrepreneurs</li> <li>▪ Gender</li> <li>▪ Age</li> </ul>
2	<p><b>Technology specific</b></p> <ul style="list-style-type: none"> <li>▪ Degree of technology transfer</li> <li>▪ Technological component</li> <li>▪ Period between idea and start-up</li> <li>▪ IP protection</li> <li>▪ Technical services</li> <li>▪ Number of founders</li> </ul>
3	<p><b>Start-up assistance</b></p> <ul style="list-style-type: none"> <li>▪ Assistance during start-up</li> <li>▪ External private financing</li> <li>▪ Metropolitan location</li> <li>▪ Cultural attitude towards entrepreneurship</li> <li>▪ Insufficient tax incentives</li> <li>▪ External factors affecting start-up</li> <li>▪ Government contracts at start-up</li> </ul>

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.

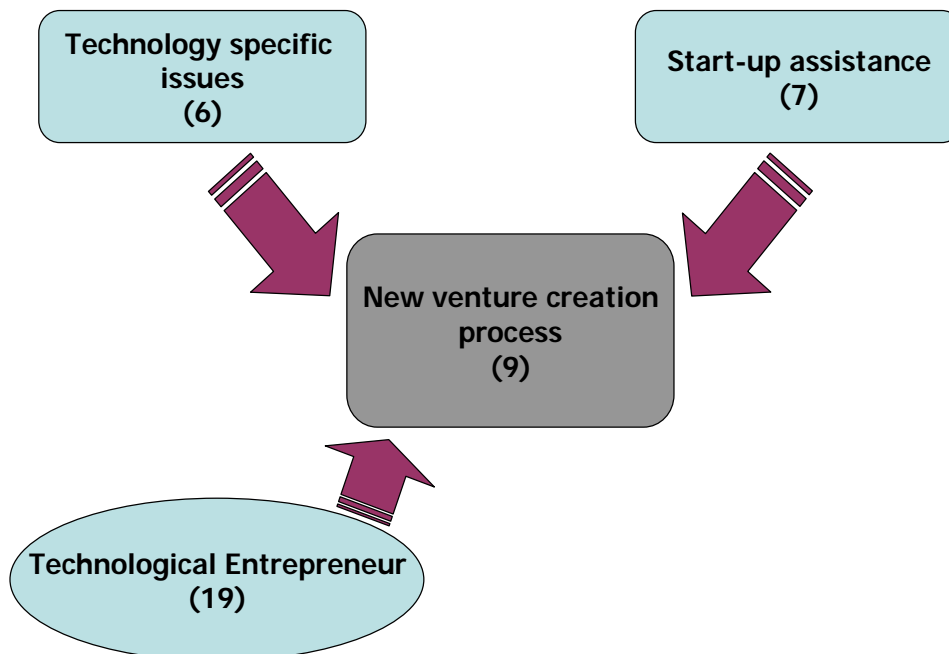


Figure 5.31 Proposed model of the new venture creation process part 2

In this part of the model the *new venture creation process* is represented by the equation:

$$Nv = \sum_{i=m}^v Y'vi \quad [5 - 27]$$

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	<p><b>Technological entrepreneur</b></p> <ul style="list-style-type: none"> <li>▪ Entrepreneurship training</li> <li>▪ Non-employment as motivator</li> <li>▪ Age</li> <li>▪ Other religion</li> <li>▪ Gender</li> <li>▪ R &amp; D work experience</li> <li>▪ Technical work experience</li> <li>▪ Language</li> <li>▪ Hindu religion</li> <li>▪ Technical training</li> <li>▪ Qualifications</li> <li>▪ Risk profile</li> <li>▪ White entrepreneurs</li> <li>▪ Indian entrepreneurs</li> </ul>
2	<p><b>New venture creation process</b></p> <ul style="list-style-type: none"> <li>▪ Number of founders</li> <li>▪ Assistance during start-up</li> <li>▪ External factors affecting start-up</li> <li>▪ Size of previous firm</li> <li>▪ Founder's finance</li> <li>▪ Technology transfer</li> </ul>
3	<p><b>Enterprise specific</b></p> <ul style="list-style-type: none"> <li>▪ Technological component</li> <li>▪ Annual turn over growth</li> <li>▪ Technological innovation</li> <li>▪ Manufacturing sector</li> <li>▪ IP protection</li> <li>▪ Metropolitan location</li> <li>▪ Technical services sector</li> <li>▪ Number of people employed</li> <li>▪ Number of business units/branches</li> </ul>
4	<p><b>Business environment</b></p> <ul style="list-style-type: none"> <li>▪ Black empowerment status</li> <li>▪ Government contracts at present</li> <li>▪ Increase efforts by private sector to improve technological innovation</li> <li>▪ Cultural attitude towards entrepreneurship</li> </ul>

These environmental categories and their relationships with the mature business constitute the third part of the model as presented in Figure 5.32.

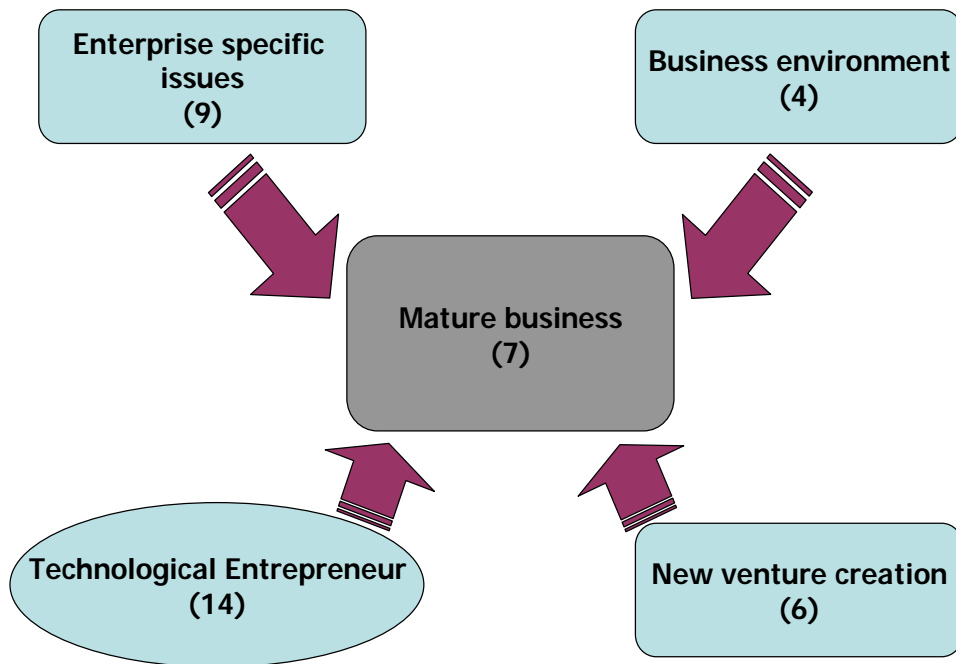


Figure 5.32 Proposed model of the mature business part 3

In this part of the model the *mature business* is represented by the equation:

$$Mb = \sum_{i=m}^t Y'mi \quad [5 - 28]$$

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. <i>Chi-square = 0.0027; Probability = 0.9587</i>
2	No correlation was found between race group and entrepreneurship training. <i>Chi-square = 2.5488; Probability = 0.2796</i>
3	No correlation was found between degree institutions and entrepreneurship training. <i>Chi-square = 2.1043; Probability = 0.1469</i>
4	No correlation was found between gender and entrepreneurship training. <i>Chi-square = 0.3017; Probability = 0.5828</i>
5	No correlation was found between race and starting previous businesses. <i>Chi-square = 2.0668; Probability = 0.3558</i>
6	No correlation was found between age group and starting previous businesses. <i>Chi-square = 0.6644; Probability = 0.7246</i>
7	No correlation was found between gender and starting previous businesses. <i>Chi-square = 1.1659; Probability = 0.2802</i>
8	*Some positive correlation was found between gender and entrepreneurial aspirations where female students reported higher entrepreneurial aspirations than male students. <i>Chi-square = 4.0954; Parameter = positive; Probability = 0.0430</i>
9	*Some positive correlation was found between race group and entrepreneurial aspirations where black students reported higher entrepreneurial aspirations than white students. <i>Chi-square = 7.2098; Parameter = positive; Probability = 0.0272</i>
10	No correlation was found between highest qualification and technology business founded. <i>Chi-square = 2.1813; Probability = 0.7025</i>
11	No correlation was found between degree and technology business founded. <i>Chi-square = 2.6066; Probability = 0.2716</i>
12	No correlation was found between schooling and entrepreneurship training. <i>Chi-square = 1.5005; Probability = 0.2206</i>
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). <i>Chi-square = 25.9325; Parameter = negative; Probability = 0.0001</i>
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. <i>Chi-square = 27.7902; Parameter = negative; Probability = 0.0001</i>

Refer to Appendix C for detail results of above correlation analysis.

The results are presented graphically in Figure 5.33.

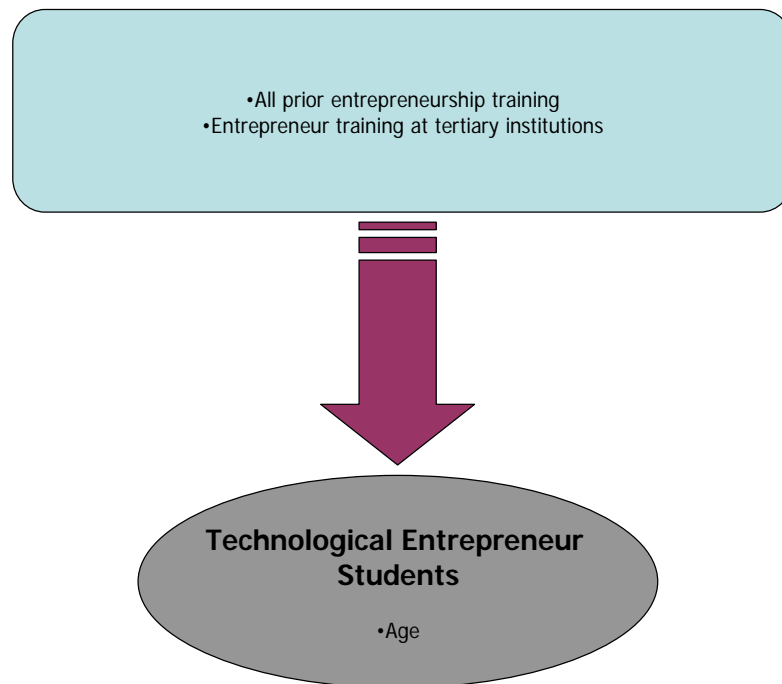


Figure 5.33 Correlations with age of entrepreneur students

## 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.

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% 2 <sup>nd</sup> 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

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.

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.

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.

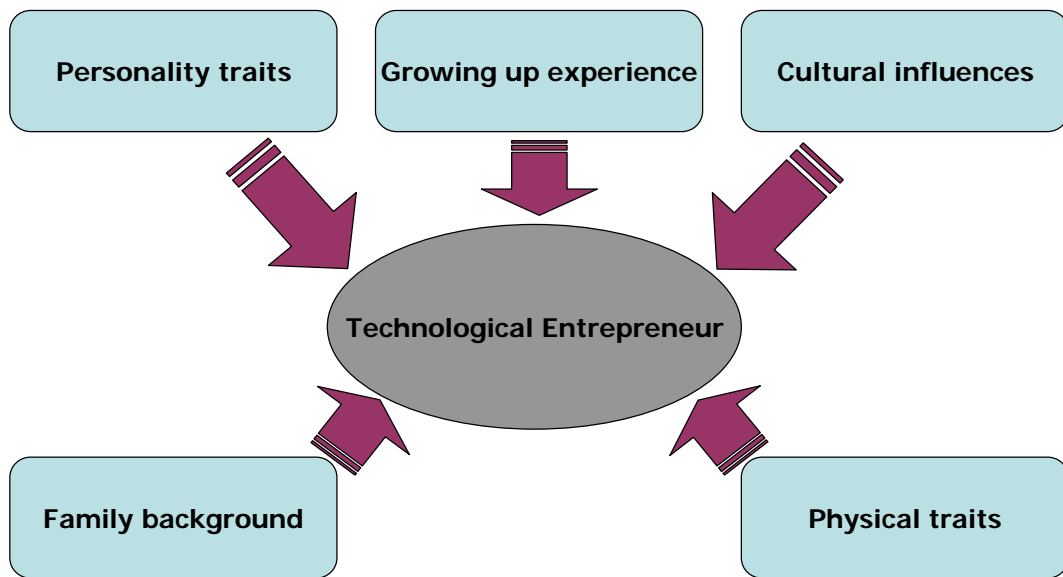


Figure 6.1 Model of the technological entrepreneur part 1

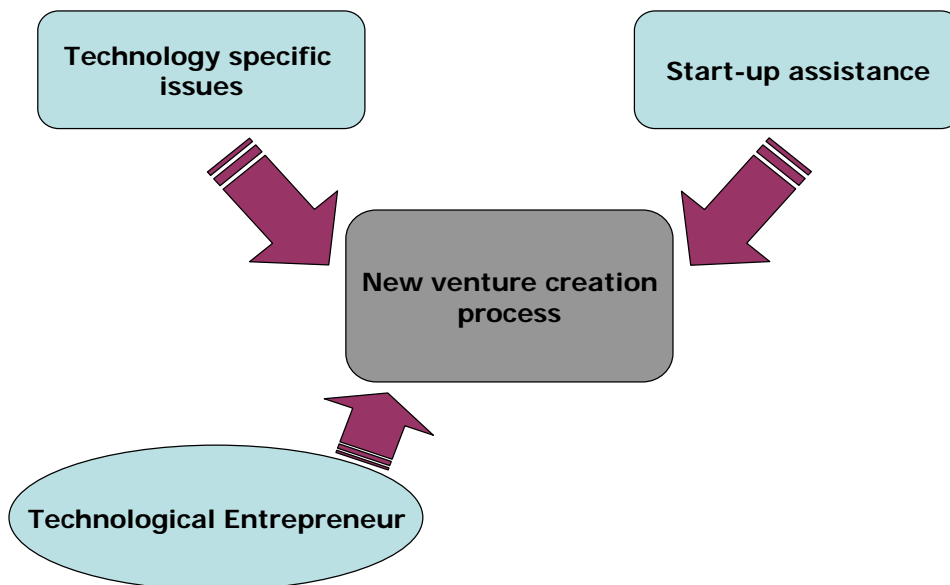


Figure 6.2 Model of the new venture creation process part 2



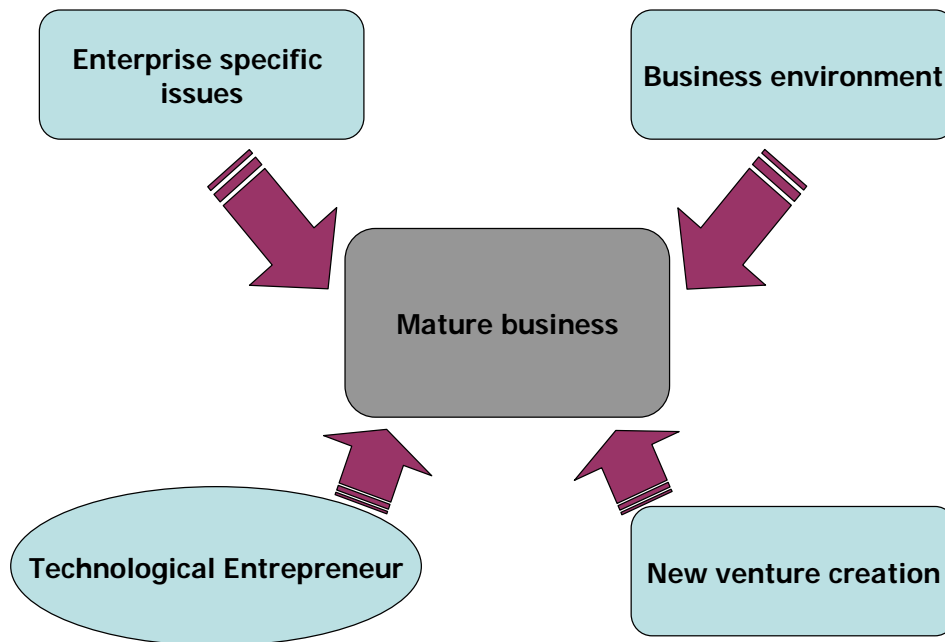


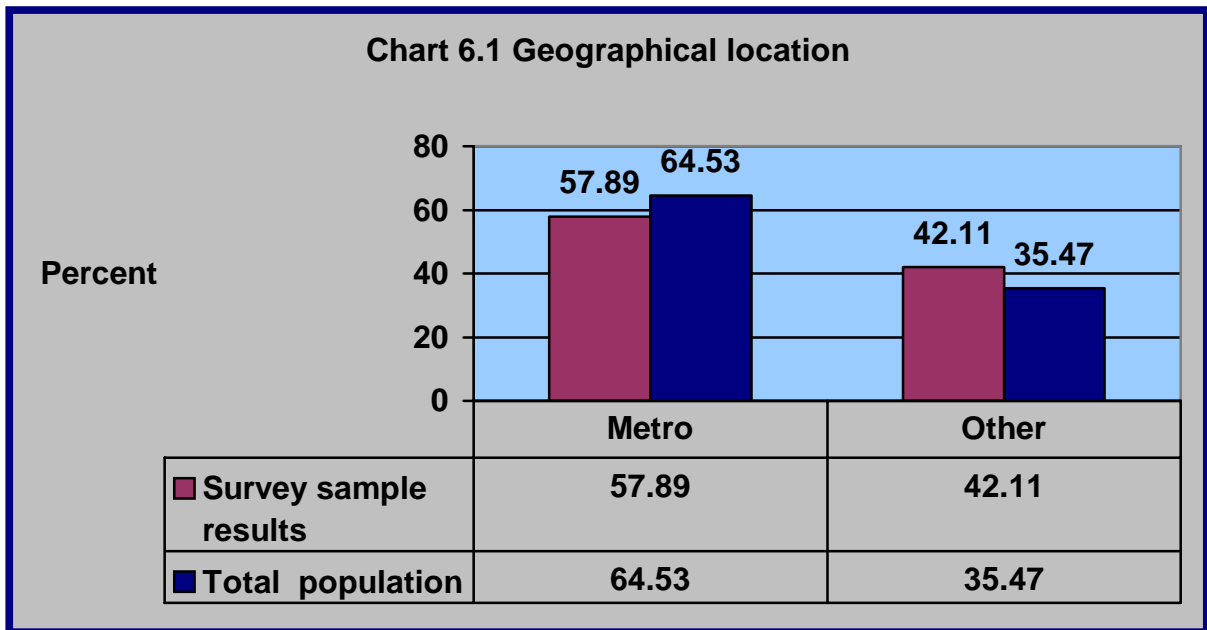
Figure 6.3 Model of the mature business part 3

### 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:

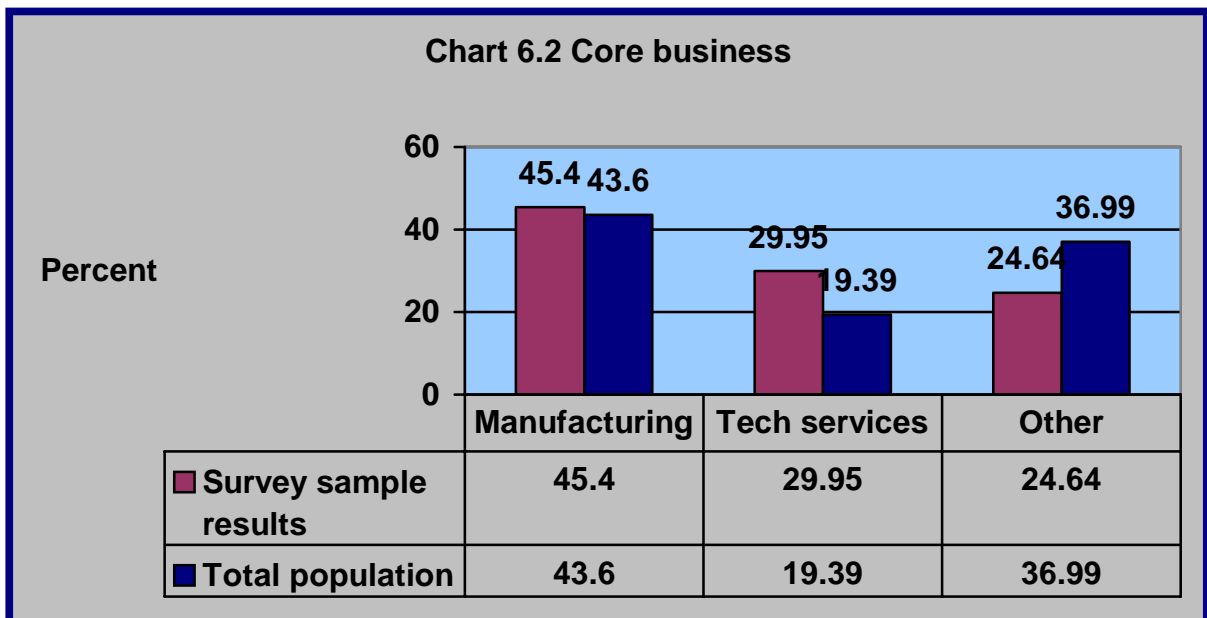
- Geographical location;
- Core business;
- Self-employed race profile.

The comparative figures are given in Charts 6.1, 6.2 and 6.3.



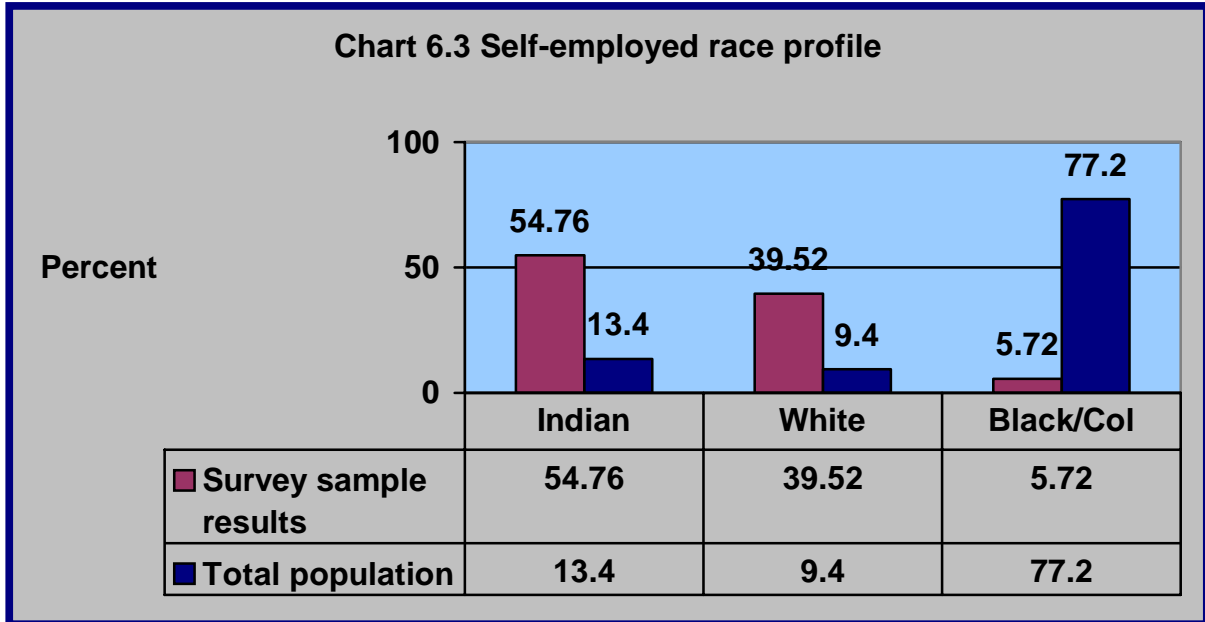
Source: Braby's data base (2004).

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
<b>1</b>	<b>Entrepreneur model part one</b>		
1.1	Dependent variables	8	7
1.2	Independent variables	18	16
1.3	Total correlations	-	16
1.4	Strong correlations	-	10
<b>2</b>	<b>New venture creation model part two</b>		
2.1	Dependent variables	9	9
2.2	Independent variables	34	32
2.3	Total correlations	-	32
2.4	Strong correlations	-	17
<b>3</b>	<b>Mature enterprise model part three</b>		
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.*

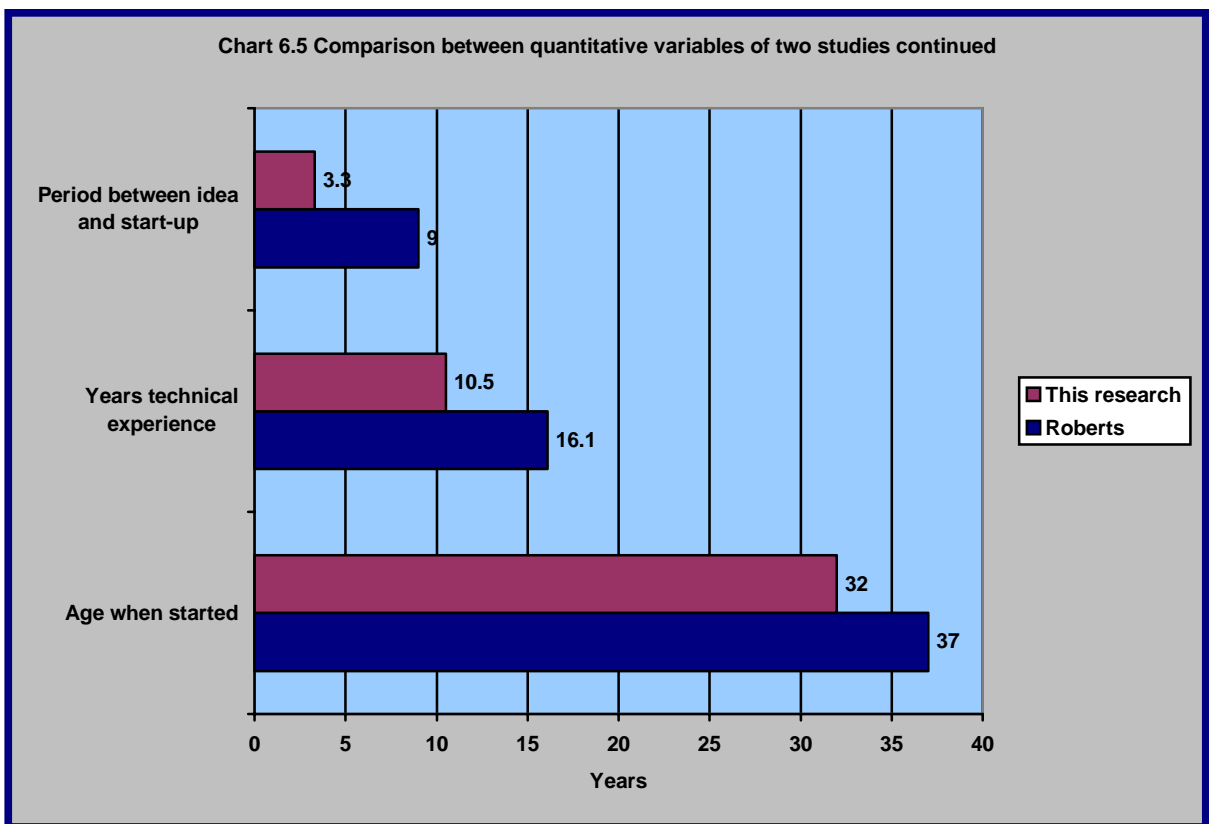
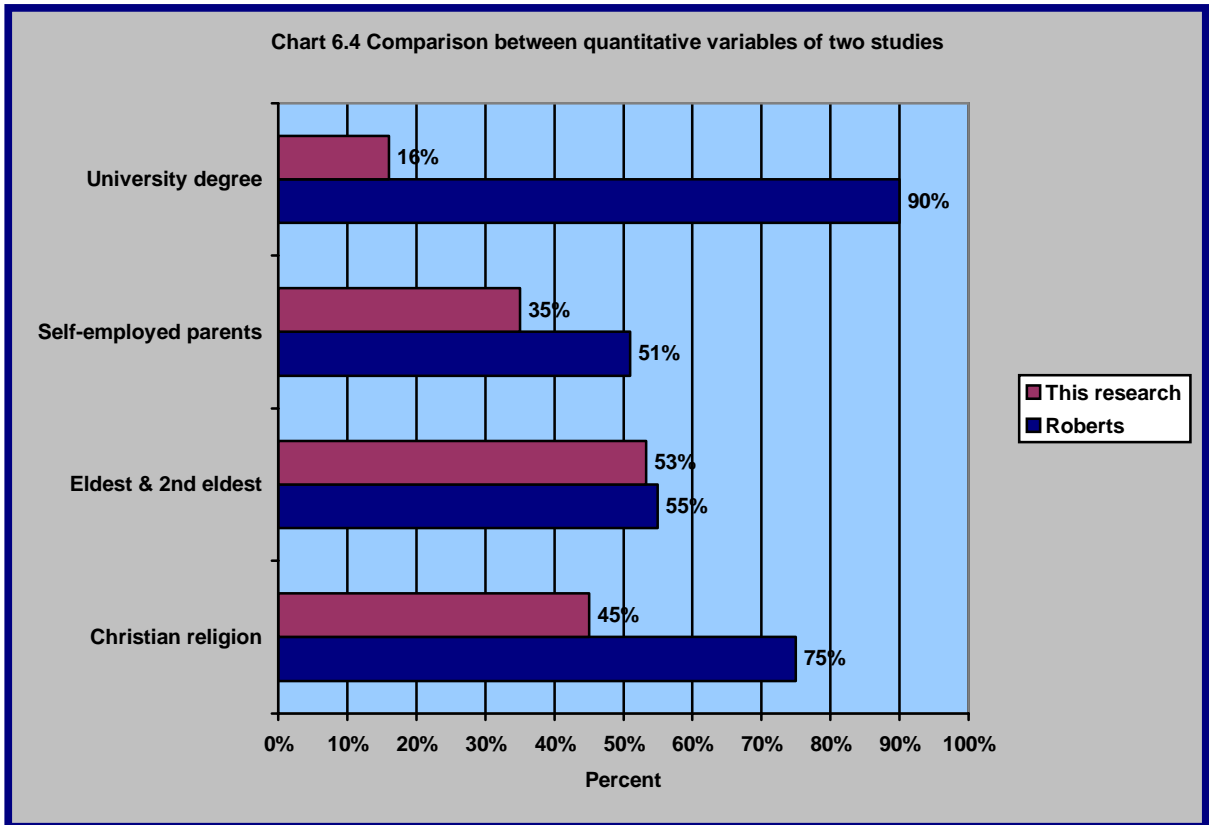
#### 6.1.5.1 Profile comparison

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):

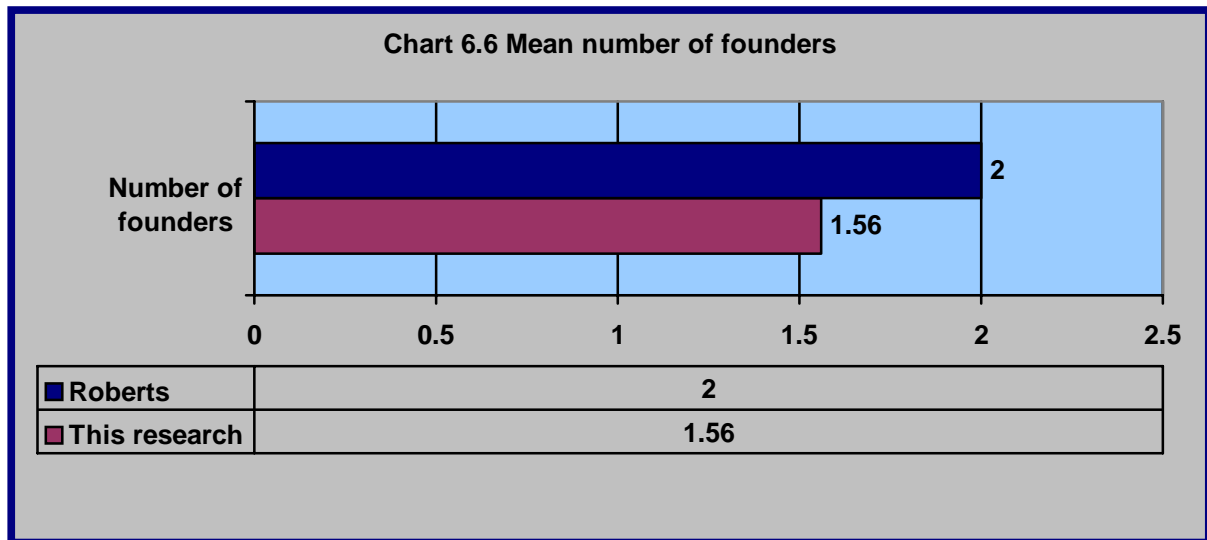
Table 6.11: Comparison between this research results and that of Roberts (1991)			
ITEM	CATEGORY	ROBERTS	THIS RESEARCH
1	Gender	Not available	Male (90%)
2	Mean age	Not available	46.5 years
3	Mean age when started first business	37 years	32.2 years

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 (16.1 years 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.







### 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.

1	Entrepreneurs who were introduced to entrepreneurship at a younger age tend to start their business earlier than those who were introduced later. <i>Probability &lt; 0.0001</i>
2	Younger entrepreneurs tend to start their new businesses earlier than their older counterparts. <i>Probability &lt; 0.0001</i>
3	Younger entrepreneurs tend to be introduced to entrepreneurship earlier than older entrepreneurs. <i>Probability &lt; 0.0001</i>
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. <i>Probability &lt; 0.0001</i>
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. <i>Probability &lt; 0.0001</i>
6	Businesses that employ more people tend to create more jobs than those employing fewer people. <i>Probability &lt; 0.0001</i>
7	Younger students reported more entrepreneurship training (all levels) and older students less entrepreneurship training (all levels). <i>Probability &lt; 0.0001</i>
8	Younger students reported more entrepreneurship training at tertiary institutions and older students less entrepreneurship training at tertiary institutions. <i>Probability &lt; 0.0001</i>

### 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
<b>1</b>	<b>Linear regression</b>			
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	-
<b>2</b>	<b>Logistic regression</b>			
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.