AN EVALUATION OF A PROFILING AND SELECTION PROCESS FOR APPRENTICES IN THE SOUTH AFRICAN AUTOMOTIVE INDUSTRY

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# AN EVALUATION OF A PROFILING AND SELECTION PROCESS FOR APPRENTICES IN THE SOUTH AFRICAN AUTOMOTIVE INDUSTRY

by

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## DECLARATION

I, Juliet Ingrid Puchert, declare that this research report on “An evaluation of a profiling and selection process for apprentices in the South African automotive industry” is my original work and has never been submitted by the author or anyone else at any university for a degree. All the sources that I have used and/or quoted have been indicated and acknowledged by means of complete references. This dissertation is submitted in fulfilment of the requirements for the degree: Doctor of Philosophy (Industrial and Organisational Psychology) at the Nelson Mandela University.

26th November 2018

## LANGUAGE EDITING DECLARATION

I hereby confirm that I have proofread and edited the following doctoral thesis using the Windows “Tracking” system to reflect my comments and suggested corrections for the student to action:
*An evaluation of a profiling and selection process for apprentices in the South African automotive industry*, by Juliet Puchert, a thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy (Industrial and Organisational Psychology) at the Nelson Mandela University.

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- The Human Resource staff at the automotive industry involved in this study. Without their hard work and persistence this research would not have been possible.

**DEDICATION**

This research project is dedicated to my children, Joy and Jacob. Thank you for your patience with my after-hours work and your smiles while I ‘plodded’ on. I love you to the moon and back!

## ABSTRACT

The South African automotive industry is the biggest manufacturing sector and the largest contributor to the domestic economy. Within the national manufacturing sector, the artisan job family has been identified as a scarce and critical skill. Artisans are a number one area of concern with regard to filling vacancies in the country. The domestic economy as well as the effectiveness and success of the automotive industry could be negatively affected if this artisanal crisis is not adequately addressed. This study aimed to evaluate a profiling and selection process for apprentices in the South African automotive industry. A multiple-stage selection method was used to screen the applicants. The selection process included the following phases: application review, rating of the application documentation, aptitude testing, skills-based teamwork assessment and interviews. The researcher obtained access to the documentation generated through an annual apprentice selection process at a large multi-national automotive firm. The final sample consisted of 3 412 individuals that had applied for two types of apprenticeship programmes, namely, automotive electrician and millwright, across three intake years. Descriptive statistics such as frequency distribution tables and medians were used. Inferential statistical analysis, using survival analysis, was used to assess whether the survival curves were statistically different across the groups.

The findings of this study are relevant to the South African automotive industry, as well as the manufacturing sector. The findings are also of value to human resource practitioners, educators, social scientists and other researchers. The 13 constructs investigated in the study showed a high association with longer survival time in the selection process. The positive evaluation of this selection process provides evidence to support its confirmation as the national selection tool. Four recommendations are proposed to the HRM field and four to the automotive industry. The multiple-hurdle selection process employed in this study should be replicated by the automotive industry in their selection of apprenticeship applicants. Standardisation practices, the use of on-line technology and the marketing of the apprenticeship position are also recommended. Furthermore, it is recommended that educational providers provide job preparation workshops to assist applicants to improve their survival opportunity within the selection processes.

*Keywords*: Artisans, apprenticeship, aptitude, selection, survival, automotive industry

## LIST OF ABBREVIATIONS

| | |
|---|---|
| AAC&U | Association of American Colleges and Universities |
| AC | Assessment Centre |
| ACM | Automotive Component Manufacturer |
| AIEC | Automotive Industry Export Council |
| APDP | Automotive Production and Development Programme |
| ASCCI | Automotive Supply Chain Competitiveness Initiative |
| BRICS | Brazil, Russia, India, China and South Africa |
| CDA | Car Distributors Assembly |
| COTVET | Council for Technical and Vocational Education and Training |
| CV | Curriculum Vitae |
| DAT | Differential Aptitude Test |
| DHET | Department of Higher Education and Training |
| DOL | Department of Labour |
| DTI | Department of Trade and Industry |
| EEA | Employment Equity Act (No. 55 of 1998) |
| EEAA | Employment Equity Amendment Act (No. 47 of 2013) |
| G20ewg | G20 Employment Working Group |
| GDP | Gross Domestic Profit |
| GM | General Motors |
| GMA | General Mental Ability |
| HPCSA | Health Professions Council of South Africa |
| HSRC | Human Sciences Research Council |
| HR | Human Resource |
| HRM | Human Resource Management |
| HRS | Human Resource Selection |
| JIPSA | Joint Initiative on Priority Skills Acquisition |
| LRA | Labour Relations Act (No. 66 of 1995) |
| merSETA | Manufacturing, Engineering and Related Services SETA |
| MIDP | Motor Industry Development Programme |
| NAAMSA | National Association of Automobile Manufacturers of South Africa |
| NAMB | National Artisan Moderating Body |

| | |
|---|---|
| NAPS | National Apprenticeship Promotion Scheme |
| NAS | National Apprenticeship Service |
| NDP | National Development Plan |
| OECD | Organisation for Economic Co-operation and Development |
| OEM | Original Equipment Manufacturers |
| OICA | Internal Organisation of Motor Vehicle Manufacturers |
| QCTO | Quality Council for Trades and Occupations |
| SA | South Africa |
| SAMAD | South African Motor Assemblers and Distributors |
| SETA | Sector Education and Training Authority |
| SPSS | Statistical Package for the Social Sciences |
| ST | Survival Time |
| STEM | Science, Technology, Engineering and Mathematical |
| TVET | Technical and Vocational Education and Training |
| TRAT | Trade Aptitude Test |
| UK | United Kingdom |
| USA | United States of America |
| VWSA | Volkswagen South Africa |

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# CHAPTER ONE
# INTRODUCTION AND OVERVIEW

## 1.1. Introduction

The global automobile manufacturing industry is commonly referred to as "the industry of industries" (Drucker, 1946, p. 149), being a mature industry (Bandyopadhyay, 2010). Despite some major obstacles over the past decade, it is still regarded as one of the world's largest manufacturing sectors (Becker, 2018; Nieuwenhuis & Wells, 2015; Wickham, 2017). The extensive network of suppliers that contribute to the industry has resulted in the automotive industry being "so embedded that its removal would lead to widespread social and economic crisis" (Nieuwenhuis & Wells, 2015, p. 3).

Fierce competition dominates the global automotive industry (Mohr et al., 2013). According to the Automotive Industry Export Council (AIEC), in 2016 an international benchmark was set with twenty countries exceeding the one million vehicle production mark. The countries with the highest global vehicle production were China, the United States of America (USA), Japan, Germany and India (AIEC, 2017). There is, increasingly, a shift in production from west to east (Becker, 2018; Nieuwenhuis & Wells, 2015; Wickham, 2017). With its production of 28.1 million vehicles and sales of 28 million units in 2016, China made and sold more vehicles than Japan and the USA combined (AIEC, 2017).

According to the International Organisation of Motor Vehicle Manufacturers (OICA, 2018a), the global automotive industry employs over eight million people. This is more than five percent of the global manufacturing employment figure. China employs 1 605 000 people, the USA 954 210, Germany 773 217 and India 270 000 people (Wickham, 2017). In addition, more than 50 million are indirectly employed in related manufacturing and service provision (Mohr et al., 2013; OICA, 2018a).

There is significant pressure to focus on enhanced technologies to improve overall cost competitiveness as well as the reliability of supply through the just-in-time delivery system (Mashilo, 2010; Meyer, 2013). The voice of the consumer has also become stronger as the demand for greener technologies in vehicle production increases (AIEC, 2017; Nieuwenhuis & Wells, 2015; OICA, 2018a). The advancements in vehicle manufacture will necessitate an increase in the innovation rate within the automotive industry. Traditional five to eight-year model cycles are set to be replaced by annual updates in order to ensure the latest hardware and software developments are integrated into the vehicle (Kuhnert, Stűrmer, & Koster, 2018). There is thus also an increasing need for the automotive industry to employ more highly skilled workers in order to facilitate its expansion into these new technologies (Wickham, 2017).

In comparison to the global vehicle supply chain, the South African automotive industry is small (AECI, 2017; Naude, 2013). South Africa's global vehicle production market share in 2016 was 0.63%, a slight drop from the 2015 0.68% figure (AECI, 2017). Seven global players in the automobile manufacturing industry currently operate within South Africa (SA). These large original equipment manufacturers (OEMs) are: BMW, Ford Motor Company, Isuzu, Mercedes-Benz, Nissan, Toyota and Volkswagen South Africa (VWSA). These OEMs have plants in various provinces, assembling vehicles for both the national and international markets (Moothilal, 2017; Naude & O'Neill, 2011; Nzimande & Patel, 2012).

The national automotive industry has considerable impact on the country (Davies, 2012; Deloitte, 2015; Vermeulen, 2017). Currently, the broader automotive industry contributes 7.4% to the national Gross Domestic Profit (GDP) (AIEC, 2017; Vermeulen, 2018). Projections for 2020 indicate that this contribution may increase to 8.5% (De Lange, 2017). The automotive industry also accounts for 15.6% of the country's manufacturing exports, with total automotive export earnings being over R170 billion (AIEC, 2017). The national government has acknowledged that the achievement of its economic goals significantly depend on the continued success of several priority sectors, including the automotive industry (AIEC, 2017; Nomvete, Patel, & Baleni, 2017).

## 1.2. Background to the research problem

Globally, there is a move to source low cost countries to host manufacturing concerns. It is projected that by 2020, emerging markets, such as Brazil, Russia, India, China and SA will constitute about two-thirds of the total automotive profit, with China at the front (Mohr et al., 2013). In this regard, SA is competing with more advanced economies, such as Mexico and Thailand. However, these countries enjoy lower labour costs and have greater proximity to the major export markets (AIEC, 2017; Barnes & Morris, 2008; Moodley, Morris, & Barnes, 2001). If SA is not able to profitably and timeously deliver quality products at competitive international prices, it may result in the OEMs deciding to locate elsewhere (AIEC, 2017).

The increase in production pressure, the rise of emerging markets and alternative technology advancements have resulted in substantial changes in the South African automotive industry (Giffi et al., 2015; JIPSA, 2010; Meyer, 2013). Indications are that in order for the national automotive industry to survive beyond 2020, it will need to increase its production volumes through exports, and improve its ability to provide more support to the component supplier sector (AIEC, 2017). Over the past decade the OEMs have made substantial investments into developing their efficiencies in order to be able to profitably and flexibly deal with new trends (Mashilo, 2010; Meyer, 2013). The amount recently spent in various capital expenditure categories has more than doubled over the past decade (Vermeulen, 2016).

Given these new production techniques, the industry's reliance on artisanal skills has been steadily increasing (Nomvete et al., 2017; Reddy & Kruss, 2015; Wildschut, Gamble, Mbatha, & Meyer, 2015). Artisans are regarded as a vital enabler to the manufacturing competiveness of the SA economy and artisanal development is hence a priority within the manufacturing sector (Brown, 2012; merSETA, 2016; Nomvete et al., 2017). The lack of these skills is regarded as one of the key factors contributing to the "slow adoption of technology, lowered productivity, lowered competitiveness and high cost of production over time" within the sector (Nomvete et al., 2017, p. iii).

However, the artisan job family has been identified as the number one area of concern with regard to recruitment and selection in SA (Government Gazette, 2018; Pandor, 2018; Peo, 2013). Demand outweighs supply and the need to attract and retain this critical skills base has led to a war for this talent (Mbatha, Wildschut, Mncwango, Ngazimbi, & Twalo, 2014). Five of the top 10 pivotal occupations within the manufacturing sector are automotive related apprenticeships. Automotive motor mechanics are rated the occupation most in demand (Nomvete et al., 2017).

The future development and growth of SA can be meaningfully improved through artisanal development (JIPSA, 2010; Mahembe, 2012). One of the National Development Plan (NDP)'s key objectives is the production of 30 000 artisans per year by 2030 (NDP, 2012; Pienaar, Venter, Govender, & Jitsing, 2016; Qonde, 2018). The national New Growth Path also aims to significantly increase the number of artisans successfully exiting the artisanal development system (Patel, 2011). Whilst there has been some improvement in the national number of artisans produced per year, these numbers have not come close to reaching the projected targets (JIPSA, 2010; Qonde, 2018).

In their ranking of the competiveness of 137 countries, the World Economic Forum's Global Competitiveness Report (2017-2018) listed SA in 61st position. This is a significant decline of 14 positions on the 2016-2017 listing when SA was ranked 47th out of 138 countries. In the 2016-2017 report, SA ranked 114 out of 137 in the quality of its education system. In terms of the quality of the South African mathematics and science education, SA ranked 128th. Therefore, the eighth most problematic factor influencing doing business in SA was an inadequately educated workforce (Schwab & Sala-i-Martin, 2017). SA is not able to optimise its business sophistication and technology readiness due to the lack of adequate skills and low education in the country (Craig, Thomas, Hou, & Mathur, 2011; Schwab & Sala-i-Martin, 2017).

Education enhances the possibility of securing a better job and improves productivity and income potential. The upgrading of the educational and skills levels of the employed is also needed to enable companies to compete in the global economy (Brewer, 2013). However, an unfortunate dichotomy currently exists in SA. The high youth unemployment rate currently exists alongside a high demand for skilled labour. Since 2008, the national youth unemployment rate has been steadily growing (Reddy, Bhorat, Powell, Visser, & Arends, 2016; Shankar, Cooper, & Koh, 2016). The government, in its design and implementation of national educational and employment policies, has an immense challenge in dealing with this contradiction (Evans-Klock & Dar, 2013; Rauner, Heinemann, Hauschildt, & Piening, 2012; Shankar et al., 2016).

Within this context of pervasive and growing youth unemployment levels, addressing artisan skills levels will assist in achieving economic and social development (Mbatha et al., 2014). Artisanal skills development has therefore been accepted as an urgent priority for the South African government (DHET, 2012; Reddy et al., 2016). The national economy, organisational effectiveness and the success of the automotive industry would benefit if the artisanal crisis was adequately addressed (Kruss et al., 2014; Pienaar et al., 2016).

## 1.3. Problem statement, objectives and hypotheses

Section 1.3.1 provides an explanation of the research problem, with section 1.3.2 clarifying the primary as well as the four secondary objectives of the study. In section 1.3.3 the 13 hypotheses of the study are provided.

### 1.3.1. Problem statement

Staffing finds itself in a curious position in the twenty-first century. Given the economic, societal and cultural changes prevalent in this century, organisational success and survival have become dependent on staffing practices (Hoffman, Kahn, & Li, 2018; ManpowerGroup, 2016). Many business decision makers continue to disregard the value of staffing. Staffing researchers and practitioners may be partially to blame for this as they fail to highlight the strategic value of their discipline and practice (Ployhart, 2006).

There has been a noteworthy decrease in staffing research since the 1980s (Schreuder & Coetzee, 2010). This is contrary to national and industry needs. Human capital development, through the attraction, selection, remuneration, development and retention, of scarce skills has been highlighted as a national priority (Reddy et al., 2016). The industrial/organisational psychology field, therefore, needs to positively respond to the research needs expressed by the business community. This should be done through ensuring research can accurately predict emerging challenges and offer potential solutions to these challenges (Anderson, Herriot, & Hodgkinson, 2001; Pietersen, 2018; Vernon, Hocking, & Tyler, 2016).

One such challenge requiring credible answers is the global and national shortage of skilled trade workers (Martin, 2016; Smith & Kemmis, 2013). Despite enhanced employment prospects and potentially higher earnings, organisations are struggling to source skilled individuals to fill vacant technical positions. It is predicted that this problem will worsen in the years to come as technology and globalisation quicken and deepen (Deloitte, 2018; Giffi et al., 2015; Jacoby, 2014).

A skills mismatch in the labour force is evident as high unemployment rates are globally prevalent (ManpowerGroup, 2016; Shankar et al., 2016; Trindale, 2015). Immediate job skills are required by new labour market entrants in the twenty-first century. However, concurrently, they also require the career and cognitive capacities to sustain their learning capacity through the various jobs they are bound to fulfil in the working landscape of this century. Given the high level of technological change inherent in the current workplace many skill requirements are volatile. A higher level of technical skills is increasingly demanded (Duarte, 2017; Government Gazette, 2018; merSETA, 2016; Nomvete et al., 2017).

There is greater awareness within industry that the science, technology, engineering and mathematics (STEM) areas play an interactive role with business success (Chalikias, Kyriakopoulos, Skordoulis, & Koniordos, 2014). STEM skills are critical for economic growth, improved innovation, enhanced entrepreneurship and business productivity. There is, however, a STEM crisis. The global economic growth and ability to develop solutions to the most pertinent problems of the world are being stifled due to the widespread shortage of STEM professionals (Craig et al., 2011).

It is widely recognised that there is an artisanal skills shortage, both nationally and globally (Evans-Klock & Dar, 2013; Peo, 2013; Van Rooyen, Du Toit, Botha, & Rothmann, 2010). Globally, businesses regularly state that the most difficult job to fill is that of technicians (Giffi et al., 2015; ManpowerGroup, 2016). A significant portion of technical vacancies in SA cannot be filled as individuals do not meet the educational and skill requirements (De Kock, 2012). Despite various governmental and non-governmental initiatives, there remains a dire need to explicate and alleviate the artisanal scarce skills problem in the country (Bhorat, Oosthuizen, & Cassim, 2014; Pandor, 2018; Pienaar et al., 2016). In 2018, the government issued the *National List of Occupations in High Demand*, to clarify and draw attention to these artisanal trades (Government Gazette, 2018).

There is currently a lack of certainty surrounding the exact nature of both the demand and supply of artisan skills within the country (Kraak, 2012; Reddy & Kruss, 2015; Wildschut et al., 2015). While there are various routes to the completion of an apprenticeship, there is a lack of knowledge and certainty about the contribution made by each of these routes. Furthermore, there is insufficient awareness of the factors that underpin the demand for artisans. Whilst it is clear that there is a quantifiable demand for artisans, there is less confidence regarding what constitutes a successful artisan in terms of quality standards (Kraak, 2012; Kruss et al., 2014; Reddy & Kruss, 2015).

Data on national skills development, specifically within vocational education and training, is scarce. There is especially a lack of data pertaining to the supply side of learnerships and apprenticeships and the role of staffing practices in these developmental initiatives. An important issue contributing to the malfunctioning of research into the artisanal labour market is that these positions fall within the *Major Occupation Group 7: Craft and related trade workers*. However, not all craft and related trade workers are qualified artisans (Mukora, 2008). This makes the understanding of both the supply and demand of artisans in SA quite problematic. This is especially true of tracking their trajectory into employment (Kruss et al., 2012).

The implementation of appropriate human resource (HR) practices, such as recruitment, selection, education and skills training are regarded as determining factors to the continued prosperity of the manufacturing industry (Chalikias et al., 2014). National employers and training providers have therefore encouraged governmental support agencies, such as the Manufacturing, Engineering and Related Services Sector Education and Training Authority (merSETA), to invest in enhanced screening and selection techniques for learners partaking in an artisanal learning pathway (Government Gazette, 2015a; merSETA, 2016). With the cost of training an apprentice being approximately R400 000, it is vital that the correct learners are accepted onto these apprenticeship programmes. Besides implementing the minimum entry requirements, government has also recommended that aptitude and attitude testing need to be done to assist in the selection process (Government Gazette, 2015a). The use of stringent selection practices has been linked to lower drop-out rates (Goastellec & Ruiz, 2015; Imdorf, 2017; Rowe, Moss, Moore, & Perrin, 2017). Multiple selection criteria have also assisted training providers to reduce their drop-out rate by 98-99% per intake (Mummenthey, Kruss, & Wildschut, 2012).

International researchers have advised stakeholders in the South African manufacturing sector to disclose best practice cases in artisanal development. Not only will this disclosure improve the image of apprenticeships but, more significantly, it will also stimulate innovation and improvement within the sector (Evans-Klock, 2012; Rauner et al., 2012). Despite this recommendation, there is still a lack of national and international empirical research on the optimum profile of a successful apprentice. Only modest outdated national and international research exists on the profile of a successful apprentice applicant (e.g., Barnes & Meadows, 2008; Gump, 2006; Mottram, Clarke, & Downs, 1980).

Furthermore, the ideal steps to be used in the selection and training of apprentices need to be determined in order to accurately identify and retain artisans within organisations. Once again, limited, and mostly outdated, international empirical research on the broad processes employed in the selection of apprentices are available. Scant research exists on the situation in SA. There is, therefore, a need for specific research on the profiling and selection of apprentices (Puchert, Dodd, & Viljoen, 2017a, 2017b). The decline in staffing research was noted earlier. Specifically, there is currently little national research on the evaluation of human resource selection (HRS) processes (Louw, 2012; Louw-Potgieter, 2012).

This study focused on the selection process employed by a national OEM. For purposes of anonymity this organisation will be referred to as the Client. The study aimed to address the gap in the literature pertaining to the profiling of apprentices, the optimum selection process to be employed for this form of tradesman and the evaluation of HRS processes. To achieve this the selection process for apprentices, designed and implemented by the Client, was evaluated. From the problem statement the primary objective, four secondary objectives and 13 hypotheses were delineated.

### 1.3.2. Objectives

The primary objective of this study was to evaluate a profiling and selection process for apprentices in the South African automotive industry.

The secondary objectives were as follows:

a) To assess the contribution of the educational profile on apprenticeship programme selection
b) To appraise the value of the application profile on apprenticeship programme selection
c) To evaluate the influence of the aptitude and teamwork profile on apprenticeship programme selection
d) To assess the impact of the interview profile on apprenticeship programme selection.

A conceptual framework for the study indicating the variables being investigated is provided in Appendix A.

### 1.3.3. Hypotheses

Following on the primary and secondary objectives, the 13 hypotheses for this study were:

$H_0^1$ The type of secondary education does not have a significant effect on the applicants' selection onto the apprenticeship programme.

$H^1$ The type of secondary education has a significant effect on the applicants' selection onto the apprenticeship programme.

$H_0^2$ The Grade 12 mathematics mark does not have a significant effect on the applicants' selection onto the apprenticeship programme.

$H^2$ The Grade 12 mathematics mark has a significant effect on the applicants' selection onto the apprenticeship programme.

$H_0^3$ The Grade 12 science mark does not have a significant effect on the applicants' selection onto the apprenticeship programme.

$H^3$ The Grade 12 science mark has a significant effect on the applicants' selection onto the apprenticeship programme.

$H_0^4$ The motivational letter rating does not have a significant effect on the applicants' selection onto the apprenticeship programme.

$H^4$ The motivational letter rating has a significant effect on the applicants' selection onto the apprenticeship programme.

$H_0^5$ The curriculum vitae rating does not have a significant effect on the applicants' selection onto the apprenticeship programme.

$H^5$ The curriculum vitae rating has a significant effect on the applicants' selection onto the apprenticeship programme.

$H_0^6$ The practical experience rating does not have a significant effect on the applicants' selection onto the apprenticeship programme.

$H^6$ The practical experience rating has a significant effect on the applicants' selection onto the apprenticeship programme.

$H_0^7$ The qualification rating does not have a significant effect on the applicants' selection onto the apprenticeship programme.
$H^7$ The qualification rating has a significant effect on the applicants' selection onto the apprenticeship programme.

$H_0^8$ The leadership potential rating does not have a significant effect on the applicants' selection onto the apprenticeship programme.
$H^8$ The leadership potential rating has a significant effect on the applicants' selection onto the apprenticeship programme.

$H_0^9$ The general aptitude rating does not have a significant effect on the applicants' selection onto the apprenticeship programme.
$H^9$ The general aptitude rating has a significant effect on the applicants' selection onto the apprenticeship programme.

$H_0^{10}$ The technical aptitude rating does not have a significant effect on the applicants' selection onto the apprenticeship programme.
$H^{10}$ The technical aptitude rating has a significant effect on the applicants' selection onto the apprenticeship programme.

$H_0^{11}$ The teamwork competence rating does not have a significant effect on the applicants' selection onto the apprenticeship programme.
$H^{11}$ The teamwork competence rating has a significant effect on the applicants' selection onto the apprenticeship programme.

$H_0^{12}$ The standard interview rating does not have a significant effect on the applicants' selection onto the apprenticeship programme.
$H^{12}$ The standard interview rating has a significant effect on the applicants' selection onto the apprenticeship programme.

$H_0^{13}$ The general impression rating does not have a significant effect on the applicants' selection onto the apprenticeship programme.
$H^{13}$ The general impression rating has a significant effect on the applicants' selection onto the apprenticeship programme.

## 1.4. Literature review

Initially, the theoretical framework underpinning the study is discussed, with section 1.4.2 providing a brief overview of the HRS process. Section 1.4.3 then offers a synopsis of selected empirical research in the study area.

### 1.4.1. Theoretical framework

The HR talent management approach highlights the need for organisations to focus their attention on managing the capacity, ability and talent within the top 10 to 20% or 'A level' (Beechler & Woodward, 2009; Tarique & Schuler, 2012). It is these selected and gifted employees that should be the beneficiaries of HR practices and initiatives (Hughes & Rog, 2008). According to this theoretical framework, the talents held by individuals should be viewed as the resource leveraging the competitive advantage of organisations. As such, this elite group of employees should be treated differently to the rest of the workforce (Beechler & Woodward, 2009; Hughes & Rog, 2008; Tarique & Schuler, 2012).

The talent management theory has come under significant criticism in the twenty-first century. The theory has specifically been reproached for its singular concentration on only the 'A level' sub-set of employees (Lewis & Heckman, 2006; Piansoongnern, Anurit, & Kuiyawattananonta, 2011). The twenty-first century has witnessed significant global economic changes, tumultuous business environments, substantial technological advances and innovation as well as the increased mobility and diversity of the workforce (Beechler & Woodward, 2009). Critiques of the theory have indicated that this HR management approach is no longer valid and realistic within the highly complex, competitive and global context (Beechler & Woodward, 2009; Lewis & Heckman, 2006; Piansoongnern et al., 2011). Rather than adopting a narrow focus, as proposed by the talent management approach, the international shortage of talent has resulted in firms needing to be more creative and aggressive in their HR management (HRM) tactics (Berenson & Smith, 2009; Tarique & Schuler, 2012). In order for the current organisation to survive and be successful, a more wide-ranging HR approach, beyond just the 'A level' employees, needs to be adopted (Beechler & Woodward, 2009).

Therefore, the theoretical framework selected for this study is the human capital theory. According to this theory, the entire labour force should be regarded as the strategic leverage feature of an organisation, rather than a select group within this pool of labour (Abhayawansa & Abeysekera, 2008). Instead of solely focusing on tangible assets, this theory proposes that the intangible human capital resource is the vital strategic resource of any firm. This is specifically valid given the increased reliance on knowledge (Todericiu & Muscalu, 2008).

This classification of the labour force as human capital relies on the workforce being regarded as rare, valuable and inimitable with no reliable alternatives for the resource (Abhayawansa & Abeysekera, 2008; Coff, 1997). Whilst all employees are regarded as important resources to a business, only some are perceived as human capital and a source of competitive advantage (Moon & Kym, 2006; Pearse, 2009). A pivotal issue within this theory is the optimisation of the human capital potential through the implementation of HRM techniques and systems (Abhayawansa & Abeysekera, 2008; Coff, 1997; Wright, McMahan, & McWilliams, 1994). Specifically, the recruitment and selection processes implemented by organisations can heighten the latent competitive advantage through the optimal matching of the required skills for a position with individuals who have these skills (Cabello-Medina, López-Cabrales, & Valle-Cabrera, 2011; Jiang, Lepak, Hu, & Baer, 2012; Takeuchi, Lepak, Wang, & Takeuchi, 2007).

### 1.4.2. Human resource selection

People represent the competitive edge for a country and are the most important asset in an organisation (Grobler, Wärnich, Carrell, Elbert, & Hatfield, 2011; Nel et al., 2011; Noe, Hollenbeck, Gerhart, & Wright, 2011). Whilst there are numerous factors that make an organisation successful, the HR element is regarded as a vital input into the production process of an organisation (Breaugh, 2013; Naude & O’Neill, 2011; Shatouri, Omar, & Igusa, 2012).

An investment in HRM activities, such as recruitment and selection, training and development, as well as compensation, can produce better organisational performance (Ghebregiorgis, & Karsten, 2007). Conversely, poor selection decisions can be a significant cost for a business (Lough & Ryan, 2010; Mueller & Wolter, 2014; Paterson & Uys, 2005). There are major costs involved in re-training individuals following an ill-fit or match of an incumbent to a job (Piro, 2011).

Selection criteria are essential to expedite the decision-making process (Breaugh, 2013; Byars & Rue, 2011). A comprehensive job analysis should be conducted, resulting in a job description and a job specification. Employing information from these documents within the selection process should facilitate obtaining an effective match or fit between position requirements and incumbent abilities (Giffi et al., 2015; Grobler et al., 2011; Nel et al., 2011; Noe et al., 2011).

Two selection models can be employed by organisations, namely, the multiple-hurdle and the compensatory models. In the multiple-hurdle model, the selection process consists of various steps with each step needing to be overcome to advance. This technique results in the pool of applicants becoming increasingly smaller after each step in the selection process. The compensatory model entails the total pool of candidates fulfilling all the selection steps. The information obtained at each step is then taken into account to make the final selection decision (Grobler et al., 2011; Nel et al., 2011).

No set, typical and/or generally accepted HRS processes exist. A wide assortment of selection procedures and methods are utilised and no two organisations conduct selection in the same fashion (Van der Merwe, 2002). Selection methods should be employed based on the selection criteria specified in the job description and job specification. These include the initial assessment of curricula vitae (CV), appraising application forms, conducting interviews, conducting assessment and testing, as well as executing medical and reference checks (Chan & Kuok, 2011; Grobler et al., 2011; Nel et al., 2011; Noe et al., 2011). A singular method (i.e., using just the CV, interviewing or testing) is used by some organisations in order to make selection decisions (Chan & Kuok, 2011). However, research has highlighted that a systematic selection approach can improve the success rates obtained (Grigoryev, 2006). Having précised the foundational literature underpinning this study the next section summarises the empirical literature on the subject.

### 1.4.3. Empirical literature

The automotive industry has needed to implement novel and proactive recruitment and selection tactics in order to attract and successfully identify the potential talent required within the sector (Giffi et al., 2015; Piro, 2011). Increased competition and rapid technological change in the manufacturing sector has resulted in challenges that have affected the selection methods, as well as training content and processes traditionally used for apprenticeship development (Evans-Klock, 2012; merSETA, 2016; Nomvete et al., 2017). Rigorous recruitment and selection practices for apprentices are therefore encouraged (Government Gazette, 2015a; Lovender, 2015).

International research has highlighted the high value placed on above average academic attainments, specifically a fundamental knowledge of engineering and science, when sourcing technical staff (Brewer, 2013; Forsblom, Negrini, Gurtner, & Schumann, 2016; Kramer, Tallant, Goldberger, & Lebus, 2015). Automotive firms therefore use the possession of a reliable technical qualification and/or technical subjects as selection criteria (COTVET, 2014; Martin, 2016; Schafmeister, 2013).

Whilst practical and technical skills are vital, the automotive industry has also stressed the significant role of other qualities such as flexibility and teamwork. Research into the selection measures used by automobile manufacturing organisations has revealed that effective communication and problem solving competencies, ingenuity, business insight and a zeal for working in the automotive industry are all central aspects to be considered (De Guzman & Ok Choi, 2013; Giffi et al., 2015; Mueller & Wolter, 2014; Rothstein, 2010). In order to improve the effectiveness of apprenticeship programmes, applicants who have shown vocational identity and commitment to the trades should be prioritised during the selection process. Selection processes should also assess the discipline and commitment of the applicants as maturity levels are regarded as key criteria for success on the programme (Mahembe, 2012).

The use of psychological testing has become a more common selection tool within the automotive industry (Grosvenor, 2017; Piro, 2011; Van der Merwe, 2005). This is primarily due to inconsistent standards and the inability to fairly compare applicants using their educational attainment as well as a general mistrust of the school grades (Mueller & Wolter, 2014; Siegenthaler, 2011). An assortment of assessments and tests have been used internationally in the selection of operator level employees. These included the testing of mathematics, reading comprehension, group problem-solving and simulated work assessments (Gump, 2006). The assessment of aptitudes in the selection of apprentices has been able to predict the success of these candidates in their first year of studying (Mottram et al., 1980). Selecting for apprenticeship positions is different to selecting for other forms of staff. Applicants applying for apprenticeship positions are likely to be very similar in many regards (i.e., recent school-leavers with similar qualifications and little work experience). Using various tests, such as ability tests, interest and values questionnaires, personality measures and situational judgement assessments, can therefore be useful in ensuring objective and informed selection decisions are made (Grosvenor, 2017).

Research conducted on learnerships and apprenticeships revealed that specific demographic and geographical criteria had a significant impact on the employment opportunities. Patterns with regard to the gender, socio-economic status, race, educational level, geographical location of applicants and positive employment outcomes were established. Specifically, applicants who are female, African, have both a low socio-economic status as well as educational level and/or are from the poorer provinces are less likely to be employed upon completion of their training (Kruss et al., 2014; Mukora & Visser, 2008; Wildschut et al., 2013).

## 1.5. Research methodology

This section outlines the research paradigm, design and approach employed in this study. The primary and secondary data collection as well as data analysis methods utilised are discussed.

### 1.5.1. Research paradigm

This study is positioned at the contextual field of information stage on the continuum of core ontological assumptions between constructivism and objectivism proposed by Collis and Hussey (2014). Whilst objective criteria were used in the study, the author and several senior instructors employed at the Client were involved in the design and execution of the selection process. The data, therefore, cannot be regarded as completely independent of the feelings and opinions of these individuals.

The predominant epistomological stance adopted for this study was a positivistic one. Whilst challenged by other epistemological viewpoints, positivism upholds that reality is logically ordered and objective, the comprehension of which can be better known (Babbie, 2007; Bryman, 2016). The research questions, objectives and hypotheses of the study required quantification, replicability and objectivity.

### 1.5.2. Research design

There are three common research designs used in the business and management discipline, namely, exploratory, descriptive and causal research (Bless, Higson-Smith, & Sithole, 2013; Bryman & Bell, 2015a; Cant, Gerber-Nel, Nel, & Kotze, 2012). A descriptive research design seeks to provide answers to questions such as who, what, where, when and how. This type of research is careful and deliberate in nature as it seeks to provide a more detailed understanding of the identified research problem (Babbie & Mouton, 2012; Burns & Bush, 2014). The central aim of this research study was to evaluate a profiling and selection process of apprentices in the national automotive industry. Specifically, the study sought to provide specific details of 'what' attributes (i.e., education type, qualification and experience levels, aptitudes, competencies) the successful applicants held and the 'how' of the selection process. A descriptive research design type was therefore applied in this study.

Research design involves making decisions regarding what will be observed, who and for what purpose. Another important consideration in research design is the time dimension. Longitudinal studies facilitate observations of the same phenomenon over an extended period (Babbie, 2007). These types of studies have been recognised for the advantage they offer in terms of analysing a sequence of events over time, thus allowing for a more in-depth understanding of pathways between variables (Ornstein, 2013). Longitudinal studies therefore have the dual advantage of prospectivity and representativeness (Gomm, 2008). This research was a longitudinal study tracking the applicants from three intake years through the various phases of the selection process. After their four-year apprenticeship period, the selected apprentices sat for the trade test.

### 1.5.3. Research approach

Two broad research approaches, namely, quantitative and qualitative, have been historically distinguished from one another (Bless et al., 2013; Collis & Hussey, 2014; Neuman, 2012). This study aimed to determine if a difference in any of the variables would have an impact on the success of the applicants in the selection process. The nature of the data resulting from the various phases of the selection phases was structured, specific and objective. A quantitative research approach was therefore appropriate for this study (Quinlan, Babin, Carr, Griffen, & Zikmund, 2015).

### 1.5.4. Data collection methods

In terms of data collection, there was a primary and secondary data stage. The primary data of the study was collected through the annual recruitment and selection process for apprentices facilitated by the Client. As depicted in Table 1.1, applicants applied over three intake project years, namely, 2012 to 2014. Following a recruitment drive to fulfill the automotive electrical and millwright apprenticeship vacancies, a mulitiple-hurdle selection process was employed. Given there was existing data, this research was therefore an archival study of the selection process utilised by the Client.

Table 1.1

*Sample Frame*

| Year of Intake | Number of Applicants (Primary Data Stage) | Number of Applicants (Secondary Data Stage) | Number of Apprentices sat the Trade Test | Year of Apprenticeship Completion |
|---|---|---|---|---|
| 2012 | 1 047 | 1 036 | 28 | 2015 |
| 2013 | 1 258 | 1 250 | 22 | 2016 |
| 2014 | 1 148 | 1 126 | 27 | 2017 |
| Totals | 3 453 | 3 412 | 77 | |

The population for this research study was broadly defined as work-seekers, whilst the target population was individuals seeking to be in apprenticeship positions in SA. The sampling frame was a database of potential apprentices that had applied to a specific automotive firm. Using convenience non-probability sampling, the sample at the primary data stage was 3 453 applicants.

The five-phase selection process used in these intake projects is summarised in Appendix B. The portion of applicants that were successful from phase one through to phase four completed their apprenticeship training during the respective four-year period and sat for the national trade test. As indicated in Table 1.1, there was a substantial reduction in the number of applicants from phase one, with only 77 actually attempting phase five.

Phase one of the selection process involved checking if the applicants had submitted the required documentation in their application and whether they had obtained the minimum educational requirements specified for the training programme. Those that survived the first selection event progressed to phase two of the intake selection process. In this phase, the CVs submitted by the applicants were rated on 12 criteria by the author and senior instructors at the Client. Details on these critera are provided in Appendix C. These criteria were scored on a five-point Likert scale ranging from well below average to outstanding. Applicants that did not perform adequately in the second selection event were terminated.

Those that survived the second hazard progressed to phase three, which culminated in a psychological assessment recommendation. This rating was derived from three forms of testing, namely, general aptitude, technical aptitude and a teamwork competency assessment. These three measures are discussed in more detail later in this section. Applicants that were not recommended from the phase three event were terminated. Phase four of the selection process involved a panel interview. A minimum of two senior instructors, from within the Client, used a structured interview sheet and scored the applicants on a four-point Likert scale, from well below average to excellent. Details of the questions asked and criteria the applicants were rated on is provided in Appendix D. Top performing applicants from this selection event were then accepted onto the apprenticeship programme. The final hazard, phase five, was the demonstration of competence in the national trade test.

As previously stated phase three involved psychological testing. Two aptitude assessment instruments, namely, the Differential and Trade Aptitude test batteries, were used for psychological testing which was the objective of phase three of the selection process. The following paragraphs provide brief details on these two batteries and the sub-tests employed in this study.

- **The Differential Aptitude Test**

The Differential Aptitude Test (DAT) was designed under the auspices of the Human Sciences Research Council (HSRC). The overall aim of this test battery is for counselling purposes or to assist in producing the best match between individuals and certain jobs or in post-school training centres (Coetzee & Vosloo, 2000). Six sub-tests from the standard version of the DAT, termed the DAT-K battery, were utilised in this study. These sub-tests are: Vocabulary; Verbal Reasoning; Non-verbal Reasoning; Reading Comprehension; Comparison and Memory. Details with regard to the purpose, number of items and time limit per sub-test are provided in Appendix E. Scoring of these sub-tests was done manually with a scoring mask.

- **The Trade Aptitude Test**

The Trade Aptitude Test (TRAT) assessment battery also originated from the HSRC. The purpose of the test battery is to assist in the selection of potential students for admittance into technical institutes and colleges. The test battery also indicates the candidate's potential to progress and successfully finish training in a specific technical field (Taljaard, 1983). Six sub-tests from the test battery were employed in this study. These sub-tests are: Dexterity; Coordination; Assembly; Calculations; Spatial Perception 2-D and Spatial Perception 3-D. Details with regard to the intention, number of items and time limit per sub-test are provided in Appendix F. Scoring of the sub-tests was done manually with a scoring mask, except for the Dexterity and Coordination sub-tests. These two sub-tests were visually scored according to the requirements within the test manual.

Besides these two psychological assessment instruments, phase three also included a teamwork competency assessment. During a practical group exercise, applicants were observed and assessed on nine dimensions. These were: Assertiveness, Conflict Management, Feedback, Initiative, Influence/persuasion, Listening, Questioning, Problem-solving and Teamwork. Descriptions of these dimensions are provided in Appendix G.

The study's secondary data therefore already existed in the Client's records, yet to be used for research purposes. This data needed to be synthesised, reduced and interpreted. From the primary data, 19 constructs were regarded as suitable for secondary data extraction. This information was aligned to the research questions, objectives and hypotheses of the study. Following the various steps of data preparation, the sample size was reduced to 3 412 applicants as portrayed in Table 1.1. Having outlined the data collection strategies employed in the study, the next section clarifies the data analysis techniques applied.

### 1.5.5. Data Analysis

Descriptive statistics were used in this study to explain the gathered data (Quinlan, 2011). Frequency tables were used to show the number of people and percentage that were successful in each of the five phases within the multi-hurdle selection process (Bryman & Bell, 2011). The demographic details (i.e., age, race and gender) of the applicants were provided in this format, along with the geographical location of the applicants. Frequency distribution tables were used for nine particular aspects of the applications and cross-tabulations depicted the transitions of the applicants across the five selection phases. The median survival times (ST) of the 13 constructs investigated in this study were provided in tabular format according to the selection phases.

Inferential statistics were used to draw inferences and make predictions about the population from a sample's data (Quinlan, 2011). The Statistical Package for the Social Sciences' (SPSS), version 21, software package was used for statistical analyses. From this package the survival analysis procedure was used. The Gehan-Wilcoxon proportional hazards statistical tool, a non-parametric test, compared the survival curves of the applicants across the five phases of the selection process. The statistical significance level was set at .05. This provided an indication of the survival probability of the applicants at each selection phase (Austin, 2017; Hosmer, Lemeshow, & May, 2011; Morita, Lee, & Mowday, 1993). The life table for each of the constructs were provided as well as the overall life table and survival chart.

### 1.6. Definitions of key terms

When explicit, the definition of a term is provided from the secondary literature. However, the meanings of other terms have been manipulated to suit the purposes of the study.

*Applicant:* a person that has applied for a position and has entered into a selection process to be considered for this vacancy. Thereafter, this term indicates an individual that has undergone at least one of the five selection phases within the research study.

*Apprentice:* an individual that has enrolled on structured on-the-job training programme with related technical off-the-job training, to learn a skilled occupation, which culminates in an industry-recognised certification (Fazio, Fernández-Coto, & Ripani, 2016).

*Aptitude:* the potential within an individual to obtain a certain level of skill or ability, following training and/or practice (Coetzee & Vosloo, 2000; Van der Merwe, 2005).

*Artisan:* a person who has fulfilled the requirements of a formal or informal trade apprenticeship and has passed the requisite trade test (Evans-Klock, 2012; Mahembe, 2012; Rauner et al., 2012).

*Evaluation:* the "determination of the value, nature, character, or quality of something" (Merriam-Webster dictionary online, n.d.).

*Event:* this term refers to what terminates a selection phase (i.e., it is the change that causes the applicant to transition from one selection phase to another).

*General aptitude:* collectively refers to Vocabulary, Verbal Reasoning, Non-verbal Reasoning, Reading Comprehension, Comparison and Memory.

*Hazard:* this term refers to the event of interest (i.e., being unsuccessful in a selection phase).

*Secondary education*: refers collectively to technical high schools, academic high schools and technical and vocational education and training (TVET) institutions. In this thesis the terminology 'secondary education', 'matriculation' and 'Grade 12 qualification' are used interchangeably. Specifically, this study outlines the following as the minimum secondary education entrance requirements into the Client's apprenticeship programmes and these are therefore regarded as synonymous forms of secondary education within this thesis:

- A full seven subject Grade 12/ Matric/National Certificate (Vocational) Level 4 qualification, with mathematics and physical science and inclusive of applicable related subjects such as electrical technology, mechanical technology, automotive repair and maintenance, engineering graphics and design,
- A full four subject N3 Technical Certificate with supporting language subjects at Grade 12 level.

In this thesis a distinction is made between a *technical* and a *non-technical* form of secondary education. To be rated as having attended a *technical* form of secondary education, the qualification must have included mathematics, science and two technical subjects. This is a unique operational distinction made by the Client.

*Survival:* this term is synonymous with being successful in a selection phase and hence progressing to the next selection phase.

*Teamwork competencies:* collectively refers to Assertiveness, Conflict Management, Feedback, Influence/persuasion, Initiative, Listening, Questioning, Problem-solving and Teamwork.

*Technical aptitude:* collectively refers to Dexterity, Co-ordination, Assembly, Calculations, Spatial Perception 2-D and Spatial Perception 3-D.

*Termination:* this term is synonymous with being unsuccessful in a selection phase and hence not progressing to the next selection phase.

## 1.7. Limitations

Given the sampling method used, broad guidelines can be formulated from the identified sample. However, the results are still valuable for the automotive industry and the field of HRM. Secondly, one of the aptitude tools used has not been validated nor revised since its publication date. Whilst the culture friendliness of the test could be questioned, it is a registered and approved test battery within SA. The third limitation concerns the dilution of the scores at the various phases in the selection process. This may have weakened the intensity and subtleties of the scores actually obtained by the applicants.

## 1.8. Delimitations

This study was delineated to the apprentice intake selection process utilised at the Client for the 2012 to 2014 time periods. The study did not consider the selection process employed in other years nor the selection process conducted at other automobile manufacturing firms. Additionally, this study did not consider all of the available aptitudes or teamwork competencies but was delineated to those indicated in section 1.6.4. The formative theoretical and practical assessments done during the apprenticeship training programme and the annual individual performance reviews of the apprentices were also not included in this study. These other aspects should be investigated in further research or an alternative study.

## 1.9. Significance of the study

Since 1994, South African economic and skills policies have emphasised that artisan and technical training be given prominence (Mbatha et al., 2014). The Skills Development Act (No. 97 of 1998) has sought to improve the quality and quantity of artisanal skilling and the Sector Education and Training Authorities (SETAs) were created to plan and co-ordinate skills development processes in designated sectors. Learnerships were introduced in 2001 specifically to address the weaknesses of the apprenticeship system. Given remaining challenges and blockages in the technical skills system, the National Qualifications Framework Act (No. 67 of 2008) created new qualifications, including the National Technical Certificate and the National Certificate (Vocational) (Evans-Klock & Dar, 2013; Fraught, 2012; Mbatha et al., 2014). To support the economic growth of the country, the New Growth Path and the NDP propose the development of technical human capital, including artisans and engineers (Patel, 2011; NDP, 2012). The Department of Higher Education (DHET) has also highlighted artisanal development in the White Paper for Post-School Education and Training (DHET, 2013). Since 2007, the critical scarcity of qualified artisans in the manufacturing and engineering sector has been emphasised (JIPSA, 2010; Mahembe, 2012; Mlambo-Ngcuka, 2008). Despite this increased and sustained focus on improving the artisanal throughput rate there is still limited understanding of the nature, extent and context of the artisanal skills development problem (Reddy & Kruss, 2015; Wildschut et al., 2015).

This study aimed to reduce the gap in knowledge pertaining to the optimum process to be utilised in the selection of applicants for an artisanal development programme within the national automotive industry. This study contributed by evaluating a profiling and selection process currently being used within one automotive plant. This process could then be considered for implementation within the broader automotive industry and manufacturing sector. The recommendations offered by this study also contribute in assisting to increase the number of successful apprentices in SA. This research is aligned to national educational and labour planning initiatives as well as the international interest in this profession.

### 1.10. Ethical considerations

The ethical principles and guidelines for research involving human subjects indicated in the Belmont Report (1979) were followed in this study. There was no risk of harm to the applicants. The personal details of the applicants were recorded and respected. Psychometric assessment protocol was utilised so results were objective, standardised and accurately reported. Informed consent was also obtained from each applicant (Appendix H). No data was manipulated and the data will be stored for five years to enable other researchers to interrogate such data to ensure its veracity. Permission to conduct the research study and utilize the data collected was obtained from the Client (Appendix I). Ethical clearance for this study was also obtained from the Nelson Mandela University (Appendix J). An acceptable Turnitin similarity index report is provided in Appendix K.

## 1.11. Structure of thesis

The structure of this thesis is provided in Table 1.2. The first chapter was an introduction to the research problem and provides the context of the study. Chapter Two is the first literature review chapter which provides a review of the national automotive industry. Chapter Three focusses on the artisan and apprenticeship context while Chapter Four provides an appraisal of the HRS literature. The research design and methodology used in this study is described in Chapter Five with the study's findings presented in Chapter Six. Chapter Seven discusses these findings with Chapter Eight outlining the conclusions, recommendations and limitations of the study.

Table 1.2

*Chapter Outline*

| Chapter | Title |
|---|---|
| One | Introduction and Overview |
| Two | South African Automotive Industry |
| Three | Artisan and Apprenticeship Context |
| Four | Human Resource Selection Context |
| Five | Research Design and Methodology |
| Six | Presentation of Findings |
| Seven | Discussion of Findings |
| Eight | Summary, Conclusions and Recommendations |

## 1.12. Summary

This chapter has highlighted the role the automotive industry plays globally and within the national economy. The urgent need to address the lack of artisans, both nationally and globally, has also been underscored. The brief overview of the empirical research conducted on the selection processes employed for apprenticeships, broadly and within the manufacturing industry, has emphasised the necessity for more research in this area. This chapter has also described the research design and methodology applied in this study. The justification for the study, the delimitations and the overall structure of this thesis were also outlined. The next chapter outlines the national automotive industry, which is the specific context of this research study.

# CHAPTER TWO
# SOUTH AFRICAN AUTOMOTIVE INDUSTRY

## 2.1. Introduction

With Chapter One providing a broad overview of the research study, the purpose of Chapter Two is to present the specific context of the research study, the national automotive industry. The industry is profiled in terms of its history and current national representation. The industry's contribution to the country, economically and in terms of capital expenditure, are briefly discussed. The envisaged trends that may impact on the automotive industry in the future are explored as well as the contribution of the industry to employment levels. Section 2.2 commences the chapter with a brief historical overview of the automotive industry in SA.

## 2.2. History of the South African automotive industry

The national large vehicle manufacturing history commenced in 1924 with the first vehicle, a Model T Ford, being assembled in Africa. As portrayed in Figure 2.1, in 1926, General Motors (GM) SA was founded in Port Elizabeth, with four other plants opening across the country over the next two decades. The Chrysler plant opened in Johannesburg in 1937 and Peugeot entered SA under the National Motor Assemblers in 1939. The South African Motor Assemblers and Distributors (SAMAD) was formed to manufacture Studebakers in Uitenhage in 1946 and in 1949 the Car Distributors Assembly (CDA) plant opened in East London to manufacture Mercedes-Benz automobiles. This era of the automotive history was crowned with the first Beetle manufactured at the Volkswagen (VW) Uitenhage plant in 1951 (DTI, 2015; Naude, 2013; VWSA, 2016).

In 1956, Volkswagen Aktiengesellschaft (VWAG) bought controlling interest in SAMAD and announced a R1 million expansion programme resulting in production output increasing from 42 to 75 units per day. The first Datsun car was assembled in 1959 in Durban. The 1960s was a busy time in the national automotive industry as Fiat and Datsun opened their factories in Rosslyn; Toyota produced the first Corona and BMW opened their doors in Rosslyn (Naude, 2013; Nzimande & Patel, 2012; Pitot, 2011).

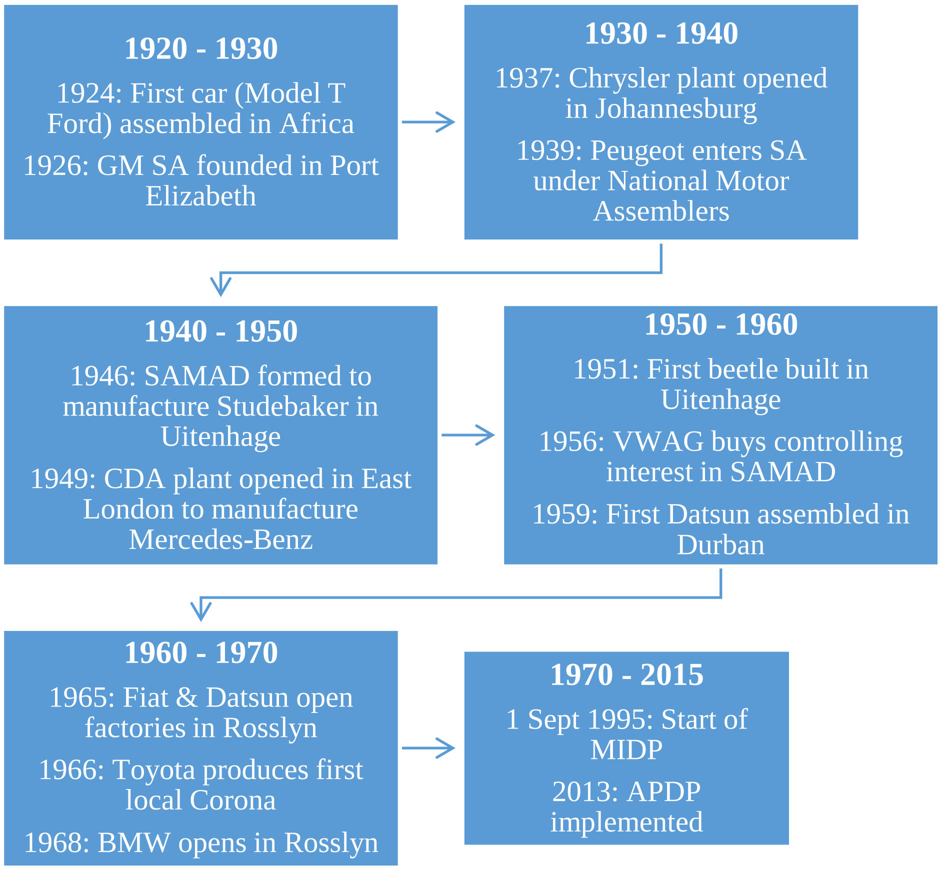


*Figure 2.1*. Significant milestones in the South African automobile industry’s history. Adapted from *Presentation on SA Automotive sector* (p. 8), the Department of Trade and Industry (DTI), 2015, http://www.dti.gov.za/parliament/2015/SA_Automotive_Sector.pdf/

Prior to 1994, most of the national automotive sector, except the German-owned OEMs, had weak international networking links. This inward-orientation was the result of a history of state protectionism and import-substitution. The inward focus was also reinforced through the economic sanctions, trade isolation and disinvestment that occurred in the country during the 1980s and early 1990s. National automotive producers were therefore isolated from international competition (Cauvin, 2001; Pitot, 2011). Post 1994, however, the automotive industry landscape radically altered due to the impact of globalisation and the liberalisation of the trade policy regime. The government also introduced initiatives to promote the integration of the domestic automotive industry into the global automotive arena (Joffe, Kaplan, Kaplinsky, & Lewis, 1995; Moodley, Morris, & Barnes, 2001).

As depicted in Figure 2.1, in September 1995, the Motor Industry Development Programme (MIDP) was launched (DTI, 2015; Nzimande & Patel, 2012; Van Zyl, 2015). Besides improving international competitiveness and encouraging growth in the industry, specifically in exports, the MIDP also had three other objectives. There was a move to improve the affordability of domestic market vehicles; a need to stabilise employment levels in the country as well as stimulate an enhanced industry foreign exchange balance (Cauvin, 2001; Pitot, 2011). The MIDP was, however, viewed as an essential but temporary measure for the national automotive industry (Cauvin, 2001).

The MIDP's successor, the Automotive Production Development Programme (APDP) was implemented in 2013 (DTI, 2015; Pitot, 2011; Van Zyl, 2015). The APDP supports and develops the South African automotive industry through four pillars, namely, stable import tariffs, a vehicle assembly allowance (i.e., allowing higher volume manufacturers to import a percentage of their components duty free), a production incentive (i.e., an allowance for duty free import of vehicles or components) and the automotive investment scheme. The latter scheme aims to enhance investment and job creation in the local automotive sector through increasing plant production volumes, strengthening the automotive value chain and stimulating investment in technologically advanced automotive production and new or replacement models or components (DTI, 2015; Pitot, 2011). The South African Automotive Masterplan 2021-2035 goes beyond the APDP and aims to assist in offering policy and support mechanisms to ensure the long-term sustainability of the automotive industry. Through the Masterplan, higher levels of investment and production are sought (AIEC, 2017; ASCCI, 2018).

### 2.3. Representation of the automotive industry

Section 1.1 indicated that there are currently seven large OEMs or automotive assemblers in SA. This category of role-player assembles both passenger and commercial vehicles. Mercedes-Benz, BMW and VWSA are European light automobile manufacturers and are solely owned subsidiaries. The Japanese and North American manufacturers are Toyota, Nissan, Isuzu and Ford Motor Company who are also 100% controlled subsidiaries (ASCCI, 2018; Moodley et al., 2001; Naude, 2013).

The national automotive industry has grown organically over the past few decades and is currently geographically located in three of the nine provinces as shown in Figure 2.2. The Ford Motor Company (including Mazda), Nissan and BMW vehicle manufacturers are in Gauteng. Toyota is positioned in Kwazulu Natal while VWSA, Isuzu and Mercedes-Benz are located in the Eastern Cape (DTI, 2015; Moothilal, 2017; Naude, 2013). At the end of 2017, GM announced its exit from Africa, with Isuzu announcing its acquisition of the GM assembly plant in Port Elizabeth (Moothilal, 2017).

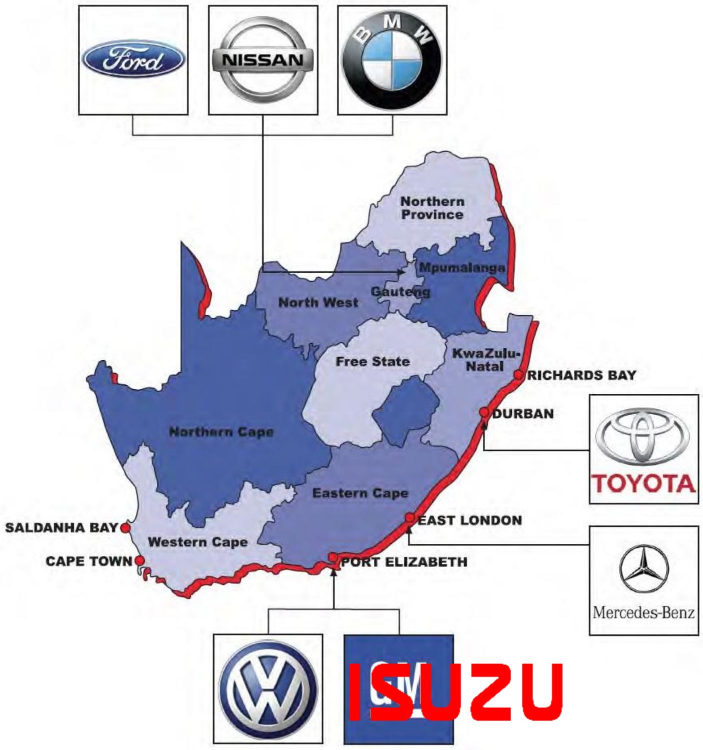


*Figure 2.2.* Geographical representation of original equipment manufacturers in South Africa. Adapted from *Presentation on SA Automotive sector* (p. 2), the DTI, 2015, http://www.dti.gov.za/parliament/2015/SA_Automotive_Sector.pdf/

The other major automobile brands present in SA are imported. These include: Peugeot/Citroen, Volvo (European); Daihatsu, Honda, Subaru (Japanese); Hyundai/Kia (Korean); Tata, as well as Mahindra (Indian). Chinese brands are also growing in the local market (DTI, 2015; Pitot, 2011).

Besides the OEMs, an extensive network of automotive component manufacturers (ACMs) exists across the country. This includes seven global first tier suppliers including Faurecia Interior Systems, Johnson Controls, Motherson Sumi Systems, Bosch and Behr. Furthermore, there are 120 first tier suppliers of which 75% are multinationals. The ACMs are component suppliers to OEMs, original equipment suppliers and the independent aftermarket (DTI, 2015; Naude, 2009; Pitot, 2011).

Original equipment suppliers, also known as the second-tier, supply automotive parts and accessory sales through the OEMs. The third-tier or automotive retail and aftermarket, provide automotive parts and accessory sales via independent retailers and repair outlets (DTI, 2015; Naude, 2009; Pitot, 2011). Most of the 200 second tier and third tier suppliers are South African. Just under half of these suppliers are in Gauteng, a third are located in the Eastern Cape, a quarter in Kwazulu-Natal and a few are in the Western Cape (AIEC, 2017). This review of the automotive industry's wide network leads to the discussion that follows on its overall contribution to the country.

## 2.4. Contribution of the automotive industry

Section 2.4.1 gives an account of the industry's economic contribution, including information pertaining to Gross Domestic Profit (GDP), production and capacity levels as well as exports. The capital expenditure contribution of the OEMs is discussed in section 2.4.2.

### 2.4.1. Economic contribution

The fourth-largest sector in the national economy is the manufacturing sector (Vass & Raidani, 2016). Within the manufacturing sector, the automotive industry is the largest. Vehicle and component manufacturing comprises about 30% of the national overall manufacturing output (De Lange, 2017).

The wider automotive network industry contribution to GDP has steadily grown post the economic recession in 2008. The contribution from this industry rose to a record high of 7.5% in 2015 (DTI, 2015; Naude, 2013; Vermeulen, 2016). The industry currently contributes approximately 7.4% to the national GDP, which has remained constant since 2016 (AIEC, 2017; Vermeulen, 2018). It is estimated that this contribution could increase to 8.5% by 2020 if it can annually produce 900 000 units (De Lange, 2017).

The nature of productivity within the South African automobile industry has significantly changed over the past two decades. Productivity is measured as the average number of vehicles produced per employee per year. In 1995, ten cars were produced per employee, with this increasing to 17 vehicles per employee in 2010. By 2012, productivity had increased to 18.5 units per employee (DTI, 2015; Pitot, 2011). In terms of global vehicle production ranking SA is ranked in position 22, with 599 004 vehicles produced in 2016, a slight decrease from the 616 082 vehicles produced in 2015 (AIEC, 2017; ASCCI, 2018).

During the second quarter of 2017, the average vehicle assembly capacity utilisation levels improved within the car, light and medium commercial vehicle sectors. There was, however, a fairly substantial decrease in the case of buses and heavy trucks. In comparison to 2010 figures, the end of the second quarter 2017 capacity utilisation levels had shown a 3.3% increase, with almost a nine percent increase in levels for light and medium commercial vehicles (Vermeulen, 2017). However, during the first quarter of 2018, there was a drop in all four capacity utilisation areas. There was a 3.6% decrease in the case of cars, 11.2% decrease in light commercial vehicles, 13% decrease in medium commercials and 9.2% decrease in heavy commercial capacity utilisation levels, in comparison to the 2017 figures. This reflected the current business conditions in terms of domestic and export sales (Vermeulen, 2018).

According to the National Association of Automobile Manufacturers of South Africa (NAAMSA), a record 97 302 534 vehicles were produced globally in 2017, which was a 2.4% increase on the 2016 figures. This is a 2 244 605 increase in the number of vehicles produced. As Table 2.1 indicates, the national share of this amounted to 0.62% in 2017, significantly above the country's share of GDP of approximately 0.42%. Local vehicle production increased by 0.2% or 1 170 vehicles, with 601 178 vehicles being produced in 2017. This increase is measured against the 2016 production units of 600 008. Current estimations are that the country's vehicle production will expand to 635 050 units for 2018 (Vermeulen, 2018).

Table 2.1

*South Africa's Share of the Global New Vehicle Production (in R millions): 2000 - 2017*

| Type | 2000 | 2010 | 2013 | 2016 | 2017 | % change 2017/2016 |
|---|---|---|---|---|---|---|
| Global production | 58.4 | 77.61 | 87.27 | 95.06 | 97.30 | +2.4% |
| South African production | .0357 | 0.472 | 0.546 | 0.600 | 0.601 | +0.2% |
| National share of global production | 0.61% | 0.61% | 0.63% | 0.63% | 0.62% | -1.6% |

*Note.* Adapted from *Quarterly review of business conditions* (p. 5), by N. M. W. Vermeulen, 2018, , https://www.naamsa.co.za/papers/2018_1stquarter/index.html

Indications are that South African production levels are far below international standards such as found in Europe, the United States of America (USA) and Australasia. SA is ranked twenty-second in global vehicle production, with China ranked first, the USA second, Japan third, Germany fourth and India fifth (AIEC, 2017). Year to date vehicle production figures as at the end of the first quarter of 2018 revealed that the USA produced 2 948 283 vehicles, China 7 022 164, India 1 371 953 and Germany 1 427 979 vehicles (OICA, 2018b). Local production is, however, expected to rise further over the 2016-2020 period due to the APDP and the rise in vehicle exports (Vermeulen, 2016). The national annual production as at the first quarter of 2018 was 134 603 vehicles, with 58.7% being exported (AIEC, 2017; OICA, 2018b).

Following the 2008-economic recession, the national automotive industry was forced to focus on new markets and partners to create new growth avenues and to diversify its risk. From 2012 to 2013 the export value more than doubled to 21 of the 152 country export destinations (AIEC, 2017). Nissan now exports its 1-ton pickup into Africa; VWSA sells the Polo series to the European Union, whilst BMW exports the 3 Series to Japan, Australia and America. Mercedes-Benz sells the C-Class to several overseas countries and Toyota exports the Corolla/Hilux to the European Union and Africa (DTI, 2015).

As graphically illustrated in Figure 2.3, there has been strong growth in South African vehicle exports, with the export-led growth model used by the industry proving sustainable since the global economic crisis post-2009. In 1995 the export value of both vehicles and components was R4.2 billion with 15 764 vehicles being exported. By 2012 the export value figure had risen to R86.9 billion with 277 893 units being exported. This is a 1 662% increase in 17 years (DTI, 2015). In 2015 approximately 630 000 vehicles were exported, a record industry vehicle production (Van Zyl, 2015). Total automotive industry exports increased to R118.1 billion in 2016 from R94.9 billion in 2012 (AIEC, 2017). A comparison between local export data between 2015 and 2017, however, is not as positive. In 2015, 333 847 vehicles were exported from SA, with 344 859 in 2016 and 338 093 in 2017. This is a 1.9% decrease in a 12-month period. This negative trend is reflected in the exports to Europe, North/Central America and South America. Exports to Europe declined by 2.6%, South America declined by 24.5% and 15.6% to North America. Exports to North America decreased as the exports of the BMW 3-series concluded. This trend is therefore expected to continue. Exports to Asia showed a positive growth of 10.9% and an increase of 10.5% to Australasia in 2017. Following sharp decreases over the past two years, a 1.3% increase in export sales to Africa was noted for the first time, suggesting a stabilisation in demand (Vermeulen, 2018).

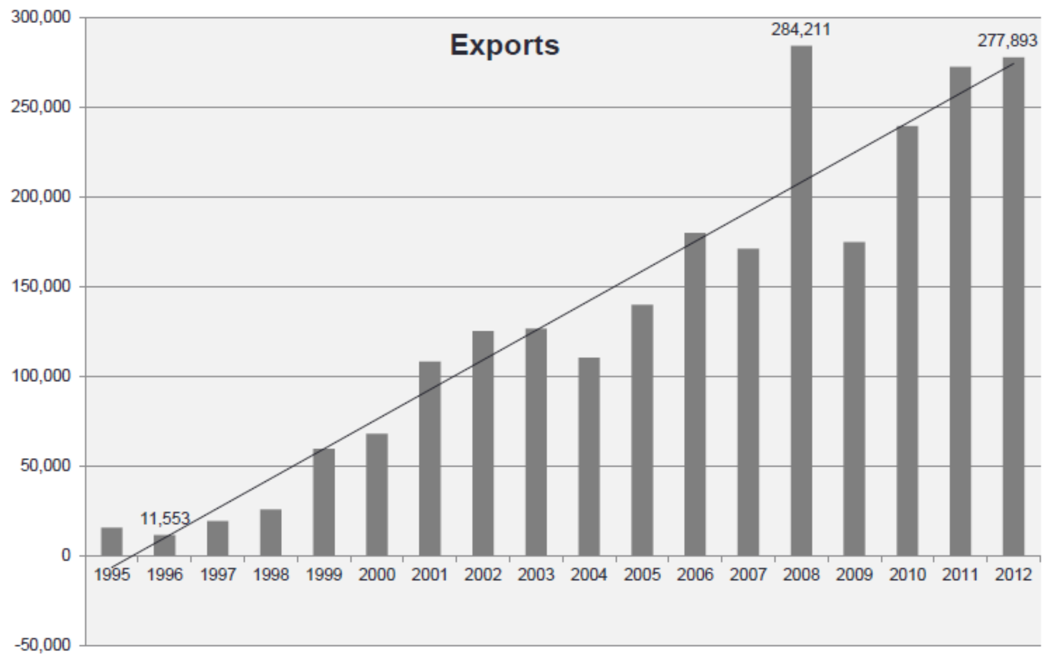


*Figure 2.3.* Increased export market share of the South African automotive industry post 1995. Reprinted from *Presentation on SA Automotive sector* (p. 10), the DTI, 2015, http://www.dti.gov.za/parliament/2015/SA_Automotive_Sector.pdf/

The APDP vision of national vehicle production being enhanced to 1.2 million vehicles per annum by 2020 can only be accomplished with significant investment levels in order to encourage value add, competitive improvement and supply chain development (DTI, 2015). Multi-national automotive corporations (i.e., both manufacturers and component suppliers) have shown their firm commitment to SA by making significant investments into their local facilities (Van Zyl, 2015; Vermeulen, 2018).

### 2.4.2. Capital expenditure

In 1995 total OEM capital expenditure was R847 million with this amount increasing to R6.4 billion in 2016 (AIEC, 2017; DTI, 2015). The R8.1 billion capital invested into the South African automotive industry in 2017 is a new industry record (Moothilal, 2017; Vermeulen, 2018). Based on capital expenditure data provided by the seven major OEMs, the actual industry capex for five years within the 2007-2017 period is provided, in Rand millions, in Table 2.2 (Van Zyl, 2015; Vermeulen, 2016, 2017, 2018). In all three expenditure categories the amounts spent in 2016 are more than double those spent nine years ago. For 2017, only the investment in land and buildings has decreased, with investments in the other two areas steadily increasing. These high capital expenditure levels can be attributed to investment projects stemming from the APDP and high production levels for export markets (Vermeulen, 2016, 2017).

Table 2.2

*Vehicle Manufacturing Industry Capital Expenditure: 2007-2017*

| Capital Expenditure | 2007 | 2010 | 2013 | 2016 | 2017 |
|---|---|---|---|---|---|
| Product/Local/Content/Export Investment/Production facilities | 2 458.7 | 3 351.1 | 3 605 | 5 146.1 | 7 144.6 |
| Land and Buildings | 382.4 | 441.2 | 424 | 905 | 301.4 |
| Support Infrastructure (I.T., R&D, Technical, etc.) | 254.4 | 202.4 | 319 | 636.5 | 724.6 |
| Totals | 3 095.5 | 3 994.7 | 4 348 | 6 414.6 | 8 170.6 |

*Note.* Adapted from *Quarterly review of business conditions* (p. 4), by N. M. W. Vermeulen, 2018, , https://www.naamsa.co.za/papers/2018_1stquarter/index.html

This capital investment by the OEMs and component manufacturers should continue at a similar level in the future as new models are launched and produced in the country. In October 2017, VWSA commenced its manufacture of the new Polo and Polo Vivo models with full production launched in early 2018. The production of these new models was preceeded by a R6.1 billion investment into the local production facility (Williams, 2018). Mercedes-Benz also announced a R9.47 billion expansion plan for its plant in preparation for the production of the new C-Class model in 2020 (Mkentane, 2018). BMW also started producing the X3 platform in Rosslyn in 2017 and Ford has announced it will be producing the new look Ranger in 2019 (Moothilal, 2017). The impact of these OEM investments is substantial. It is estimated that at least 12 component firms also benefit from every OEM-project initiated (De Lange, 2017). Having reviewed the history, profile and contribution of the national automotive industry in the previous three sections, the next section outlines the future challenges and developments therein.

## 2.5. Future trends

The global automotive industry is characterised by a persistent focus on efficiency improvements and cost reductions. The necessity of South African automotive firms embracing world class manufacturing standards and improving supplier competiveness are regarded as two key issues for the future success of the national automotive industry (Naude, 2013; Van Zyl, 2015). Without these, the development and long-term sustainability of the national industry is questionable. The ongoing upgrading and implementation of world class manufacturing standards is pivotal for the industry to have a chance of penetrating the global automotive value chain. SA now competes directly with medium-sized market economies such as Thailand and Mexico. However, these countries have greater proximity to the major export markets and enjoy lower costs (AIEC, 2017; Barnes & Morris, 2008; Moodley et al., 2001).

Major policy developments have impacted on the South African automotive industry. Firstly, governmental agencies are encouraging electric vehicles and green production which involves supporting the development and production of this form of technology and its associated components. Secondly, there have been significant moves towards enhancing the medium to heavy commercial vehicle segment. Increased investment levels into researching and developing this area has been encouraged as well as enhancing support for component manufacture to service this segment of the industry (DTI, 2015).

Section 2.4.1 indicated that national automobile production is a small segment of the world's total production. Even before the 2009 economic recession, the global industry was reaching capacity saturation point (Cauvin, 2001; Naude, 2013). Transnational companies currently have significant control of international production and trade networks making it difficult for local automotive firms to export independently. This could have a fundamental impact on the ability of the industry to survive and compete in the global arena (AIEC, 2017; Moodley et al., 2001). However, SA is regarded as the foremost destination for investment in Africa. Global investors and business leaders have indicated an overwhelming preference for SA as both a place of business and an investment destination (AIEC, 2017; Deloitte, 2015). SA was ranked 82$^{nd}$ out of 190 countries for ease of doing business and 24$^{th}$ for good practice in protecting business investors (World Bank, 2018). Forty-one percent of the global leaders surveyed rated SA in first place (i.e., with Morocco second at eight percent) and 61% placed the country in their top three (i.e., with Morocco and Nigeria tying at second place with 20%). This preference is reflected in the consistent inward flow of foreign direct investment into SA with a 10% year-on-year growth. Specifically, since 2003, the automotive industry has been attracting close to 10% of the foreign capital invested in SA (Lalor & Taku, 2013).

Other challenges experienced within the industry include high labour costs, modest infrastructure and outmoded technology. These issues are specifically impacting on the ACMs as they compete against cheaper, and even counterfeit, imported parts (Ambe & Badenhorst-Weiss, 2011; Moodley et al., 2001). The ACMs are being placed under significant strain by their cutomers to compete on price and non-price factors These ACMs will need to source innovative methods to deal with this global competitive pressure if they are to be sustainable (Barnes & Meadows, 2008; Moodley et al., 2001; Naude, 2013).

Given these challenges, the human capital element within the industry has been prioritised (Mashilo, 2010; Nomvete, Patel, & Baleni, 2017; Nzimande & Patel, 2012). Specifically, more technical knowledge and skill is required. Over the past decade, this demand for core technical skills, particularly at the level of technician and artisan, has significantly increased (Brown, 2013; DeSimone & Werner, 2012; Peo, 2013). There is also a global need for increased interest in pursuing a career within the manufacturing sector. It has been cited that the biggest challenge facing the sector is sourcing potential employees (Giffi et al., 2014, 2015; Kramer et al., 2015). However, in an American public poll, respondents indicated a high degree of interest in programmes such as internships, work studies and apprenticeships (Giffi et al., 2014).

### 2.6. Contribution to employment

Direct employment levels within the South African motor vehicle manufacturing industry have remained fairly stable over the past few years (Van Zyl, 2015; Vermeulen, 2016). At the end of the first quarter in 2018, there were 30 032 employees on the payroll. These figures are comprised from major new vehicle manufacturers and specialist commercial vehicle and bus manufacturers (Vermeulen, 2018). There has been a slight decrease in head count on the March 2017 figure of 30 197. This decrease is also seen in a comparison to the average 2016 employment number of 30 953 and 31 260 in 2015 (Vermeulen, 2017). However, there was a 0.75% or 224 jobs gained on the 29 808 industry head count as at the end of December 2017 (Vermeulen, 2018).

Broadly speaking, about 900 000 people are employed in the local automotive industry (De Lange, 2017). Within the service and sales outlets of the automotive industry, employment levels are over 200 000. This segment of the industry includes petrol stations, workshops, dealers, panel beaters and spare parts dealers (Pitot, 2011). It is estimated that the automotive industry contributed R55.9 billion or three percent of the total compensation provided to national employees in 2015. Of these job opportunities offered by the industry, over 76% are medium to low-skilled positions (Cokayne, 2017). Taking into account the dependants supported by these employees, therefore, about four million South Africans currently rely on the automotive industry (De Lange, 2017).

Besides direct and indirect employment, the automotive industry also supports society in several other ways. Between 2013 and 2015, the OEMs spent R1.5 billion on socioeconomic projects. Over R569 million was contributed to skills development, R346.6 million to healthcare, R13 million to conservation and environmental concerns and over R118 million to education. Over R306 million was also spent on small, medium and micro business development and education (Cokayne, 2017; De Lange, 2017). Furthermore, the national automotive industry is committed to the creation and development of Black owned manufacturing suppliers. Several OEMs implemented plans in 2017 to drive this transformation. These included the VWSA R86 million Black supplier fund and the Black empowerment fund set up by Toyota with an initial R42 million investment (Moothilal, 2017).

### 2.7. Summary

Chapter Two has discussed the national automotive industry, which is the context area for the study. This chapter has outlined the local profile of the industry, including a historical perspective and the major role-players therein. The industry’s contribution to the country in terms of GDP and capital expenditure were also discussed. The future trends impacting on the sector were outlined in the latter part of the chapter. Whilst the automotive industry is a significant contributor to the growth of the country, it has been placed under pressure to adequately align itself with global trends. Keeping abreast of technological innovations given the current skills shortages in core technical areas, such as artisans, is an area of concern.

The next chapter describes the artisan and apprenticeship context. In creating a background, the broad nature of apprenticeship programmes is discussed, as well as highlighting the latest developments both globally and nationally in this form of training. The dichotomy between the current demand and supply of artisans is also debated. In doing so, Chapter Three discusses the difficulties being faced within artisanal development as well as proposed solutions to these challenges.

# CHAPTER THREE
# ARTISAN AND APPRENTICESHIP CONTEXT

## 3.1. Introduction

Chapter Two outlined the specific context of this research study, the national automotive industry. The chapter highlighted the role of human capital in the long-term sustainability of the industry. Specifically, the need for addressing the current skills shortages in core technical areas, such as artisans, was emphasised. Chapter Three, the second literature review chapter of this thesis, considers the artisan and apprenticeship context, both internationally and within SA. The apprenticeship system is described and the apprenticeship life cycle is explained. The implementation of apprenticeship systems in SA and four international countries are outlined. The supply and demand issues, as well as the selection challenges experienced within the artisanal landscape, are discussed in the latter sections of the chapter. Section 3.2 commences with a generic explanation of the apprenticeship system.

## 3.2. Defining apprenticeship

An artisan is an individual who has successfully fulfilled the requirements of a formal or informal trade internship or apprenticeship and has passed the requisite trade test (Evans-Klock, 2012; Mahembe, 2012; Rauner et al., 2012). An artisan typically works in the categories of millwright, electrician, plumber, boilermaker, carpenter, mechanic, fitter and turner, pattern maker or injection moulder (Smith & Kemmis, 2013; Van Rooyen et al., 2010; Windapo, 2016).

Apprenticeships are regarded as a type of workplace or on-the-job learning that imparts general skills (Mohrenweiser & Zwick, 2009; OECD, 2011). However, a range of practices are encompassed in this form of training. Apprenticeship programmes are in fact quite distinct from other on-the-job training programmes in several ways. These unique elements include the legal framework, the use of off-the-job-training and formal assessment as well as the training model culminating in industry-recognised certification (Fazio et al., 2016). Appendix L summarises the key similarities and differences between an apprenticeship programme and four other forms of training, namely pre-apprenticeship or traineeship, internship, informal apprenticeship and workplace learning.

An apprenticeship can then be defined as "a job that includes structured on-the-job training combined with a share of related technical off-the-job training to learn a skilled occupation that is certified and recognised by the industry upon completion" (Fazio et al., 2016, p. 2). This definition highlights four elements of apprenticeships that distinguish it from other training methods. Firstly, the structured training implies that a training plan has been devised for the apprentice. Secondly, this training plan is a combination of training in the workplace (with a professional master) and classroom-based training offered by a school, college or training institution. The third distinctive characteristic of an apprenticeship is the written contract of employment between the apprentice and the employer reflecting the mutual benefit of the relationship through the rights and responsibilities of each (Cedefop, 2016b; Fazio et al., 2016; Steedman, 2012). The duration of the training programme is contractually specified in advance and is independent of the competence demonstrated by the trainee on the programme (Malcomson, Maw, & McCormick, 2003; Steedman, 2012). Apprentices have the status of employees and are paid for their work. Fourthly, upon completion, an assessment is done to obtain recognition of skills resulting in the award of an officially recognised certificate (Cedefop, 2016b; Fazio et al., 2016; Steedman, 2012).

As with other training programmes, the apprenticeship programme works through stages. The apprenticeship life cycle model incorporates all the stages the individual apprentice undertakes and completes during their apprenticeship, including the various people and bodies engaged in the stages (Smith & Kemmis, 2013). This life cycle, depicted in Figure 3.1, is used throughout this chapter to review both the international and national trends in apprenticeship.

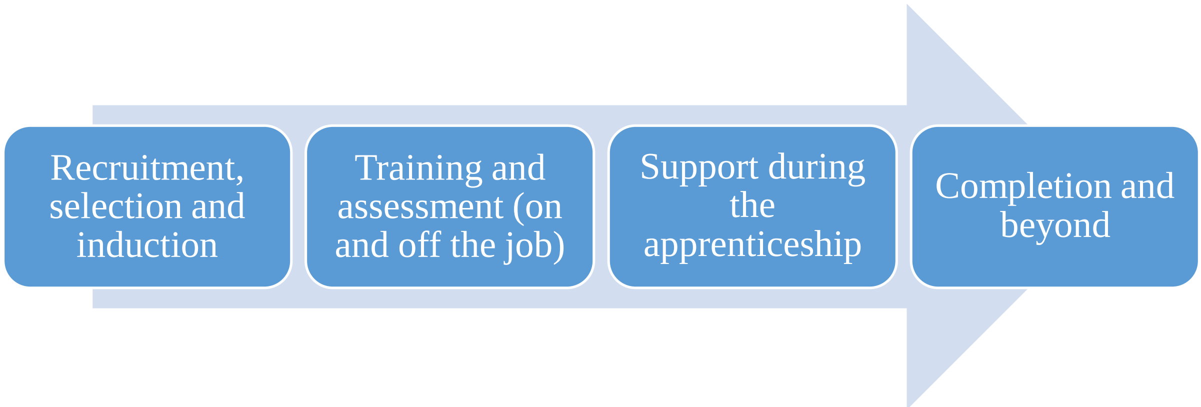


*Figure 3.1.* The apprenticeship life cycle. Adapted from *Towards a model apprenticeship framework: A comparative analysis of national apprenticeship systems* (p. 22) by E. Smith and R. B. Kemmis, 2013, from http://hdl.voced.edu.au/10707/292934.

During the first stage of the life cycle, processes are implemented to attract potential apprentices and screen for the appropriateness of match between applicants and the particular industry. Induction is a practice instigated to assist in the retention of these apprentices selected for the organisation. These aspects are done either directly by the employer or organising agents at local or provincial level. In this stage, apprentices may be required to enter into a formal legal contract with the employer or agency and/or commence a probationary period before entering into this apprenticeship agreement.

As illustrated in Figure 3.1, in the second stage of this life cycle, apprentices engage in the training and assessment stage of the programme. The implementation context of the apprenticeship determines the quality of training and assessment as well as the ratio of on-the-job training to off-the-job training experienced by apprentices. This training and assessment can be established and controlled centrally, either provincially or nationally, or be decentralised into the hands of the employer or training provider. Assessment can take various forms, from log books to final examinations, which lead to recognised qualifications.

The third stage centres on supporting the apprentice during the life cycle. This support comes from various sources with the aim to increase the likelihood of the apprentice completing the programme with the highest skill level possible. Forms of support can range from a tutor to masters or even case managers.

In the final stage of the life cycle, termed completion and beyond, the focus is on the future of the apprentice post the programme. In some cases, the apprentice continues with the training firm and becomes a full-time employee. However, this is not a consistent phenomenon. Another factor considered within this stage are the opportunities available for the apprentice to build on their apprenticeship qualification. Further training possibilities (e.g., journeyman training) or other off-the-job qualifications could be recommended. But, once again, this is not compulsory (Smith & Kemmis, 2013).

## 3.3. International apprenticeship systems

The global vocational education and training practices have been documented by Eichhorst, Rodríguez-Planas, Schmidl and Zimmerman (2015). They distinguish the various types of systems on two characteristics: firstly, the comparative weighting provided to learning versus workplace training and, secondly, whether the learning is provided as part of the secondary educational system or at vocational training centres that have close linkages to the private sector. Based on these two characteristics a continuum of vocational systems can be discerned with two main forms of apprenticeship programmes at either poles. This dichotomy is illustrated in Figure 3.2. On the one side of the continuum, there is the dual apprenticeship system that combines the school education system with firm-based training as implemented in countries such as Austria, China, Denmark, Germany and Switzerland. On the other end of the spectrum there are the apprenticeship programmes aimed at out-of-school individuals as seen in the UK, USA, India, SA and Australia.

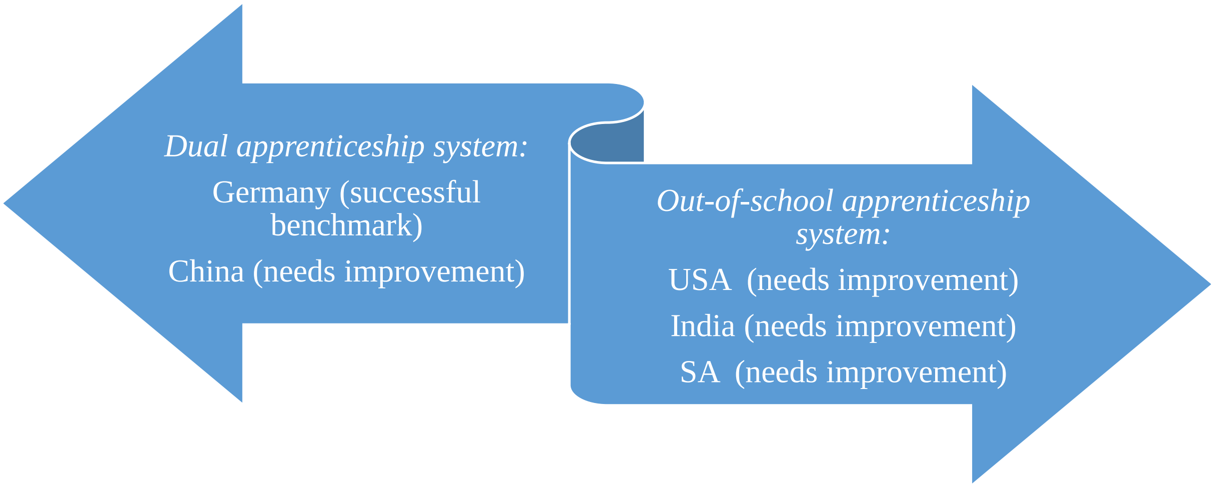


*Figure 3.2.* Continuum of apprenticeship types.

The available literature on the apprenticeship programmes implemented in four global countries were selected for review in this study. These countries are Germany, the USA, China and India. Germany, covered in section 3.3.1, was chosen as its apprenticeship programme is regarded as the global benchmark. Based on 2012 data, Germany had by far the highest participation rate across the globe and in 2013, Germany had the second highest (87%) completion rate (Keese, 2014). It is also a country implementing the dual form of apprenticeship training as described previously by Eichhorst et al. (2015). The USA, discussed in section 3.3.2, was selected due to strong global position of the country and the status similarity of the apprenticeship programme to that within SA (i.e., in decline, but with the need to improve it being emphasised by the government). It is also a country implementing an apprenticeship system on the opposite side of the continuum to Germany as outlined by Eichhorst et al. (2015). Considering that they are all part of the Brazil, Russia, India, China and SA (BRICS) association; China, India and SA share many similarities as developing countries

(Jayan, 2012). As is the case with the USA and SA, China and India are attempting to revitalise their apprenticeship systems. China and India were therefore chosen as the third and fourth comparative countries in this literature review. Furthermore, as indicated in section 2.4.1, these four countries are also positioned within the top five countries in terms of global vehicle production. Appendix M tabulates the key differences between these four countries and SA, in terms of the implementation of their respective apprenticeship programmes. The benchmark apprenticeship programme is discussed in the section that follows.

### 3.3.1. German apprenticeship system

In Germany, there is a long-standing apprenticeship tradition in many industries, including manufacturing, banking and services (Fairless, 2016; Malcomson et al., 2003; Muehlemann, Pfeifer, Walden, Wenzelmann, & Wolter, 2010). There are approximately 350 officially recognised apprenticeship programmes in the country (Fazio et al., 2016; G20ewg, 2012; Kahlen, 2016). However, a third of the apprenticeship training schemes are for craft related professions. The remaining two-thirds of occupations trained in this manner are white-collar professions, such as sales, banking and insurance (Dustmann & Schönberg, 2007; Smith & Kemmis, 2013).

Acceptance onto a German apprenticeship programme is no mean feat with several firms advertising their trainee vacancies at least a year in advance (Kahlen, 2016). Researchers indicate that only about 3.7% of applicants are successful in acquiring an apprenticeship position (Jacoby, 2014). Companies commit to contributing towards the national goal of apprenticeship placements through a focus on their recruitment and selection practices (Fazio et al., 2016). A school-leaving certificate is not compulsory to start this form of training in Germany as each sponsoring firm decides on the entrance qualifications required. However, if there are numerous applicants, a school-leaving certificate, good results therein and adequate German language skills has been shown to be advantageous (Kahlen, 2016).

The German apprenticeship system is regulated by the Vocational Training Act of 1969. This Act specifies the legal rights and obligations of both employers and apprentices. Employer bodies (chambers) and trade unions have significant authority under this legislation (Dustmann & Schönberg, 2007; G20ewg, 2012). At the onset of the apprenticeship, the two parties (i.e., firm and apprentice) are usually required to sign a legally-binding contract. This binds the employer to providing an occupation-specific curriculum according to the training regulations of the country. The employer also needs to provide the apprentice with a wage whilst on training (Kahlen, 2016; Muehlemann et al., 2010; Smith & Kemmis, 2013).

As indicated in Appendix M, which summarises the main characteristics of the German apprenticeship programme, there is a combination of theory and practice. The apprentice is required to spend a set amount of time in the publicly financed vocational school, usually one to two days per week. The rest of the apprentice’s time is spent in the training firm (Fazio et al., 2016; Kahlen, 2016; Muehlemann et al., 2010). The curriculum of the apprenticeship programme is directly regulated by governmental intervention in the implementation thereof (Elbaum, 1989; Kahlen, 2016; Malcomson et al., 2003). This ensures high quality programmes and enables mobility and flexibility for apprentices aiming to move from the training firm upon apprenticeship completion (Dustmann & Schönberg, 2007; Jacoby, 2014; Smith & Kemmis, 2013).

Apprentices are required to sit for an external examination at the end of the apprenticeship period, which culminates in the receipt of a nationally recognised training certificate (G20ewg, 2012; Kahlen, 2016; Muehlemann et al., 2010). Both employers and apprentices in the country value and respect practical work and vocational training (OECD, 2011). These parties are seeking more than short-term upskilling through the apprenticeship programme. Rather than only developing technical skills, the apprenticeship system therefore also aims to enhance the problem-solving, innovation and self-reliance skills demonstrated by the apprentices. Thoughtful artisans, that can make insightful and flexible judgements, are required to interpret the preferred strategies and methods of their training firms (Jacoby, 2014). The apprenticeship certificate is therefore also nationally recognised as a vital skill qualification (Dustmann & Schönberg, 2007; Fazio et al., 2016; OECD, 2011).

Despite this recognition of the qualification, there is limited capacity to meet industry demands given the high demand for young talent in Germany. A large number of positions in vocational training have not been filled (Kahlen, 2016). Notwithstanding improved access to vocational training in the country, there is an increasing trend of the youth moving directly to university. The actual numbers entering the dual apprenticeship system are declining (Fazio et al., 2016).

Given the long-standing tradition of apprenticeship in the country, Germany is expounded as an authority on the dual apprenticeship training model (Fazio et al., 2016; Jacoby, 2014; Mohrenweiser & Zwick, 2009). The German apprenticeship scheme is regarded as a role model for similar systems in other countries, such as the UK, USA, Canada, France and Norway. These countries have therefore implemented either new apprenticeship programmes or expanded their existing apprenticeship schemes based on the German dual apprenticeship model (Dustmann & Schönberg, 2007; Grosvenor, 2016; Lehmann, 2000). The apprenticeship system employed in one of these countries, the USA, is described in the next section.

### 3.3.2. North American apprenticeship system

Apprenticeship practices and its related legal arrangements were imported from Britain into the American colonies as part of the discovering and claiming of the New World (Elbaum, 1989; Martin, 2016). There are now over 1 000 apprenticeable trades in the USA, divided into two broad groupings, namely, construction and manufacturing (Martin, 2016; Reed et al., 2012). However, there are currently incentives to design apprenticeship programmes in high-growth industries, such as information technology, health care, social services, transportation and advanced manufacturing, since the establishment of the Apprenticeship Grant in 2015 (Fazio, et al., 2016; Martin, 2016; Reed et al., 2012).

North American youth may start an apprenticeship at 16 years of age. However, firms working under hazardous conditions may require the trainees to be 18 years of age (Fazio et al., 2016; Torpey, 2013). The entrance requirement into most apprenticeships is a high school diploma or equivalent. Furthermore, regardless of trade, basic mathematics and measurement are regarded as essential entrance requirements (Martin, 2016; Torpey, 2013). Work experience related to the trade being embarked upon is also sometimes necessary in the selection of potential apprentices (Torpey, 2013).

The average apprenticeship runs for four years. However, as shown in the summary of the North American apprenticeship system in Appendix M, some apprenticeship programmes take as little as one year and others six years (Fazio et al., 2016). In terms of certain specific trades, a millwright apprenticeship is three to four years in duration, an automobile mechanic trains for four years whilst a machine operator is in apprenticeship for one year (Torpey, 2013). A discerning feature of the North American apprenticeship system is the defining role of employers. Eligible employers or 'sponsors' have their programmes registered by the government. The content and characteristics thereof are designed specifically to meet the needs of the sponsor. Sponsors also determine the minimum qualifications required, develop their own formal agreements, identify the length of the programme and determine the wage payment amounts and timing (Fazio et al., 2016; Smith & Kemmis, 2013). Union involvement in apprenticeship programmes results in better enrolments, higher numbers of females and minority groups registering on the programmes and better overall performance and completion rates (Glover & Bilginsoy, 2005).

Formal apprenticeship programmes are registered with the Department of Labour (DOL) and are required to meet specific guidelines set by the DOL (Reed et al., 2012; Torpey, 2013). Most apprenticeships in the USA require 8 000 hours of on-the-job training, with 500 to 700 hours of theoretical training (Martin, 2016; Reed et al., 2012; Smith & Kemmis, 2013; Torpey, 2013). The theoretical component of the training is conducted by technical schools, community colleges or internally through employers hosting apprentices within their firms, known as apprenticeship training centres. Trainees attend classes before or after work, one or two days a week. Other apprenticeships are structured into blocks where apprentices attend classes full-time for several weeks in a year (Martin, 2016; Smith & Kemmis, 2013; Torpey, 2013). To meet the total hours required, however, most apprentices in the country work full-time, under the supervision of experienced artisans, within the sponsoring firm (Martin, 2016; Reed et al., 2012; Torpey, 2013).

Upon completion of their apprenticeship, trainees are awarded a nationally recognised certificate in acknowledgement of their skills attained. This is provided by the DOL directly, or by an approved state agency (Reed et al., 2012; Torpey, 2013). Apprenticeship graduates can also receive the credential equivalent of a two- or four-year college qualification (Perez, 2016). Employment prospects significantly improve for certified artisans post their apprenticeship (Obama, 2016; Torpey, 2013). Research indicates that 91% find employment with above average wages being earned (Perez & Zients, 2016; Wu, 2016). Estimated career earnings of apprenticeship graduates, on average, are more than similar non-participants (Reed et al., 2012).

Despite these enhanced employment prospects and higher earnings, there is currently a shortage of skilled trade workers within the USA which is impacting on the country’s ability to compete and grow (Martin, 2016; Smith & Kemmis, 2013). Whilst there are 9.3 million unemployed North Americans, 4.8 million jobs are vacant due to an inability to source adequately skilled individuals to fill these positions. A skills mismatch in the labour force is therefore clear. It is also evident that this problem will worsen in the years to come as technology and globalisation quicken and deepen (Jacoby, 2014).

A further challenge is the fact that the North American culture has been encouraging its youth to attend college, towards obtaining a degree, rather than entering vocational training (Smith & Kemmis, 2013). Almost 70% of the youth plan to attend college after completing high school (Jacoby, 2014; Martin, 2016; Reed et al., 2012). Less than five percent of the North American youth train as apprentices, the majority in the construction trades. This is in stark contrast to Germany, where close to 60% of its youth enrol in an apprenticeship in diverse fields (Jacoby, 2014).

Apprenticeship programmes are nevertheless touted as win-win initiatives for workers and employers within the USA. On the back of significant improvements already made in the advocacy of the programme, the government is pushing for further renaissance through the 'earn-while-you- learn' training model (Perez, 2016). There is a strong drive to assist service members, veterans and historically under-represented individuals (i.e., women, minorities, and people with disabilities) in entering apprenticeship programmes. There is also emphasis being placed on starting apprenticeship programmes in new industries (Obama, 2016; Perez & Zients, 2016). However, currently the apprenticeship system is predominantly concentrated within the construction industry (Glover & Bilginsoy, 2005). The apprenticeship programmes employed by two economically developed countries, namely, Germany and the USA, have been discussed. The programme within China is outlined in the next section.

#### 3.3.3. Chinese apprenticeship system

Apprenticeship has a long history in China. Some trace the Chinese origin of apprenticeship to Confucius (Wang, 2014) and there are reports of apprenticeships operating in China dating back to the Tang (i.e., 618 - 906) dynasty (Risler & Zhiqun, 2013). For thousands of years then this form of training has been used to train handcraft workers (Wang, 2014). Currently, apprenticeships are mostly used in trades where manual competence or skills is especially important, such as hair cutting and cooking in the services sector and carpentry, plumbing and masonry in the construction industry (Risler & Zhiqun, 2013).

Apprenticeship job offers occur regularly in China. Over 220 companies, in six cities, advertised 1 578 apprenticeship posts in a one-year period. More than 50% of these positions were for manufacturing workers to repair production and transport equipment. Workers in commerce and service were ranked second most in demand at 34% (Junlan, 2013). However, despite a significant growth in educational attainment within the country, firms experience sourcing sufficiently skilled labour difficult (Li, Li & Su, 2014; Risler & Zhiqun, 2013). Essential shifts in the economy has led to newly emerging industries struggling to recruit the skilled required within their labour force (Molnar, Wang, & Gao, 2015).

As summarised in Appendix M, legislation stipulates that a minimum of a year, during an apprenticeship, is spent on workplace training. However, this is not monitored nor enforced. There are also few quality standards regarding the workplace training with the result that the skills obtained are either too narrow in focus or of insufficient quality to meet industry requirements (Li et al., 2014; OECD, 2011). There is also minimal incentive offered to industry. with regard to implementing apprenticeship training within their firms. From the prospective employer's perspective, apprenticeship programmes therefore involve high costs and low benefits (Li et al., 2014; Wang, 2014).

Chinese apprentices are exploited in several ways through the current apprenticeship system (Risler & Zhiqun, 2013). The national labour law stipulates that work conducted by apprentices is not to be regarded as employment and is hence not part of a formal labour relationship. This has the implication that labour contracts are not deemed necessary. Apprentices, therefore, do not enjoy the benefits and protection awarded to workers engaged in work regarded as formal labour by the government (OECD, 2011; Wang, 2014). Apprentice students also have to pay for their own schooling. They are required to obtain double certification in order to qualify for employment readiness. Firstly, a school-based examination is written to indicate competence in the theoretical areas resulting in a diploma and, secondly, a workshop-based examination is completed within the company documenting their vocational skills. There is, however, a lack of standardisation pertaining to these examinations. Furthermore, the apprentices are required to source their own one-year internship in a firm. With the current lack of co-ordination from the government in terms of monitoring the involvement of these firms in their training, human resource managers have been documented as requiring compensation from potential apprentices before agreeing to accept them onto internships within their firms (Risler & Zhiqun, 2013).

Being a leading global player, China is facing challenges in terms of the availability, capacity and competency of its labour force. Competency requirements are exponentially increasing. There is rising pressure within the country for an external and independent testing and certification body for the apprenticeship trades, rather than this being operationalised internally within firms. This would also aid in the differentiation between skill grades (i.e., highly skilled, technologist or 'master') and between the various trades and vocations (Risler & Zhiqun, 2013).

In China, 2014 was the year of TVET and the commencement of significant reforms within the national TVET field. Part of this transformation includes an initiative to build a 'modern apprenticeship' (Wang, 2014). This stemmed from a decision, taken in 2005, to promote the combining of work and study thereby linking schools and firms again. However, this decision has come under severe criticism. Companies are still regarded as the 'junior partner' in the dual training system with their contribution being only to provide part-time trainers and practical sites and equipment (Risler & Zhiqun, 2013). To sincerely revitalise the Chinese apprenticeship system, a comprehensive reform of the vocational educational institutions will be required from what is currently mainstream practice. This will entail curriculum restructuring, redesigning assessment and evaluation methods, reorganising the teaching and learning approaches, as well as reworking methods employed in recruiting and selecting teachers (Li et al., 2014; Wang, 2014).

As shown in Figure 3.2, China, like Germany, adopts a dual apprenticeship system. On the opposite side of the continuum are out-of-school apprenticeship programmes. The USA and India offer this form of apprenticeship. India is the third country in the BRICS association and their apprenticeship system is discussed in the next section.

### 3.3.4. Indian apprenticeship system

The National Apprenticeship Training Scheme was established through the Apprentices Act in 1961. State apprenticeship advisors are required to ensure the implementation of the scheme in all government departments and within private enterprises (Fazio et al., 2016; G20ewg, 2012; Smith & Kemmis, 2013). The purpose of the Scheme is imparting practical skills in order to meet industry requirements for skilled manpower (Fazio et al., 2016; G20ewg, 2012).

The Indian apprenticeship system is well-established with three types operating at different levels, namely, trade, technician and graduate. Central government regulates the ratio of apprentices to workers in each trade. Whilst most apprenticeships are formally arranged through a contract registered by apprenticeship advisors, informal apprenticeships are also recognised (Fazio et al., 2016; G20ewg, 2012). A wide variety of sectors are covered under apprenticeship training. Agricultural services, automobile, construction, food processing, mining, production and manufacturing, tourism and the security industry are a few of the sectors. Apprenticeship training can be offered in designated and optional trades. A designated trade is a trade or occupation reported as such by the government. Currently 259 designated trades are available for apprenticeship training. Optional trades are those decided upon by the employer. These are either from the Prime Minister's Kaushal Vikas Yojana/Modular Employable Skills courses or a trade decided and designed by the employer in order to meet their specific requirements. Between 2.5% to 10% of the firm's total labour force, including contractual workers, are required to be apprentices. Employers with 100 workers may engage a minimum of three and a maximum of 10 apprentices. The scope of apprenticeships has been extended to include non-engineering pass-outs (NAPS, 2016).

Of the almost 500 million people in the Indian labour force, only 300 000 are apprentices (Fazio et al., 2016; Smith & Kemmis, 2013). Therefore, in 2016, the Indian government launched the National Apprenticeship Promotion Scheme (NAPS). Besides promoting apprenticeship training, NAPS incentivises employers to engage with apprenticeships and thereby aims to increase apprentice enrolments to 500 000 youth by 2020 (NAPS, 2016; Saravanabava, 2016). As reflected in Appendix M, NAPS offers two incentives to promote apprenticeship programmes. Firstly, a 25% reimbursement of the prescribed stipend is offered up to a maximum of 1500 rupees per month per apprentice to all employers who contract with apprentices. Secondly, the government reimburses the cost of basic training for the apprentices who enrol on apprenticeship training without any prior formal training. The latter reimbursement is set at a maximum limit of 7500 rupees for a maximum of 500 hours per three months (NAPS, 2016; Saravanabava, 2016; Smith & Kemmis, 2013).

The Indian apprenticeship scheme is targeted at persons above 14 years of age. There is no maximum age limit although apprenticeships are not specifically designed for the adult workforce. Physical fitness and the completion of education standards required for the trade are prerequisites to entering the programme. Students who have completed their schooling successfully benefit from a considerably shorter apprenticeship training programme (Fazio et al., 2016; G20ewg, 2012; NAPS, 2016).

Basic training centres established by government or government training institutes can provide the off-the-job training (Fazio et al., 2016; G20ewg, 2012). Since 2014 the outsourcing of basic training to an institute of choice was also allowed. Basic training is comprised of both theoretical and practical training within the trade to be adopted. It is one fifth to a quarter of the total duration of the apprenticeship training, with the majority of the time being on-the-job training. Basic training is compulsory for those who have not done any formal training at a government or private Industrial Training Institute as well as for those who have done courses under the Prime Minister Kaushal Vikas Yojana/Modular Employable Skills that have been conceded as equivalent to basic training (NAPS, 2016).

On-the-job practical training is provided in the workplace of the employer. In firms with a workforce exceeding 500 workers a distinct training area needs to be determined for the purpose of training apprentices. Government loans are made available to assist with this requirement. Practical training is specifically emphasised in Indian apprenticeships and employers are expected to optimise their facilities to realise this expectation (Fazio et al., 2016; G20ewg, 2012; Smith & Kemmis, 2013).

Central apprenticeship advisors conduct extensive monitoring of the programmes through the right of inspection. There are high levels of regulatory requirements for employers and noncompliance is met with penalties. Noncompliance includes employing an ineligible apprentice, not adhering to contract specifications and failure to employ the required number of apprentices (Fazio et al., 2016). For designated trades the registration of an apprenticeship contract is mandatory. For optional trades a contract is not required unless the benefits under NAPS are sought to be claimed. In the latter case the registration of a contract is compulsory (NAPS, 2016). The employer is however not obligated to offer full-time employment to the apprentice following the completion of the programme, and no incentives exist for them to do so (G20ewg, 2012).

Apprenticeship training programmes vary in duration, according to type of trade, from six months to four years. Apprentices are required to pass the All India Trade Test conducted by the National Council for Vocational Training to qualify for the nationally and internationally recognised National Apprenticeship Certificate. The testing is conducted through the National Council for Vocational Training. When seeking employment, the certificate serves as an indicator of an obtained qualification (Fazio et al., 2016; G20ewg, 2012; NAPS, 2016). The assessment and certification of apprenticeship outcomes is however not compulsory in India (Steedman, 2012).

The minimum monthly stipend paid to apprentices is specified in government regulations and is uniform across all trades. The pay scale is revised every two years based on the consumer price index. The stipend increases, from 70% to 90% of the minimum wage for semi-skilled workers, over the duration of the training programme. Employers of trade apprentices pay the stipend in full. The stipend for graduate, technician and technician (vocational) apprentices is shared equally between the employer and government. Upon graduation these stipend payments are refunded to the employer (Fazio et al., 2016; G20ewg, 2012; Smith & Kemmis, 2013). Despite a low monthly stipend, employment conditions and protection offered to apprentices are better than other employees in India. Nevertheless, manual occupations (which are mostly apprenticeships) have a low status in the country which makes promoting the apprenticeship scheme difficult (Fazio et al., 2016).

Inadequate training is provided as the reason for a low trade test pass rate in the country. Of those that undertake the apprentice certificate tests there is only a pass rate of 70%. Furthermore, this certificate is currently outside of the formal education scheme and until apprenticeship certificates are integrated into the national qualification framework (i.e., currently in process) these certificates remain unattractive to the youth (Fazio et al., 2016; Smith & Kemmis, 2013). Another challenge is that the curriculum is unfortunately regarded as outdated and inflexible with regard to the industry's needs. In consultation with industry, the government designs and updates the curricula of these training programmes. However, this process needs to be revised as there is currently insufficient consultation and transparency (Fazio et al., 2016; G20ewg, 2012; Smith & Kemmis, 2013; Steedman, 2012).

Thus far, this section has summarised the context, nature of, challenges and future trends within the apprenticeship programmes of four international countries. In the section that follows the national apprenticeship programme is discussed.

### 3.4. South African apprenticeship system

In section 3.2 the four stages of the apprenticeship life cycle were discussed. In this section the characteristics of the national artisanal system are outlined according to these stages.

#### 3.4.1. Recruitment, selection and induction

Compared to countries such as Australia, Germany, Canada, England and France, SA has relatively low numbers in the formal apprenticeship system. However, there is currently a focus on increasing these participation numbers (Smith & Kemmis, 2013). Apprenticeship enrolment figures have been steadily increasing over the past seven years. In 2011 24 415 learners enrolled on artisanal development programmes. In the 2015 this enrolment figure increased to 28 640 and to 30 817 in 2016 (Qonde, 2018).

The vast majority of learners currently enrolled on an artisanal pathway within SA are African males. A 2012 national study reported that 72% of apprentices are Black African, 22% White with six percent unknown (Janse van Rensburg, Visser, Wildschut, Roodt, & Kruss, 2012). Of the 1 483 registered apprentices within a trajectory study, 76% were Black African, six percent were Coloured, three percent Indian and 15% White (Wildschut, Kruss, Janse van Rensburg, Haupt, & Visser, 2012). According to the DHET, almost 77% of the learners entering an artisanal learning programme in 2016 were male. The gender difference in enrolment figures is more pronounced in the larger cities of the country (Qonde, 2018).

A minimum age of 15 is set for individuals commencing an apprentice, with no maximum age cap specified (Janse van Rensburg et al., 2012). National policy further indicates that individuals that have successfully completed a Grade nine may be admitted into TVET programmes (DHET, 2011). However, in practice the policy is deemed too flexible in terms of entrance requirements. Qualitative research has revealed that an individual who expresses interest in obtaining a skill or trade is admitted. A significant challenge then is that learners are admitted into TVET programmes without adequate attention being paid to their performance (Arfo, 2015).

Only 3.9% of apprentices enter the development programme directly after school. The most likely trajectory for entering an apprenticeship is after the second or third transition. Students are most likely to study after completing school. A national study established that at least 56% of the youth either studied, or studied then worked, before commencing an apprenticeship (Wildschut et al., 2012). However, this profile may have changed or be different within the manufacturing industry. In a more recent tracer report, merSETA (2016) found that 44% of apprentices entered the programme directly after completing school. There is a significant difference (i.e., about 40%) between the national statistic and that found within the manufacturing industry. Notwithstanding this, the merSETA (2016) study also found that 40% of the sample held undergraduate degrees, diplomas and certificates at the time of entering their apprenticeship.

With regards to geographical location, there are learners from all nine provinces registered for apprenticeship training (Qonde, 2018). The majority (40%) of apprentices are studying in Gauteng, with 18% in KwaZulu Natal and 16% in Mpumulanga. Only five percent of apprentices have been recorded as registered within the Eastern Cape (merSETA, 2016). This profile has not substantially changed in eight years. In 2008, Mukora established that most apprentices were registered in Gauteng (35%), KwaZulu Natal (14%) and the Western Cape (10%). Nine percent of the apprentices were registered in the Eastern Cape.

Across all sectors, there is a significantly high registration rate for the electrical trade (Qonde, 2018). Between 20 to 30% of learners register for this type of apprenticeship. The mechanical fitter apprenticeship has approximately 11 to 13% of the registrations and is the second most popular apprenticeship type (Janse van Rensburg et al., 2012; Qonde, 2018). In comparison, only 1.1% chose the automotive electrical and 6.3% the millwright apprenticeships (Janse van Rensburg et al., 2012). In contrast, Wildschut et al. (2013) found that the plumber trade was the most prevalent with 12.9% of the registrations, with the boiler-maker a close second with 12.4%.

An impact report of apprenticeships and learnerships within the manufacturing industry, done by Mukora and Visser (2008), investigated the enrolment of over 23 500 apprentices across 54 trades. Motor mechanic was the most popular (19%) trade, with the fitter and turner (7.6%), diesel mechanic (7.3%) and electrician (7.1%) trades being the other four most popular. The fifth most prevalent was the millwright trade with 6.9% of the registrations and the automotive electrician trade obtaining 3.7% of the registrations. Eight years later a tracer study within the manufacturing sector revealed a similar popularity rating. The most popular trades were mechanic, electrician, welder and fitter. Of the 900 apprentices surveyed, six percent were registered for the millwright trade and 2.3% as automotive electricians (merSETA, 2016). The next section progresses to the second stage of the apprenticeship life cycle, dealing with the implementation of training and assessment.

### 3.4.2. Training and assessment

In SA, an apprenticeship is governed by sections 13 to 29 of the Manpower Training Act (No. 56 of 1981). It is a non-unit standard aligned registered qualification. The integration of workplace and institutional learning culminates in a national qualification at the appropriate level. Off-the-job training for apprentices is done by both public colleges and private training providers (Smith & Kemmis, 2013).

For some apprenticeship trades, there is a stipulation of 72 practical weeks, with the maximum duration being three years. For other trades, there is a minimum period of 85 weeks of practical on-the-job training with a maximum of four years to complete. For both of these types of apprenticeships the minimum time period excludes time spent at a training provider, extended sick leave and any other leave of absence beyond the control of the apprentice (merSETA, 2016; Smith & Kemmis, 2013). On average, however, apprentices take 36 months to complete their learning programme and graduate. Within this, welding is regarded as the quickest trade to complete, with the motor mechanic trade being the longest (merSETA, 2016).

A trade test is the final external summative assessment for an apprentice conducted by an assessor registered with the National Artisan Moderating Body (NAMB) at a trade test centre accredited by the Quality Council for Trades and Occupations (QCTO) (Mummenthey et al., 2012; Nzimande, 2012). Prior to 2000, there was only one central national testing centre for apprentices. However, private providers can now gain trade testing status through obtaining accreditation with the relevant Sector Education and Training Authority (SETA) offering the specific trade (Parliamentary Monitoring Group, 2010). Different sources provide different pass rates. Some sources indicate that about 54% of the learners are passing the trade test each year, whilst others indicate only between 24 to 45% (Government Gazette, 2015a; Pienaar et al., 2016; Van Rooyen et al., 2010). According to the DHET, the number of learners completing artisanal learning programmes has improved by 13% over the past year. The pass rate in 2015/2016 was 56% and in 2016/2017 this had increased to 69% (Qonde, 2018). A recent tracer study in the manufacturing sector revealed that pass rates of 70% at first attempt, 20% at second, three percent at the third attempt, with the remaining seven percent being unspecified (merSETA, 2016).

There are currently four pathways to being accepted for this trade test, namely, a Section 13 apprenticeship; a learnership; an occupational qualification; or a Section 28 apprenticeship through Recognition of Prior Learning (Evans-Klock & Dar, 2013; Mummenthey et al., 2012; Smith & Kemmis, 2013). The third stage of the apprenticeship life cycle, namely, support offered to apprentices during the apprenticeship programme, is discussed in the next section.

### 3.4.3. Support during the apprenticeship

The official regulatory body responsible for artisan development and the apprenticeship system is the NAMB. This statutory entity falls under the auspices of the Department of Higher Education and Training (DHET) and is responsible for all trades under the QCTO (Smith & Kemmis, 2013). However, there is confusion amongst the various stakeholders regarding funding options and procedures, certification and the apprenticeship system in general (Mummenthey et al., 2012; Smith & Kemmis, 2013).

In SA, apprentices are paid as employees. Local apprentice wages differ according to occupation, as pay rates are linked to the occupation being trained for. The learnership system offers a short term financial window of opportunity for learners. With the high rate of unemployment in the country, the learnership stipend is regarded as a life-line for most post-school candidates. Thus, even though they have already obtained a matriculation equivalent, individuals are attracted to the lower level learnership system allowing themselves some financial sustainability (Smith & Kemmis, 2013).

Employers in SA obtain financial incentives or tax rebates for training apprentices. Within the country a compulsory skills levy of one percent of payroll over R500 000 is implemented. Through this levy system an employer can apply for an apprenticeship grant through the relevant SETA. The funding regime procedure and amounts available differ per SETA (Smith & Kemmis, 2013). The next section details how the fourth stage of the apprenticeship life cycle is implemented in SA.

### 3.4.4. Completion and beyond

Section 3.4.1 discussed the race, gender, age and geographical location of learners registered for artisanal learning programmes. The majority are African young males from Gauteng. The profile of the graduated apprentice seems to be very similar. However, there are more men that complete apprenticeship programmes compared to women (merSETA, 2016). Of the apprentices that graduated in 2016, 82% were male (Qonde, 2018). Of those that graduated in 2012 and 2013, 62% were African males with White males comprising 17% of the sample. African females made up 11%, Coloured males six percent and Indian males comprised four percent of the cohort. There was inadequate representation of the categories White females, Coloured females and Indian females (merSETA, 2016). Of the 21 198 learners that completed their artisanal learning in 2016, the vast majority (48.3%) were from Gauteng. Sixteen percent of the learners were from KwaZulu-Natal, 10.2% from the Western Cape and five percent from the Eastern Cape (Qonde, 2018).

The apprenticeship and learnership routes provide successful pathways for the skills development of the unemployed (merSETA, 2016; Smith & Kemmis, 2013). In a national study only 9.4% that entered the apprenticeship system were unemployed at the time of completion. The majority of those finding employment were young, previously unemployed individuals and they found employment immediately after completing their apprenticeship. Similarly, those entering a learnership qualification are likely to find employment, even though the numbers are still relatively low for this category of potential artisan (Janse van Rensburg et al., 2012).

A more recent tracer study, however, painted a less encouraging picture. Whilst 48% of the learners were employed full-time and four percent part-time by their original training firm, 16% of the sample could not find employment. Employment by another firm, not the original training firm, was nevertheless obtained by some of the learners. A further 25% were employed full-time and five percent part-time by a different employer post-graduation (merSETA, 2016).

Remuneration is the most important factor for artisan retention (Jordaan & Barry, 2009; Shabane, Schultz, & Van Hoek, 2017; Van Rooyen et al., 2010). In Jordaan and Barry's (2009) study, 40% of the sample indicated that remuneration was the key factor contributing to the shortage of artisans in the country. A further 30% blamed a lack of training for this deficiency. All 14 candidates in the research completed by Van Rooyen et al. (2010) rated remuneration as an important determinant of artisan retention. Development opportunities and equity were rated as the second and third contributors. Shabane et al. (2017) also recently established that local artisans are dissatisfied with their remuneration but suggested enhancing transformational leadership within the superiors of the artisans as a means to improving artisan retention levels. In contrast, Schlechter, Faught and Bussin (2014) found that an environment commiserate with a work-life balance was more important to artisans than compensation. Similarly, Naidoo and Hoque (2017) concurred that a positive and enabling working environment was the most critical success factor amongst permanently employed artisans.

### 3.5. Nature of demand for artisans

Having reviewed the broad characteristics of the South African artisanal system in section 3.4, the next section discusses the nature of the demand for artisans both nationally and globally. Section 3.5.1 provides an overview of the benefits realised by organisations through implementing apprenticeship programmes, with section 3.5.2 discussing the extent of the demand for artisans as well as the requirements inherent in this demand.

#### 3.5.1. Benefits of apprenticeship programmes

There are several benefits that can be realised through the apprenticeship training model. A wide variety of stakeholders - from government to employers, the youth and the currently employed - have interest in pursuing the broad range of benefits stemming from this form of training (Fazio et al., 2016).

The first benefit is an increase in productivity levels (Brewer, 2013; Fazio et al., 2016; Kramer et al., 2015). One study noted a seven to 10% increase in profits and revenues per assigned apprentice (McCasland, 2015). The main cause of weak economic growth in certain countries is low productivity. In order to increase this productivity rate more efficient methods of employing resources, such as the physical and human capital, need to be designed and implemented (Pagés-Serra, 2010). A positive and noteworthy improvement on all productivity measures has been realised in several countries, namely, Italy, Norway and the UK, following apprenticeship reform (Cappellari, Dell'Aringa, & Leonardi, 2012; Fazio et al., 2016; NAS, 2017).

Secondly, innovation can be enhanced through the implementation of apprenticeship training programmes (Cedefop, 2016a; Fazio et al., 2016). One of the main obstacles to improving innovation is a shortage of adequately trained employees. Through improving the education of workers, training firms will be in a better position to innovate (Pagés-Serra, 2010). Specifically, apprenticeship programmes develop the skills required for innovation to occur. They impart the techniques required by workers to adapt and develop new technologies and they facilitate human capital coming closer to the operational needs of firms by increasing competiveness and productivity (Fazio et al., 2016; Kramer et al., 2015; OECD, 2011).

Apprenticeship programmes are also more successful in facilitating the transition of new labour market entrants. This third benefit assists in reducing youth unemployment (Cedefop, 2016a; Dustmann & Schönberg, 2007; Fazio et al., 2016; Keese, 2014; Ryan, 2001). Young people who have undergone an apprenticeship programme are regarded as being ‘job ready’. Employers prefer these individuals especially in countries where employing the inexperienced youth is expensive in terms of employment rules (Cedefop, 2016c; Nkosi, 2012; OECD, 2011).

The fourth benefit of apprenticeships is the reduction of mismatch between employers and employees. Through apprenticeships, skills supply and demand are aligned (Cedefop, 2016a; Fazio et al., 2016; Steedman, 2012). For the past decade skilled tradespersons have been globally recorded as the hardest positions to fill. Firms are currently training and developing the talent required from within (Giffi et al., 2015; ManpowerGroup, 2016). The education system in most countries is not adequately aligned with industry needs. Many of the unfilled STEM positions require mid-level skills, yet students often complete higher-level qualifications, resulting in them being overqualified for the available jobs in the marketplace (Kramer et al., 2015).

The fifth benefit is the access to a stable career ladder as apprenticeships provide a positive employability pathway for the youth. Not only are the skills and experience of the apprentices enhanced but they also gain the ability to deal with more responsibilities, increase their earning capacity and progress up the career ladder (Fazio et al., 2016).

The sixth benefit is lower dismissal costs through using the programme as a selection screening device. Over the duration of the training employers are able to assess the abilities of the apprentice and can evaluate the suitability of a good match to their internal requirements (Acemoglu & Pischke, 1998; Soskice, 1994). This information advantage leads to longer tenure compared to those employees hired externally from the company (Malcomson et al., 2003;

Muehlemann et al, 2010). Apprenticeship programmes, therefore, operates as a selection or rejection mechanism for training firms (Lene & Cart, 2018).

A related seventh benefit is lower hiring costs, including those pertaining to recruitment and adaptation. Through hiring former apprentices, the need for job interviews, advertising the post and agency fees are negated. Externally hired employees also initially have lower productivity (i.e., in comparison to internally hired workers) due to their lack of knowledge on firm-specific issues. On-the-job training is hence required before the externally employed individual has adequately adapted to the specific requirements of the company (Malcomson et al., 2003; Muehlemann et al., 2010).

Benefit number eight is that apprenticeship training programmes are a more effective manner of imparting knowledge and certain skills than traditional school-based education (Carling & Richardson, 2004; Dustmann & Schönberg, 2007). Regular practical experience and training results in better student performance and improves employment prospects. On-the-job training programmes therefore achieve better outcomes than classroom-based vocational training (Carling & Richardson, 2004). Teaching skills in a practical work context is more conducive to skills transfer, than the classroom. Through this training methodology trainees obtain first-hand exposure to the internal mechanisms of firms, they experience how to interact with customers and other workers as well as comprehend how their jobs are conceptualised and implemented within the grander scheme of the organisation (Dustmann & Schönberg, 2007).

In addition to the eight benefits documented, the recent findings of the World Economic Forum added input to the argument that there is an increased demand for apprenticeship programmes in SA. The Forum's Global Competitiveness Report offers a comprehensive review of the performance of 137 countries on 12 pillars and 114 indicators. As reported in section 1.2, the 2017-2018 ranking placed SA in 61$^{st}$ position, showing a decline of 14 positions on the ratings attained in the previous year. In section 3.3, the apprenticeship programmes employed in four countries were reviewed, as a form of comparison to that implemented within SA. In this section, SA is compared with these same four countries in terms of global competitiveness. The USA and Germany are rated as stage three countries being innovation driven. China and SA are stage two countries, being efficiency-driven, and India is a stage one country being factor driven (Schwab & Sala-i-Martin, 2017).

As illustrated in Table 3.1, in terms of technological readiness, SA performed better than both China and India. SA has the technology available to be highly competitive. SA also has the potential to become a stage three country given its relatively high ranking on both the business sophistication and innovation sub-indexes. SA performed better than India, another BRICS member, on business sophistication and was a close third contender behind India and China in the innovation pillar (Schwab & Sala-i-Martin, 2017).

Table 3.1

*Ranking of Countries: Global Competiveness Report 2017-2018 (part 1)*

| Indicator | Germany | North America | China | India | South Africa |
|---|---|---|---|---|---|
| Overall ranking | 5 | 2 | 27 | 40 | 61 |
| Technological readiness (pillar) | 8 | 6 | 73 | 107 | 54 |
| • Availability of latest technology (indicator) | 16 | 6 | 81 | 72 | 45 |
| Business sophistication (pillar) | 5 | 2 | 33 | 39 | 37 |
| Innovation (pillar) | 5 | 2 | 28 | 29 | 39 |
| • Availability of scientists and engineers (indicator) | 11 | 2 | 29 | 32 | 100 |
| Labour market efficiency (pillar) | 14 | 3 | 38 | 75 | 93 |
| Higher education and training (pillar) | 15 | 3 | 47 | 75 | 85 |
| • Extent of staff training (indicator) | 6 | 2 | 36 | 34 | 39 |
| • Quality of education system (indicator) | 9 | 4 | 29 | 26 | 114 |
| • Quality of mathematics and science education (indicator) | 15 | 10 | 50 | 37 | 128 |

*Note.* Adapted from *The World Economic Forum's Global Competitiveness Report 2017-2018* (p. 90-269), by K. Schwab and X. Sala-i-Martin, 2017, from http://www3.weforum.org/docs/GCR2017-2018/05FullReport/TheGlobalCompetitivenessReport2017%E2%80%932018.pdf

SA therefore seems fairly well-positioned to deal with the Fourth Industrial Revolution. This revolution is an evolution to novel systems based on the infrastructure inherent within the digital revolution. Whilst this revolution does not rest on any particular suite of emerging technologies it is predicted that as these new systems and technologies become more universal and permeating they will profoundly impact on the way we behave (Schwab & Sala-i-Martin, 2016). However, innovation breakthroughs do not automatically happen. They require complementary efforts of ensuring that both people and organisations are able to access and make use of the technologies that are available.

Whilst SA appears to have prioritised the importance of vocational and on-the-job training (i.e., as evidenced in the moderate extent of staff training indicator ranking), the national low ratings in the other five rankings provided in Table 3.1 are poignant. SA is currently not performing well in labour market efficiency, higher education and training (specifically, mathematics and science performance) as well as in the availability of scientists and engineers. SA is one of the countries that is "leaving sections of their population behind", thus limiting the ability of the country to compete with more advanced economies (Schwab & Sala-i-Martin, 2017, p. 17).

Specifically, SA does not have the technical human capital to optimise this vital research and development commodity in the country (Vass & Raidani, 2016). In terms of the availability of scientists and engineers, the country performed in the bottom half of the 137 countries compared on this indicator. As indicated in Table 3.1, SA scored significantly worse than China and India in this indicator (Schwab & Sala-i-Martin, 2017). A deficiency of adequate technical abilities within a workforce could negatively impact on the countries overall innovation, growth and ability to remain competitive (Nomvete et al., 2017; Vass & Raidani, 2016). This lack of core technical skills, specifically at the levels of technician and artisan, urgently requires attention, specifically within the national manufacturing sector (JIPSA, 2010; merSETA, 2016; Nomvete et al., 2017).

Given the extensive growth in various global industrial sectors, there has been an increased demand for engineers, project managers and skilled artisans. South African apprenticeship programmes are regarded by some international firms as world class resulting in them recruiting from the local artisan pool (Jordaan & Barry, 2009). Having documented the benefits of apprenticeship programmes, both globally and within SA, the next section looks at the scope and magnitude of the demand for artisans.

### 3.5.2. Extent and requirements of demand

Skilled trade positions are currently the most difficult to fill globally (Deloitte, 2018; Giffi et al., 2015; Jacoby, 2014). It has occupied this top position since 2010. Included within this skilled trade position category are jobs such as electricians, carpenters, welders, bricklayers, plasterers, plumbers and masons (ManpowerGroup, 2016; Prising, 2016). At any given time, there are about 28 000 apprenticeship vacancies advertised on-line (NAS, 2017). A similar picture is found in SA. The 2016/2017 Talent Shortage Survey results revealed that 34% of South African employers are experiencing problems filling open positions. This is a three percent increase from the 2015 survey results and a significant 26% increase in comparison to the 2014 results. The most difficult position to fill was in the skilled trades, the same as the global rating (ManpowerGroup, 2016).

There are three main categories of technical occupations in SA, namely, engineers and technologists, technicians and artisans. Artisans constitute the largest quota of the key technical occupations in the country. They currently represent at least 72% of the occupational category, decreasing by approximately 0.7% per year (Vass & Raidani, 2016). Technicians and trade workers as wells as machinery operators and drivers are the two largest scarce and critical skills within the manufacturing sector. Toolmakers, electricians, millwrights, as well as fitters and turners, are also noted as skills shortage areas (Mummenthey et al., 2012). A scarce skill is one that has inadequate supply and a critical skill is regarded as being core to the sector (merSETA, 2009; Mukora, 2008). In another occupational category, construction contractors are experiencing difficulty in sourcing workers with technical scarce skills, such as in the fields of carpenters, electricians and plumbers (Windapo, 2016).

In 2014, the government published the *National Scarce Skills List* (Government Gazette, 2014a), with artisans being included in this list. According to this document, scarce skills were regarded as the job types for which employers were unable to source adequately qualified and/or experienced applicants. Given the consistent shortfall of certain skills in the country, the government legislated the critical skills work visa in 2014. This legislation aims to attract skills from abroad to meet the national needs. Occupations or critical skill areas identified are, amongst others, automotive electrician, automotive motor mechanic, boiler maker, diesel mechanic, fitter and turner, mechatronics technician, millwright and toolmaker. There is no limit on the number of foreign professionals that can be employed and the application process has deliberately been made simpler by the Department of Home Affairs. A job offer is not a requirement for this visa (Government Gazette, 2014b). However, the demand remains and the government therefore issued the *National List of Occupations in High Demand* in 2018, where similar artisanal trades were specified (Government Gazette, 2018).

Artisans are regarded as vital facilitators of competiveness within the manufacturing sector (Brown, 2013; Pandor, 2018). To enable this, vocational programmes need to provide students with a skills set and knowledge mix that will enable them to operate within a complex work landscape (Wedekind, 2015). Job specific, technically oriented skills are hence in high demand. At least 76% of the employers within the South African manufacturing sector upheld that practical and technical skills are principal in their recruitment of artisans (Peo, 2013). Given its reliance on modern production techniques, such as lean manufacturing practices, these skills are specifically required within the automobile industry (Shatouri et al., 2012).

Rather than a narrow focus on only these skills, however, a broader inter-disciplinary approach is required. Basic and generic skills such as verbal and numerical literacy as well as planning and communication abilities are vital. Various managerial and leadership skills are also considered essential, specifically the ability to work effectively in teams of a diverse nature. Furthermore, a range of information technology skills are becoming increasingly necessary within the field (merSETA, 2016; Ramdass, 2009).

Twenty-first century workers need advanced problem-solving skills. A recent report published by the World Economic Forum indicates that by 2020 robust problem solving skills will be required by 36% of jobs (Schwab & Samans, 2016). Competence in problem identification, analysis and solution have increasingly been expected from artisans within industry. A number of contextual issues, such as social, ethical and environmental factors have to also simultaneously be taken into account in these problem resolution activities (Laberge et al., 2016). Within the automobile industry, mechanics need to comprehend the complex modern systems being employed which entail an interaction between software, electronics and mechanical components (Wedekind, 2015). Section 3.5 has outlined the nature of the demand for artisans both internationally and within SA. The section that follows discusses the nature of the supply of this form of human capital both nationally and globally.

### 3.6. Nature of artisanal supply

According to Fazio et al. (2016), apprentices tend to be the out-of-school youth, about 20 years of age, probably unemployed, with an interest in working while learning a skilled occupation. They possibly do not have the interest and/or economic opportunities to pursue an academic career. However, individuals aiming to gain access to an apprenticeship programme must possess sufficient basic and soft skills in order to enter the programme. These are considered vital as it is a means to entering a position within a formal company setting.

Internationally, apprenticeships tend to benefit women less than men, in terms of entry, occupational access and employment outcomes upon completion of the programme (Bonnal, Mendes, & Sofer, 2002; Lodovici et al., 2013). Females are more likely to discontinue their apprenticeship within the first 12 months than their male counterparts (Bonnal et al., 2002; Hill & Dalley-Trim, 2008). However, organisations that avoid hiring female apprentices significantly constrain the applicant pool of applicants to choose from (Glover & Bilginsoy, 2005). A significant correlation remains between female apprentices and non-trade apprenticeships, especially in the service sector. Apprenticeships in this sector include business administration, health and social care and child care (Leung-Syke, 2016). However, the female-dominated occupations, such as health care, business administration and child care, tend to have lower pay and less favourable career progression routes than apprenticeships in the traditional male-dominated occupations (Gambin & Hogarth, 2015). In SA, the engineering profession remains male-dominated. The absorption of women into the profession is slow given various systemic constraints. Less than 10% of engineers and technologists and just below a third of the technicians in the country are women (Vass & Raidani, 2016). A trajectory study on apprenticeship programmes revealed that 83% of those registered for an apprenticeship were male (Wildshut et al., 2012). However, a more recent tracer study stated that 89% of registered apprentices were male (merSETA, 2016).

Several countries specifically focus on promoting apprenticeships within the minorities and disadvantaged people within their population. The USA gives strong prominence to enhancing participation amongst the minorities within the country, while Germany and Australia have initiatives that focus on assisting their disadvantaged youth in apprenticeship programmes. In SA, previously disadvantaged racial groups are well-represented in apprenticeships. This is in stark contrast to the former situation under the apartheid regime when apprenticeships were routinely White-dominated (Smith & Kemmis, 2013). A recent technical report has, however, revealed that White apprentices are still more likely to be employed than their Black African counterparts (Janse van Rensburg et al., 2012). Nevertheless, there is a continuing decrease in White engineers, technologists and technicians as the race profile of these technical occupations deepens into the other racial groupings within the country (Vass & Raidani, 2016).

Globally there are different age focus areas within countries. Countries such as Egypt, France, Germany, India and Turkey predominantly focus on providing apprenticeship programmes for young people. In contrast, Canada and the USA focus primarily on offering this form of training to adults. Australia, England, Indonesia and SA, however, routinely extend apprenticeships to both young people and adults (Smith & Kemmis, 2013). SA's technical skills pipeline is relatively young. Specifically, 44.2% of engineers and technologists are in the 25 to 34-year age group. This is particularly worrying given the centrality of these two occupational categories in the production process. Within the technician segment there is a more balanced mix of experience and youth. Almost 30% are in the 25 to 34-year age group, 33.8% are between 35-44 years and 28.4% constitute the 45-64 age category. This enhances the possibility of skills transfer to the incoming youth in this employment category. However, the number of technicians in their prime productive years (25-34 years) has substantially decreased (-24.9%) between the years 2002 to 2014. There has also been minimal growth of entry-level technicians between the ages of 15 and 24 years of age (Vass & Raidani, 2016). The average age of registered apprentices in SA is about 26 (Hauschildt, 2016; Naidoo & Hoque, 2017; Wildschut et al., 2012). White apprentices, however, tend to be younger than those of other races (Wildschut et al., 2012).

According to Vass and Raidani (2016), artisans constitute the vast majority of SA's technical positions with at least 72% being within this occupational category. However, it is noteworthy that these authors make no commentary in their information brief regarding the demographic profile of artisans within the country. Detailed analysis of the gender, population group and age distributions of engineers, technologists and technicians are provided, but no similar data on the artisan segment of this occupational category is provided. This dearth of information on artisans is regarded as comprehensive and is hindering national planning processes. There is a lack of information regarding the number of apprentices being trained, passing trade tests and having qualified as artisans. Information regarding their race, gender, which field they are qualified in, where they are and what they are currently doing is severely lacking (Du Toit & Roodt, 2008; Hauschildt, 2016; Pandor, 2018).

As discussed in section 3.5.2, there is currently an acute talent shortage being experienced globally, the highest level since 2007. In the 2016/2017 Talent Shortage Survey, 42 300 employers reported the category of skilled trade workers as being the most difficult position to fill, for the fifth consecutive year. The two main reasons given for this difficulty are a lack of available applicants and a deficiency in hard skills or technical competence (ManpowerGroup, 2016). In an American survey, just less than half of the manufacturing concerns indicated that potential employees lacked basic employability (e.g., punctuality) and teamwork skills (Giffi et al., 2015).

With regard to the first issue, a lack of suitable applicants, studies and reports from a wide variety of sources consistently highlight that technical apprentices and artisans are a scarce and critical skill in SA (Government Gazette, 2014b, 2018; Nomvete et al., 2017; Pandor, 2018). There has been a longstanding shortage of prospective candidates for artisan training in the country (Kleynhans, 2006; Kruss et al., 2012)

In terms of the second reason provided, there is a clear dichotomy between the demand for technical human capital and the current supply thereof in the South African context. There is a concerning disparity between industry requirements and artisan training (Mukora, 2008; Patel, 2012; Peo, 2013; Vass & Raidani, 2016). In a recent survey, 36% of employers in the national manufacturing sector stated that their artisans were deficient in the vital skills required (Peo, 2013). Furthermore, the current quality of graduate technicians and artisans is regarded as poor and variable (Hauschildt, 2016; Nzimande & Patel, 2012). Estimations of the actual annual number required within the country varies according to source, ranging from 53 000 to 60 000 (Duarte, 2017; JIPSA, 2010). Nevertheless, there is a significant shortfall with the current annual production rate being approximately 13 000 artisans (Duarte, 2017). Statistics reveal that only between 24 to 45% of learners are passing the trade test each year (Government Gazette, 2015a; Van Rooyen et al., 2010). The human capital within the national manufacturing sector is therefore currently not capable of embracing the new technology and innovation prevalent within the sector (Mummenthey et al., 2012; Nzimande & Patel, 2012). This lack of core technical skills in the national labour pool needs to be urgently addressed (DeSimone & Werner, 2012; Patel, 2008; Peo, 2013). It is regarded as being in the best interests of both manufacturers and government to remain committed to developing and implementing skills development programs that alleviate this challenging issue (Giffi et al., 2015). Several factors have been found to be contributing to the shortage of skilled artisans. The section that follows outlines various reasons for the shortfall between demand and supply of artisans, both internationally and nationally.

### 3.7. Challenges in the apprenticeship system

In this section three challenges to the implementation of apprenticeship programmes, both nationally and globally, are offered. Whilst there are numerous other problems that trouble apprenticeship implementation, these three are elaborated on as they pertain to the study's focus area. Section 3.7.1 commences by discussing the poor quality of the national education system.

#### 3.7.1. Quality of schooling

Despite the global increase in education the economic progress of many third world countries, including SA, has been slow. Researchers indicate that the type and quality of education offered may be the key factor (Alam, 2008; Arfo, 2015). Current educational systems are not satisfactorily preparing youth with the skills required to progress within the STEM fields (Spaull, 2013). Out of five basic skills, Malaysian final year technical students scored the worst in mathematics, being the only skill rated below the moderate level (Kazalin, Hamzah, & Bakar, 2009). Nigerian apprentices have low educational qualifications, with the majority only having completed primary school level (Evawoma-Enuku & Mgbor, 2005).

The quality of the South African labour market entrants is largely dependent on their quality and quantity of formal education. The deficiencies within the national education system is hence a significant constraint on the quality of potential workers seeking employment. This can also hinder the capacity of the youth to source acceptable employment. Whilst the youth are more educated than their older cohorts, they are not regarded as having the skills required by the economy (National Treasury, 2011). Forty years of apartheid education in SA has certainly left a huge backlog in the current skill level of the population (Mukora, 2008; Puchert et al., 2017a, 2017b; Rasool & Botha, 2011). School leavers are currently lacking in general life and work-readiness skills. Aspects such as business ethics, dress code, team work and communication are believed to have been sorely neglected in the general education of the youth. This lack of ability to manage themselves is resulting in the youth being under prepared in their transition from school to the workplace (Mummenthey et al., 2012).

As discussed in section 3.5.1, SA was assessed and ranked in the Global Competitiveness Report recently released by the World Economic Forum. The 2017-2018 rankings of SA and the four global countries on the higher education and training pillar, alongside four of the indicators within this pillar were provided in Table 3.1. These rankings highlight that the quality of education is extremely low in SA, significantly worse than the other BRICS countries. In mathematics and science education, specifically, the country ranks with the bottom 10 countries (Schwab & Sala-i-Martin, 2017). The national mathematics and science matriculation results are extremely poor, which may be contributing to the lack of available scientists and engineers (Mummenthey et al., 2012; Vass & Raidani, 2016; Wedekind, 2015). In a local study within the automotive industry, the science performance of applicants was significantly worse than their performance in mathematics. Of 1 748 applicants that had completed their secondary education, incorporating the subjects' mathematics and science, 10.7% attained 39% and less for mathematics. Just over a quarter (25.6%) attained the same level of performance in science. Whilst 63.7% of the sample obtained a mark 50% and above for mathematics, only 30.7% obtained a similar level of performance in science (Puchert, Dodd, & Viljoen, 2014).

The poor quality of schooling within SA has been identified as a key factor contributing to the shortage of skilled artisans within the country. Primarily, the lack of high-quality basic education amongst potential employees was noted as inhibiting the entry of these individuals into TVET colleges (Windapo, 2016). Researchers have recommended that the national government proactively establish strategies to subsidise technical and vocational schools in order for this form of secondary education to be improved. It is believed that this will improve the likelihood of capable individuals entering and exiting TVET colleges and apprenticeship programmes (Kruss et al., 2012; National Treasury, 2011; Windapo, 2016). Vocational training is therefore being aggressively pursued through the offering of the National Certificate (Vocational) by TVET colleges as a suitable alternative to traditional academic programmes offered by schools (National Treasury, 2011; Smith & Kemmis, 2013).

However, there are significant challenges currently being faced by these national TVET institutions (DHET, 2014; Manuel, 2011). The TVET system has not attained anticipated output targets, despite substantial investments to improve curriculum development and learner performance. This has resulted in an increasing skills gap being evident in the SA potential labour market (Mayer et al., 2011; Ramdass, 2009; Smith, 2011). In comparison to the other types available, individuals with a technical type matriculation consistently performed poorly in several general and technical aptitude tests employed in a selection process for automotive operators (Puchert et al., 2017a, 2017b). The weak relationships between TVET colleges and the workplace, which results in unsuitable levels and forms of training, may be the cause of this unfortunate phenomenon in the national landscape (Arfo, 2015; Manuel, 2011).

SA needs to promote an educational environment where academic, technical and vocational skills are valued. In order to achieve this, foundational skills, such as mathematics and science, need to be fostered. Adequate achievements in these subjects encourage technology shifts and innovation which is vital for a country's social and economic future (Manuel, 2011; Mayer et al., 2011; National Treasury, 2011; Ramdass, 2009; Smith, 2011; Spaull, 2013; Van der Berg, Taylor, Gustafsson, Spaull, & Armstrong, 2011). Specifically, there is a need to revitalise the current SA TVET system in order for the quality and quantity of artisans required within the country to be realised (Smith & Kemmis, 2013). In the next section improving the value of the training programme for potential trainees, employers and sponsors is discussed.

### 3.7.2. Attraction and recruitment

Apprenticeship programmes can be efficient human capital development mechanisms. However, in order to optimise this efficiency they need to be perceived as valuable to the youth as well as being viewed as attractive to employers and funders or sponsors (Fazio et al., 2016; Keese, 2014). This section provides an account of the challenges inherent in realising the value and attraction of apprenticeship programmes to these three stakeholders, as is summarised in Figure 3.3.

| Potential applicants | Employers | Sponsors |
|---|---|---|
| • Stigmatisation<br>• Perceived lower status<br>• Lack of technical career path<br>• Wages<br>• Working conditions | • Lack of basic skills in applicants<br>• Prescribed inflexible programme<br>• Lack of cost sharing<br>• Free-riding problem | • Poaching<br>• Uncertain return on investment |

*Figure 3.3.* Stakeholder challenges in apprentice recruitment and attraction.

#### 3.7.2.1. Potential applicants

The benefits of workplace training, such as apprenticeship programmes, need to be attractive to potential apprentices and stigmatisation must to be avoided (Mummenthey et al., 2012; Shankel, 2010; Zelloth, 2013). However, the literature review on the global apprenticeship programmes, provided in section 3.3, indicated the increasing trend of the youth preferring university to vocational type qualifications (Fazio et al., 2016; Jacoby, 2014; Kahlen, 2016; Martin, 2016; Smith & Kemmis, 2013). In section 3.4.1 it was also identified that only 3.9% of those entering an apprenticeship do so directly after school. It is more likely for individuals to either pursue other studies or seek employment. With registering for an apprenticeship being the second or third trajectory, it was concluded that apprenticeship is not deemed a viable career option by the national youth (Wildschut et al., 2012).

Increasingly, global competition is requiring countries to vie on the quality of goods and services. In order to adequately do so, a workforce with a range of mid-level trade, technical and professional skills, together with high-level university education is required. However, whilst tertiary education has rapidly expanded in most countries TVET has been neglected and is often perceived to be of a lower status (Fazio et al., 2016; OECD, 2011; Smith & Kemmis, 2013). This perception remains despite comparative studies confirming that vocational training should not to be regarded as an easier option to formal schooling. In fact, the cognitive demand of mathematics and science, within the vocational stream, are regarded as being more demanding than in the traditional academic stream (Houston, Booyse, & Burroughs, 2010; Wedekind, 2015).

Furthermore, apprenticeships tend to be perceived as being the development option to be selected if all else fails, whilst academic programmes are believed to hold higher prestige (Giffi et al., 2015; Grosvenor, 2016; Keese, 2014). Several countries, such as the UK, Australia and Turkey, have reported difficulty in enticing an adequate quality of applicants into their apprenticeship programmes. The prime reason for this is the perceived low status of apprenticed occupations in these countries (Grosvenor, 2016; Kramer et al., 2015; Smith & Kemmis, 2013).

Schooling systems are regarded as not adequately encouraging students to pursue careers in manufacturing, such as apprenticeships (Giffi et al., 2014). The status of apprenticeship programmes is also minimised if they do not lead to recognised qualifications, the acquired skills are too specific and there is a lack of transferability across occupations or sub-fields. These aspects have been successfully addressed within the apprenticeship programmes implemented in Australia, Japan, Netherlands and Switzerland (Keese, 2014). British training providers and organisational councils have implemented novel techniques to improve the awareness of their youth regarding vocational opportunities and thereby aim to attract a more diverse pool of applicants. A directory of available apprenticeships has been produced and circulated at schools, community centres and libraries. A website listing apprenticeship vacancies has been designed and plays are being delivered at schools to showcase the benefits of selecting non-traditional training and work (Miller, 2005).

Amongst the youth in SA, there is an overall lack of interest and understanding of the worth of technical training. Despite the dire need for qualified artisans the value of a technical career path has not successfully been instilled in the South African population (Mummenthey et al., 2012; Pandor, 2018; Patel, 2008, 2012). There is a widespread belief that vocational training does not lead to good jobs and TVET colleges are therefore struggling to attract a large student body. University education is perceived as first prize with vocational training being the second best option (i.e., essentially for those who could not make it into tertiary education) (Mummenthey et al., 2012; Pandor, 2018; Smith & Kemmis, 2013). In China, at least one in five secondary school students enrol in TVET. In the Russian Federation it is more than one in six children. This is a significantly higher enrolment rate than found in SA (Bokova, 2014). The image of vocational training in the local context therefore needs to be enhanced (Evans-Klock, 2012; Manuel, 2011; Mukora, 2008).

This problem exists within the context of most countries providing incentives and setting targets for apprenticeship intake. In Germany, despite incentives being in place, the numbers entering the dual apprenticeship programme are declining (Fazio et al., 2016). America has invested substantial amounts of money into supporting the expansion of apprenticeships in the country (Perez & Zients, 2016; Wu, 2016). President Obama signed the first-ever annual federal funding for apprenticeship programmes into law in 2015 and over $50 million in new grants to states were awarded. This initiative also involves close to 300 colleges offering apprentices college credits for the skills they have gained on-the-job (Obama, 2016; Perez, 2016; Perez & Zients, 2016; Wu, 2016). In Brazil, a minimum of five percent and a maximum of 15% of the work force employed in jobs requiring formal training must be composed of apprentices. Furthermore, employers are not permitted to hire any apprentice without first enrolling them on technical or professional training relevant to the position they are hired to fulfil (Fazio et al., 2016; G20ewg, 2012). The Indian NAPS incentivises employers to engage with apprenticeships and thereby aims to increase apprentice enrolments (NAPS, 2016; Saravanabava, 2016). Furthermore, between 2.5% to 10% of the firm's total labour force, including contractual workers, are required to be apprentices. Employers with 100 workers may engage a minimum of three and a maximum of 10 apprentices (NAPS, 2016).

Rather than only increasing apprenticeship enrolment by enforcing minimum participation numbers and through financial incentives, it is recommended that there be *professionalisation* of the artisan career path. This includes creating platforms for the national recognition of various pathways and qualification to obtaining the trades, increased focus on the quality of artisan training and assessment as well as the monitoring of the progress of artisans through national registers (Evans-Klock, 2012; JIPSA, 2010; Manuel, 2011). The selection of apprentices, specifically section 18.2 learnership students, has been recognised as a key challenge. Care should be exercised in identifying these students as those who have low interest and/or aptitude for either the trade and/or the industry may prematurely terminate their registration on the programme. Adequate standards and selection procedures therefore need to be implemented by employers of apprentices (Mummenthey & du Preez, 2010).

Researchers in the field have called for an awareness drive of technical trades to be undertaken through career and recruitment vehicles thereby attracting learners to these career types (merSETA, 2016; Pandor, 2018). According to Griffin and Fox (2000), a North American firm successfully introduced an innovative apprentice enrichment programme to assist in the recruitment of talent into the organisation and reduce their high staff turnover rate. The programme centred on changing the mind-set of existing employees towards embracing their position within the firm as a career versus just a job. The programme included pamphlets, presentations and one-on-one meetings to affirm the commitment of the firm to developing the employees. The apprentices are also tracked across predetermined skill levels. Upon certification of attaining a particular skill level, the apprentice progresses to the next higher complexity level. Apprentices can move into other business areas and progress into branch management. Given that most individuals prefer a career over a job, "young people are hungry for this type of employment solution" (Griffin & Fox, 2000, p. 38). Since the introduction of the programme, staff turnover has been reduced by 60% and hiring capacity improved to 97%, in one year.

A crucial ingredient for a quality apprenticeship programme is the establishment of effective career guidance for potential applicants (Brewer, 2013; Pandor, 2018). Apprentices who have a misguided perception of the nature and requirements of an apprenticeship are unlikely to successfully complete the training programme (Hill & Dalley-Trim, 2008). This was echoed by the Organisation for Economic Co-operation and Development (OECD) (2011) when they included the provision of effective career guidance and advice as one of the five key challenges with regard to the implementation of vocational education and training. Career guidance should provide information on the opportunities and benefits of vocational learning and provide up-to-date labour market information to assist the youth to make informed decisions. It is believed this will facilitate their efficient transition from school to further training, and then to work (Brewer, 2013). In SA, the university failure rate is about 50%. Career guidance to the youth could facilitate the consideration of a career as an artisan, thus enhancing their full-time employment opportunities as well as earning potential (Duarte, 2017).

There is also a need for a specialist technical career path that will attract the youth to progress as technical practitioners. This will also eradicate the need for individuals with technical jobs to redirect their career plan into a management career in order to be promoted (Manuel, 2011). Other challenges to be overcome in order to enhance the perceived value of apprenticeships for the youth are the issues of wages and working conditions (Keese, 2014).

Besides the perceived low profile of the apprenticeship position, potential applicants are also not attracted to the manufacturing industry. The future talent pool within the global manufacturing industry is therefore being thwarted by the low level of attractiveness of the industry. Over 60% of the executives surveyed believe this aspect is having a significant to high impact, whilst another 29% believe it is having a moderate impact (Giffi et al., 2015). Rather than the manufacturing industry, individuals are more attracted to the financial, healthcare and services sectors (Giffi et al., 2014; Kramer et al., 2015). In an American poll, 52% of the youth stated they had a zero interest in a manufacturing career. Two thirds of these individuals stated their reason as being that a manufacturing career involved working in a "dirty, dangerous place that requires little thinking or skill from its workers and offers minimal opportunity for personal growth or career advancement" (Shankel, 2010, p. 2). A more recent poll found that the Generation Y (i.e., aged 19-33 years) youth ranked a career in manufacturing as their least choice. Furthermore, only a third of the respondents stated that they would encourage their children to pursue a manufacturing career (Giffi et al., 2014).

#### 3.7.2.2. Employers

The second stakeholder, employers, also need to perceive the apprenticeship programme as being an attractive employment option (Fazio et al., 2016; Smith & Kemmis, 2013; Zelloth, 2013). This is specifically true during times of economic pressure as firms tend to restrict the number of apprenticeship positions they offer (Juul & Jørgensen, 2011; Steedman, 2012). Some industries have built a strong apprenticeship culture, which assists in enhancing the attractiveness and status of their programmes. However, firms tend to be unwilling to hire apprentices if there is a general lack of basic skills amongst the youth as this may exacerbate the nature and duration of the training needed to be provided (Dustman & Schönberg, 2007). Germany and the USA have overcome this obstacle through the introduction of pre-apprenticeship programmes (Smith & Kemmis, 2013).

Employers may also be reluctant to embark on apprenticeship programmes if they are not involved in the development of the programme itself and/or if the contracts are too rigid (Fazio et al., 2016; Steedman, 2012). The Australian government therefore built flexibility into their apprenticeship contracts in order to minimise this hurdle in attracting employers. In Germany and the USA employers and trade unions are highly involved in the design and management of apprenticeship systems. Another deterrent for employers is the lack of cost sharing amongst themselves, the public sector and the apprentices themselves. Canada, Germany, France and the Russian Federation share the cost equally and offer incentives to employers for hiring apprentices (Keese, 2014). In contrast, 23% of artisan respondents indicated that the lack of recognition by the employer for the value and need for artisans in their industry was a significant employment factor contributing to the lack of retention of artisans in SA (Jordaan & Barry, 2009).

The market-failure, or free-riding problem, is a significant deterrent to apprenticeship training (OECD, 2011; Steedman, 2012). Employers may be hesitant to invest in this type of training due to fearing their trainee apprentices will be poached by other firms. This leads to imparting only firm-specific skills in the training as a means of securing their investment of time and resources. However, this has the negative consequence of the apprentices obtaining skills that are not easily transferable to other firms. Even in countries with long-standing traditions of apprenticeship, this free-riding problem still persists. The one potential solution is for governments to encourage firms to see their investment in the general training of apprentices as an investment in the public good, as is apparent in Germany. The alternative is for governments to become more involved in the training through offering incentives to employers (Fazio et al., 2016).

#### 3.7.2.3. Sponsors

Besides apprentices and training firms, apprenticeship programmes also need to be perceived as a worthwhile endeavour by potential sponsors or funders. The poaching issue being one deterrent, there are several other barriers that can deter these investors. The uncertainty of the return on their investment makes cost-benefit analyses and impact evaluations vital tools to convince these stakeholders. This is especially true in small and medium sized enterprises as these firms probably face higher costs in participating in apprenticeship programmes (Fazio et al., 2016; Gambin & Hogarth, 2017). Within well-functioning artisanal development systems, the majority of training firms recoup their training costs by the end of the training period. Using the apprenticeship programme is therefore a useful recruitment strategy for the training firm who can retain the most suitable candidates. However, other firms can also benefit as they recruit skilled workers from the pool of graduates that are not initially employed by their training firms (merSETA, 2016).

### 3.7.3. Selection

Apprentice training is often used as a screening mechanism within firms (Malcomson et al., 2003; merSETA, 2016; Steedman, 2012). In countries with a deregulated labour market, firms can recruit the young apprentices at lower wages, train them and then retain those that are most productive as employees (OECD, 2011). Given that apprenticeship programmes are on average at least three years in duration the training firm has ample time to get to know the apprentice. Information concerning the abilities and characteristics of the apprentices are readily available throughout the training programme and firms can use this valuable information to retain the most skilled individuals as employees at the completion of their training (Dustmann & Schönberg, 2007; Malcomson et al., 2003; Muehlemann et al., 2010). The quality of the match between worker and firm is therefore much higher through the use of the apprenticeship programme as a screening device. This also has an additional knock-on effect of reduced layoffs, compared to hiring from the external market (Malcomson et al., 2003; Muehlemann et al., 2010). However, there is a perception that the apprentices do not have sufficient practical skills and are therefore not able to complete the tasks desired of them. Rather than employing apprentices, Chinese firms would rather employ graduates from the secondary schools that have completed sufficient training (Li et al., 2014; Wang, 2014).

Using the apprenticeship programme as a selection technique is not used indiscriminately. Dustmann and Schönberg (2007) argue that students from school-based vocational training institutions are likely to be well marketed by these institutions as they have no vested interest in not sharing information on their students. However, these authors also found that firms hosting apprentice students are unlikely to reveal such information on their students to external sources as they probably aim to employ some of them later. A cross-sectional analysis of German firms training apprentices established that employers are willing to incur the costs of training apprentices, in lieu of hiring them thereafter, given that three conditions exist. These are: the skills sought are fairly specific, there is a high retention rate of apprentices in this sector and thirdly, the labour market makes hiring this form of skilled employee difficult (Mohrenweiser & Zwick, 2009).

Organisations require a unique blend of technical and human relations skills that move the employee beyond the step-by-step completion of delegated tasks (Hauschildt, 2016; Overtoom, 2000; Sermsuk, Triwichitkhunb, & Wongwanich, 2014). Core skills, such as teamwork, are a high priority for most employers as they build on the individuals' basic education. Other skills sought by employers include analytical skills, effective communication, creative thinking, ability to solve problems independently, leadership, motivation and organisational ability (Ahmad & Schroeder, 2002; Brewer, 2013; Zhu & Dowling, 2002). Employability skills, such as communication, adaptability, group effectiveness and influencing skills are also regarded as key (AAC&U, 2013; Carnevale, Gainer, & Meltzer 1990; Husain, Mokhtara, Ahmada, & Mustapha, 2010). Managing oneself at work is also a key employability skill (Brewer, 2013). For individuals in low-level positions, higher levels of self-directedness have been linked to a higher probability of promotion to higher-level job positions (i.e., vertical job mobility) (Raemdonck, Tillema, De Grip, Valcke, & Segers, 2012).

However, according to the 2017 Job Outlook Survey, 50% of employers believe that recent graduates lack these desired core employability skills and are not adequately prepared for the workplace (AAC&U, 2013; Burning Glass Technologies, 2013; Gallup Inc., 2014; NACE, 2016). Specifically, technical graduates lack generic employability skills (Rahman, Mokhtar, Yasin, & Hamzah, 2011; Rasul, Rauf, Mansor, Yasib, & Mahamod, 2012; Rasul et al., 2013). Global studies on technical graduates have consistently established that while the students may have mastered the technical skills, they lack the core employability skills required by industry (Bakar & Hanafi, 2007; Husain et al., 2010; Kazalin et al., 2009; Markes, 2005; Mustapha & Greenan, 2002; Rasul et al., 2013). STEM graduates lack the basic personal professional skills such as teamwork, communication and problem solving skills to enhance their employability (Kramer et al., 2015). Researchers advise educators to have a balanced approach in the training of technical students. Employability and technical skills need to be integrated into the curriculum. The curriculum also needs to be sufficiently flexible to accommodate current and future needs (Mustapha & Greenan, 2002).

There is a pervasive skills shortage within SA, specifically amongst the supervisor and artisan positions (Hall & Sandelands, 2009). In studies investigating the occupational competence of apprentice students and artisans, deficiencies in their holistic problem solving and thinking skills was established. This is particularly disturbing as it is believed that these specific skills assist in the transition of these students from school/college to the workplace (Hauschildt, 2016; Jacobs, 2015; merSETA, 2016). Apprentices, within the learnership track, were found to have a low level of applied competence or work readiness. The training providers of these students rated 43% as having achieved a fair level of overall competence with industry-related bodies rating the majority of these students as having fair (40%) to poor (10%) work readiness (Mummenthey & du Preez, 2010).

The difficulty in sourcing applicants with the correct skills set is evidenced in the lengthy turnaround time for the recruitment and selection of apprentices. The average lead-time is five months in Brazil (Gray & Wragg, 2015), six months in India (Fazio et al., 2016; Smith & Kemmis, 2013), three months in North America (Giffi et al., 2015) and four months in SA (Barnes & Meadows, 2008).

### 3.8. Summary

This chapter has outlined the pertinent issues related to the artisanal context. The apprenticeship training programme system, being the most commonly employed method of obtaining artisanal status, was considered. The national apprenticeship system was outlined as well as that implemented in four international countries. The nature of the demand and supply of artisans, both nationally and globally, were discussed. This chapter also elucidated three current challenges faced in the development of artisans. SA, as is the case in the USA, China and India, is attempting to revitalise its apprenticeship system. Many private and governmental initiatives are being implemented to assist in this revitalisation. These are, however, mostly focussed on improving the attraction of stakeholders to the training programme as well as implementing improvements to the methods of training and assessment. Germany, unlike SA and these three global countries, places emphasis on the selection phase of the apprenticeship life cycle.

The next chapter clarifies the underpinning theoretical framework of the study, namely the human capital theory. Chapter Four also deals with the managerial activity of human resource selection. The nature and importance thereof as well as the various methods employed by industry are discussed. The key challenges experienced in human resource selection as well as the current practices, adopted both nationally and globally, in sourcing apprentices are elucidated.

## CHAPTER FOUR
## HUMAN RESOURCE SELECTION CONTEXT

### 4.1. Introduction

Chapter Three provided an overview of the artisan and apprenticeship context, both internationally and within SA. The current inadequate supply to meet the high demand for artisans requires a holistic solution. The three challenges discussed in Chapter Three pertaining to the recruitment, selection and induction phase of the apprenticeship life cycle have not been adequately addressed in research to date. Chapter Four, the third literature review chapter of this thesis, considers the HRS perspective of the study. The underpinning theoretical framework, the human capital theory, is examined as well as the concept of HRS. Various methods employed in HRS as well as the challenges experienced within this managerial task are elucidated. The specific selection practices utilised, globally and nationally, for apprentices are also discussed. Section 4.2 commences the chapter with a discussion on the study's theoretical framework.

### 4.2. Human capital theory

Economist, Gary Becker (1962, 1964), is known for commercialising the term 'human capital'. In his 2002 analysis of the term he extended his definition to encompass the "knowledge, information, ideas, skills, and health of individuals" (p. 3). Whilst other forms of capital, such as factories, machinery and financial capital are important, he believed that human capital was the most significant. According to Weatherly (2003, p. 1), the human capital asset of a firm is "the collective sum of the attributes, life experience, knowledge, inventiveness, energy, and enthusiasm that its people choose to invest in their work". The knowledge and skills that employees jointly possess comprises the human capital of an organisation (Subramanian & Youndt, 2005).

Within Becker's (1962) classical human capital theory, there is a distinction between general and firm-specific human capital. General human capital are skills or abilities that have the same value in various firms and are hence compensated accordingly. Firm-specific abilities or skills are solely valued within the firm they were acquired (Wright et al., 1994). Both general and firm-specific human capital can be employed to enhance the financial and operational performance of firms (Ployhart & Moliterno, 2011; Snell & Dean, 1992). However, HR practices, such as selection and training, should be used to create and maintain the valuable firm-specific human capital for the organisation. This high quality firm-specific human capital then has the potential to operate as the competitive advantage of the organisation (Wright et al., 1994).

A key aspect of the human capital theory is the term ‘employability’. Employability skills are those that assist individuals to prepare successfully to obtain positions and progress in their careers (Fugate, Kinicki, & Ashforth, 2004). Employability skills also substantiate the value of employees to the organisation (Askov & Gordon, 1999). Employability then has more to do with the ability to implement the work expected of the incumbent than only the techniques, experience and talent the individual brings with them. Whilst these employability skills are transferable, they are core to the job and encompass the knowledge, skills and attitudes required to be outstanding in their positions (Rasul, Rauf, & Mansor, 2013). It is these employability skills that are deemed to be the most valued raw material within the firm (Wesselink, De Jong, & Biemans, 2009). Having described the depth of the theory, the next section outlines the relevance of the theory within the management context and section 4.2.2 discusses the criticisms levelled against the theory.

#### 4.2.1. Relevance of the human capital theory

Organisations in the modern economy cannot ignore the necessity of investing in the human capital of their workers. Consistently, human capital is regarded as the key determinant of productivity. A pool of high quality employees is more likely to achieve organisational objectives such as high productivity and quality, better service and higher levels of innovation (Crook, Todd, Combs, Woehr, & Ketchen, 2011; Dess & Shaw, 2001). However, research has also indicated that the competitive advantage of human capital as a strategic asset will only be realised if organisations select and retain individuals with knowledge that is both valuable and unique for the firm (Barney & Wright, 1998; Boxall, 1996; Subramaniam & Youndt, 2005). Furthermore, human capital is a source of competitive advantage not only due to the competencies brought into the organisation, but given the capacity these can offer to solve organisational problems and dilemmas (Coff & Kryscynski, 2011).

HR practices have been conceptualised as falling into three primary facets, namely, skill-enhancing, motivation-enhancing and opportunity-enhancing (Lepak, Liao, Chung, & Harden, 2006). These three facets have a differential impact on organisational outcomes. Skill-enhancing HR practices, such as recruitment, selection and training, are more influential in enhancing human capital, with motivation- and opportunity-enhancing HR practices having a significant impact on improving employee motivation (Jiang et al., 2012). This is consistent with previous research that established the heterogeneous influence of HR practices on organisational outcomes (Batt & Colvin, 2011; Gardner, Wright, & Moynihan, 2011; Shaw, Dineen, Fang, & Vellella, 2009).

The human capital of a business is influenced through its HRM practices. The acquisition and development of skills is leveraged through the firm's recruiting and selection procedures. A large pool of qualified candidates and a reliable and valid selection procedure will have a significant impact on the type and quality of skills new employees will possess (Huselid, 1995). There is agreement amongst authors that the use of effective and thorough selection practices will result in the collective human capital of an organisation being enhanced (Cabello-Medina et al., 2011; Takeuchi et al., 2007; Yang & Lin, 2009). A significant link between rigorous staffing practices, improved customer service and increased profits has also been established (Van Iddekinge et al., 2009).

New hires should be selected on their potential to learn (i.e., their aptitudes, cognitive abilities and motivation), rather than their current level of knowledge, skills and experience (Lepak & Snell, 1999, 2002). This form of selection will enable the organisation to source potential employees that can obtain firm-specific human capital. This will then facilitate the acquisition of the valuable and unique knowledge required to enhance the competitiveness of an organisation (Subramaniam & Youndt, 2005). Staffing practices should therefore ensure that employees have task-specific and organisation-specific skills to enable optimum work performance (Jiang et al., 2012). Organisational learning can be enhanced through establishing the candidates that have potential and the willingness to develop new and specific knowledge (Collins & Smith, 2006; Lepak & Snell, 1999; López-Cabrales, Real, & Valle, 2011).

In order to improve their social capital, organisations should also include the attitudes of teamwork, interpersonal adaptability and other similar criteria in their selection processes (Lengnick-Hall & Lengnick-Hall, 2003). In knowledge-intense contexts, technical abilities are not regarded as the most important criteria within selection practices. Sharing of creative ideas and knowledge within a team are prized as being more predictive of success (Swart & Kinnie, 2003). Incorporating interpersonal skills as a selection criteria and using people interaction exercises as a selection practice will identify high-potential individuals that could enhance the organisational human capital and learning capability (López-Cabrales et al., 2011).

The human capital theory has informed this research study by highlighting the significant impact selection processes have on optimising human capital competitive advantage (Abhayawansa & Abeysekera, 2008; Wright et al., 1994). This study aims to evaluate a specific profiling and selection process and identify the key criteria for acceptance of applicants onto an apprenticeship programme. As indicated in Chapter Two and Three, the skills and abilities attained through completing an artisanal qualification are regarded as key to the long-term sustainability of the automotive industry. The human capital theory also emphasises the meaningful contribution of education and training on increased ability, performance and productivity within the workforce (Akinyemi & Abiddin, 2013). The problem statement in Chapter One has alluded to a lack of education and skills being the cause of copious technical positions remaining vacant within the country. It is one of the objectives of this study to investigate the impact of the educational profile possessed by applicants on their success within the apprenticeship programme.

### 4.2.2. Criticism of human capital theory

In contrast to the human capital theory, behavioural theorists advocate that it is not the competencies of the employees that enable organisations to perform well. Rather, HR practices identify and encourage the behaviours required for organisational productivity and through these practices improved operational and financial performance is achieved (Jackson, Schuler, & Rivero, 1989). The HR practices of organisations seeking different employee behaviour are therefore likely to differ. HR practices can be regarded as effective when employees behave in ways that assist in achieving business objectives and enhance the implementation of strategies chosen by the firm (Jiang et al., 2012).

Unlike other resources and forms of capital, human capital cannot be owned (Brymer, Molloy, & Gilbert, 2014; Coff, 1997). Behavioural researchers therefore suggest that optimal human capital cannot be realised unless employees are willing to utilise their capabilities (Jackson & Schuler, 1995). A weak positive relationship has been established between firm-specific human capital and organisational performance through the mediating influence of restricted employee mobility (Campbell, Coff, & Kryscynski, 2012). It has therefore been argued that the human capital approach ignores the workings of the labour market and it is questionable whether mechanisms such as firm specificity are actually efficient in limiting the mobility of a firm's human capital (Delery & Roumpi, 2017).

Another criticism of the human capital theory is that HRM practices are viewed as simple 'levers' in the influence of human capital resources and organisational competitive advantage (Delery & Roumpi, 2017). Researchers believe that it is impossible for HR strategies to be rare, inimitable and non-substitutable (Wright et al., 1994). Furthermore, it is contended that no human capital based study has established a causal link between HR practices and organisational performance (Wright, Dunford, & Snell, 2001). Micro and macro-level human capital research is also criticised for making inferences and assumptions beyond their respective levels. Rather than adhering to and limiting their findings to their particular discipline level, researchers tend to inappropriately generalise their findings to either a higher or lower level of analysis, known as the cross-level fallacy (Ployhart, 2006). Section 4.2 has discussed the nature and relevance of the human capital theory as well as the criticisms pertaining to the theory. In the next section the HRM activity of selection is discussed.

## 4.3. Human resource selection

Staffing is defined as "the process of attracting, selecting, and retaining competent individuals to achieve organisational goals" (Ployhart, 2006, p. 868). Others categorise staffing according to three main activities, namely, recruitment, selection and career planning (Rynes, Brown, & Colbert, 2002a). Whilst both are focussed on identifying and securing suitable people to meet the HR needs base within organisations, recruitment and selection are two distinct processes (Nel et al., 2011; Noe et al., 2011). Both processes, however, commence with the recognition of the need for labour. Following on this, it is highly recommended that a job analysis first be conducted resulting in the development of clear job and person specifications (Coetzee & Schreuder, 2010; Greenidge, Alleyne, Parris, & Grant, 2012; Scolarios, Lockyer, & Johnson, 2003).

Recruitment pertains to the first half of the hiring process. It aims to source a wide network or pool of suitable candidates, whilst selection focuses on making a choice of the best from this candidate pool (Nel et al., 2011; Noe et al., 2011). The primary goal of the selection process is to determine which candidates will provide the highest value to the organisation over time. Besides determining the human capital within an organisation, selection also influences the level of diversity within firms (Lievens, Van Dam, & Anderson, 2002; Ployhart, 2006).

The quality and quantity of applicants applying for a position will determine the effectiveness and financial viability of the selection process (Ployhart, 2006).

There is no broadly accepted, standard nor fixed selection procedure which is consistently used by organisations (Van der Merwe, 2002). The nature of the organisation, the HRM philosophy and the complexity of the vacant position will dictate whether it is a simple or complex process (Aiken, 1994; Branine, 2008; Louw, 2013; Ployhart, 2006). Figure 4.1 depicts a general selection process, comprising of eight steps from initial recruitment to the selection of the short-listed successful candidates.

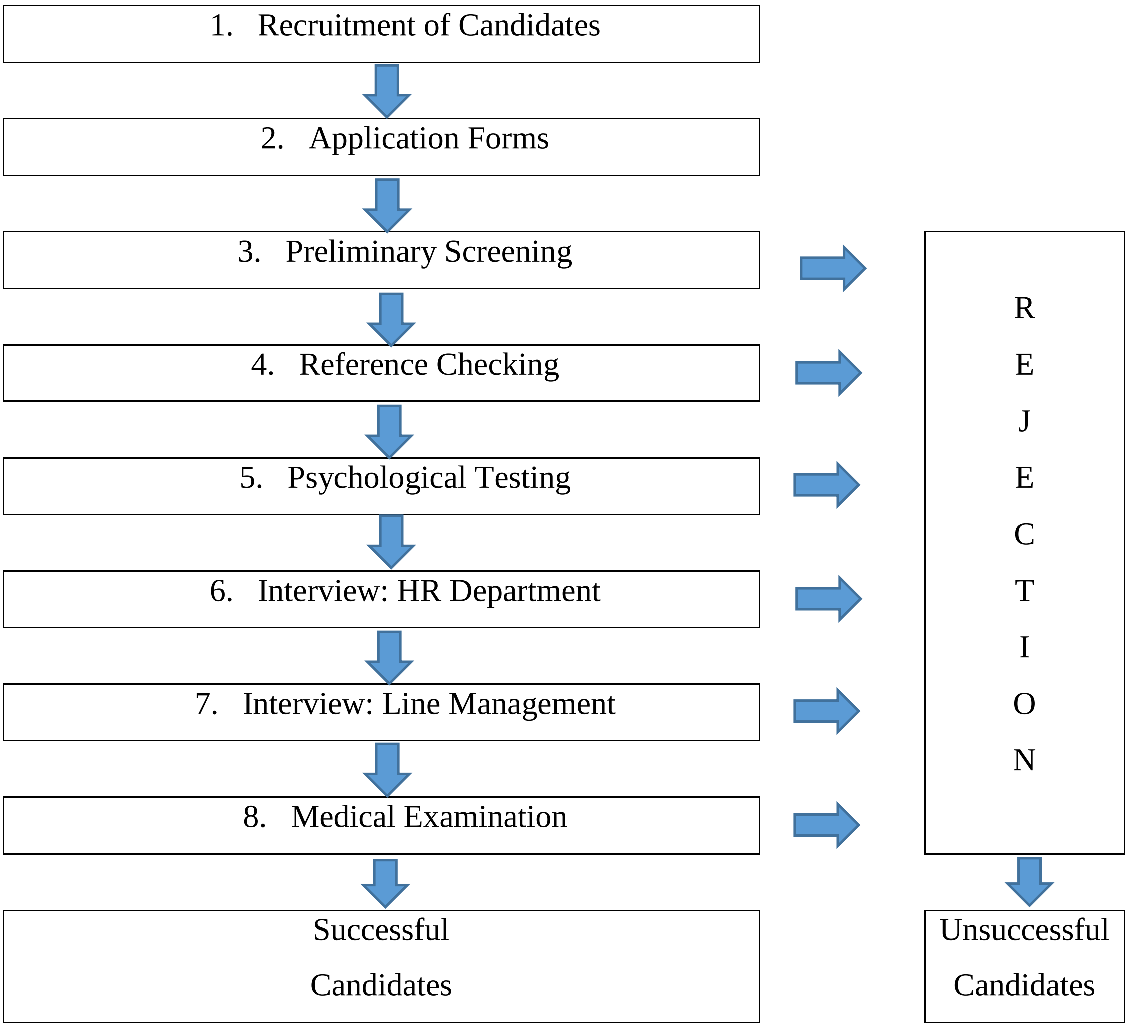


*Figure 4.1.* A selection process. Adapted from *Psychometric testing and human resource management* (p. 78), by R. P. van der Merwe, 2002, South African Journal of Industrial Psychology, 28(2).

Figure 4.1 outlines a successive-hurdle selection process. When this technique is employed, applicants need to successfully proceed through various screening phases or hurdles in order to be hired. Each step could result in the candidate being rejected from the selection process. This successive or multiple-hurdle approach is utilised by the vast majority of organisations in their selection activities (Van der Merwe, 2002). Having provided an overview of various definitions of the HRS function, the next section outlines the importance of selection for firms and individuals alike.

### 4.3.1. Importance of human resource selection

The most difficult and important challenge facing organisations within the twenty-first century is procuring the right workers (Hoffman et al., 2018; Ployhart, 2006). Globally, there is a lack of suitable applicants to fill vacant positions. Applicants are believed to be deficient in the key skills and competencies required within organisations. Innovative and alternative recruitment and selection processes are hence being employed. The training and development of the internal talent pool is also often cited as a means to address this challenge (Lievens et al., 2002; ManpowerGroup, 2016).

Effective selection procedures can have a significant impact on various aspects of performance within a business (Liu, Combs, Ketchen, & Ireland, 2007; Ployhart, 2006). According to Huselid (1995), firms with well-developed selection practices will have better overall performance. By utilising selection methods with high validity, an employer can save a significant amount of money as well as increase their revenue and profits. Whether measured in percentage increase in output or dollar value of increased output, there are both practical and economic benefits to using a valid selection measure (or combination of measures) (Schmidt, Oh, & Shaffer, 2016). Investments in best practice HR initiatives result in significantly lower employee turnover as well as higher productivity and corporate financial performance (Huselid, 1995).

Chapter Three provided a comparison of SA with four other global countries, namely, Germany, the USA, China and India. In contrast to these countries, SA was ranked the lowest at position 61, in terms of global competitiveness. As indicated in Table 4.1, the labour market efficiency in SA is the lowest in comparison to the other four countries. Specifically, SA performs significantly worse on the hiring and firing practices indicator. The ability of the country to attract and retain talent is also lower than these other global countries (Schwab &

Sala-i-Martin, 2017). High employee turnover can have a significant impact on an organisation. Whilst there are several causes of high employee turnover, errors in employee selection are regarded as the root cause thereof (Kalugina & Shvydun, 2014). Rather than validating their staffing practices, HR practitioners overly rely on feedback from line managers, probationary periods and disciplinary procedures to rectify any selection errors (Wickramasinghe, 2007). Weaknesses in the selection process, such as the use of invalid selection methods as well as the lack of monitoring and remedial action, can have dire and widespread consequences for an organisation (Ifill & Moreland, 1999). For example, the cost of a poor hiring decision can be up to five times the annual salary of the incumbent (Trindale, 2015).

Table 4.1

*Ranking of Countries: Global Competiveness Report 2017-2018 (part 2)*

| Indicator | Germany | North America | China | India | South Africa |
|---|---|---|---|---|---|
| Labour market efficiency (pillar) | 14 | 3 | 38 | 75 | 93 |
| Hiring and firing practices (indicator) | 18 | 5 | 24 | 19 | 125 |
| Country’s capacity to retain talent (indicator) | 13 | 3 | 34 | 24 | 78 |
| Country’s capacity to attract talent (indicator) | 13 | 5 | 23 | 19 | 66 |

*Note.* Adapted from *The World Economic Forum’s Global Competitiveness Report 2017-2018* (p. 90-269), by K. Schwab and X. Sala-i-Martin, 2017, from http://www3.weforum.org/docs/GCR2017-2018/05FullReport/TheGlobalCompetitivenessReport2017%E2%80%932018.pdf

Personnel selection, therefore, cannot be deemed an administrative task. Rather, organisations need to ensure that their HR staff have the professional skills and up-to-date knowledge required to adequately fulfil their function within the firm (König, Klehe, Berchtold, & Kleinmann, 2010; Lievens et al., 2002; Louw, 2013; Rynes et al., 2002a; Wickramasinghe, 2007). Staffing should be deemed a vital strategic mechanism for gaining competitive advantage. However, organisational decision-makers are yet to appreciate the actual value of staffing (Liu et al., 2007; Ployhart, 2006; Rynes, Colbert, & Brown, 2002b). This section has clarified the HRS function as well as the importance of this practice for organisations and potential employees. Section 4.4 describes the various methods employed in the practice.

## 4.4. Human resource selection methods

Initially an overview of selection methods in general is provided. Thereafter, each section discusses a selection method category. Section 4.4.2 discusses preliminary screening methods and section 4.4.3 outlines reference checking and other types of verification. Section 4.4.4 deliberates testing and assessment methods employed within selection and section 4.4.5 discusses the interviewing method.

### 4.4.1. Overview of selection methods

Since the beginning of the twentieth century studies have been conducted to establish the effectiveness of selection methods in predicting future job performance and learning (Schmidt et al., 2016). Nevertheless, there is a gap between the provided research findings and the actual implementation of these selection practices. This is more so than any other task within HRM (Rynes et al., 2002a; Rynes, Giluk, & Brown, 2007; Zibarras & Woods, 2010). Employers and practitioners should note that the use of selection methods with enhanced predictive validity will result in significant improvements in employee performance, as seen in increases in output and increased learning of skills (Bartram, 2004; Schmidt et al., 2016; Wickramasinghe, 2007).

Countries differ in terms of the methods used in employee selection. Labour legislation within the country as well as whether the applicants are sourced from within or outside the organisation are key determinants of the techniques employed (Louw, 2013; Nzukuma & Bussin, 2011). In the UK the CV is the most popular method, followed by the triad of the application form, interviews and reference checking (Zibarras & Woods, 2010). Selection practices in Sri Lanka are predominantly a triad of the application blank, the interview and assessment centres (Wickramasinghe, 2007). This was similar to a local study's findings conducted by Louw (2013).

Organisations employ various blends of selection methods to assist them in screening job applicants (El-Kot & Leat, 2008; Louw, 2013). Selection methods range on a continuum from traditional forms, such as interviews, application forms and references, to the more sophisticated techniques including psychological testing, assessment centres and work samples (Wickramasinghe, 2007). The traditional triad or classic trio is known as the application form, interview and reference checks (Cook, 1991). However, according to a study by Sackett and Lievens (2008), a combination of the application form, interviews, reference checking and an assessment centre is the most popular. In terms of validity in predicting job performance, the combination of general mental ability (GMA) and integrity testing yields the highest composite validity (.78), with the combination of a GMA test and a structured interview rated as the second most valid combination (.76). Given that these two combinations are also less expensive to implement, they are regarded as the best combinations (Schmidt et al., 2016).

Should applicants have a negative experience during the recruitment or selection process this could have a negative impact on the organisation's brand and reputation (Anderson, Salgado, & Hűlsheger, 2010; Bartram, 2004; Schmitt, 2014; Trindale, 2015). More research has been done regarding the experiential perceptions of job applicants than any other aspect of personnel selection (Schmitt, 2014). Enhancing candidates' experience of the screening process is therefore a core goal of most global employers. Through making the screening process more transparent as well as improving the access and quality of information communicated to applicants can minimise the level of confusion and uncertainty experienced by applicants, thereby creating a more positive experience (Trindale, 2015). A relationship between the reactions of applicants to employers' selection procedures and their attraction to the organisation has been noted (Ryan & Ployhart, 2000). An explanation for this trend is that applicants, with little information pertaining to the organisation at this stage of the selection process, uses the selection procedure characteristics as signals of the characteristics of the employing organisation (Lievens et al., 2002). However, other researchers have concluded that the perceptions of the selection process held by applicants and/or the tools employed have little to no impact on their actual pre-hire decisions (Ployhart, 2006; Ryan, Sacco, McFarland, & Kriska, 2000; Schmit & Ryan, 1997).

The selection methods perceived most favourably by applicants are work samples and interviews (Anderson et al., 2010). Whilst not the most preferred method, applicants perceive GMA tests favourably as they are deemed more relevant to job performance than other selection measures such as application blanks, personality and integrity tests (Anderson et al., 2010; Hausknecht, Day, & Thomas, 2004). Applicants perceive the selection process as being more stringent when GMA tests are included and this increases their perception of the attractiveness and status of the applied position. Cognitive testing, the use of résumés, references, biodata and personality measures fall within the second category of being favourably evaluated, whilst honesty tests, personal contacts and graphology were the least preferred selection methods by applicants (Anderson et al., 2010). Regardless of preferred selection method, applicants need to portray themselves in a dynamic fashion consistently across the various methods (Fox, 2018).

#### 4.4.2. Preliminary screening methods

For the purposes of this literature review, two preliminary screening methods are outlined in this section, namely, application forms and the CV. This section therefore covers the second and third steps of the selection process illustrated in Figure 4.1.

##### 4.4.2.1. Application blanks

Application blanks, or biographical data measures, request information pertaining to past life experiences, such as in their family and at high school, as well as hobbies and other lifestyle pursuits (Schmidt et al., 2016). Application forms also provide information pertaining to education completed, work experience obtained and the general state of health of applicants (Booi, 2005). Whilst each item on the application form contains information about the candidate, it is rare for any one aspect to be regarded as adequate to screen out an applicant (Catano, Wiesner, Hackett, & Methot, 2009).

Pre-screening devices, such as the application form, are increasingly being used when large numbers of applicants are received for vacancies. The tool facilitates the easy comparison and filtering of applications in order to identify high-potential candidates (Wickramasinghe, 2007). Another reason for their popularity is their equivalent validity to other selection tests (Reilly & Chao, 1982). Some researchers in fact believe that biographical data measures are, in part, an indirect assessment of GMA (Schmidt et al., 2016).

The application blank is the most popular selection method used in SA. In one study, all the HRS practitioners surveyed indicated that they made use of application blanks in their selection process (Louw, 2013). In a recent study, Grobler, Wärnich and Mokobane (2018) found that 69.2% of South African companies used applications forms when selecting professionals. However, in an earlier survey, only 14% of the HR managers indicated the use of this diagnostic assessment (Krause, Rossberger, Dowdeswell, Venter, & Joubert, 2011). This may be due to improved abilities in choosing questions to be included in an application blank (Schmidt et al., 2016). In SA, the questions must comply with the Employment Equity

Act (No. 55 of 1998) (EEA) requirements. These requiremnts are covered in detail within section 4.5.3.

Application forms have been criticised for their lack of objectivity. Based on the information provided in an application form and their knowledge of the vacant job, the HR practitioner and/or line manager makes a subjective decision about the candidate. The alternative is the development of a weighted application blank. This is a quantitative method of assessing an application form. Weighting is done on the basis of prior job success by current and previous job incumbents (Catano et al., 2009; Kaak, Feild, Giles, & Norris, 1998). This method is both economical and easy to use. Being well received by job applicants they are also effective predictors of a variety of work behaviours ranging from absenteeism to turnover (Catano et al., 2009).

#### 4.4.2.2. Curriculum vitae

Whilst interviews are part of almost every selection process, CVs are used even more frequently (Schmidt & Zimmerman, 2004). A British study across 579 organisations, representing different sizes and sectors, found the CV to be the most commonly employed selection method (Zibarras & Woods, 2010). The CV and covering letter are commonly employed to facilitate the shortlisting of applicants for interview purposes (Breaugh, 2009; Cole, Rubin, Feild, & Giles, 2007; Stewart & Knowles, 2000; Tsai, Chi, Huang, & Hsu, 2011). In a survey of small and medium-sized organisations, 53% indicated a preference for the combination of a CV and covering letter (Branine, 2008). Covering or motivational letters are used to assess the degree of match between the job description and the skills and experience possessed by applicants (Ogden, 2016). A well composed covering letter can act as a catalyst for promoting the candidate into the next phases of the selection process (Stewart & Knowles, 2000; Tomaska & Nosek, 2018). Recruiters rated two-page covering letters more favourably than one-page letters for entry-level positions (Blackburn-Brockman & Belanger, 2001) and recommend that the content should be tailored to the specific occupation and field being applied for (Ross & Young, 2005). Most employers prefer the electronic delivery of CVs, résumés and covering letters, either by e-mail or via the company's website (Schullery, Ickes, & Schullery, 2009).

A CV can be regarded as the most important document one will ever write. It is suggested that a CV should be written specifically for the position applied for and be able to attract the attention of the reader within two to three seconds. The content should also be presented in an accurate, concise and honest manner (Wallwork, 2014). Research has focussed on the three categories of information primarily obtained from CVs. These are: academic qualifications, work experience and extracurricular activities, and thirdly, employability ratings obtained from recruiters (Brown & Campion, 1994). Academic qualifications and extracurricular activities are positively correlated with the judgements made by reviewers on the employability of applicants. Work experience is also a factor, but is not as highly correlated as qualifications and extracurricular activities (Cole et al., 2007).

In terms of the first category of information (i.e., academic qualifications), more weight tends to be given to these and/or grades for entry-level positions (Roth & Bobko, 2000; Rynes, Orlitzky, & Bretz, 1997). Type of secondary education (incorporating subject choice), was revealing of the general and technical aptitudes of operator-level applicants, which in turn had a high correlation with employability. The case was made for the use of education as a cost-effective preliminary screening technique to reduce the applicant pool prior to the use of costlier psychometric tests (Puchert et al., 2017a, 2017b). The use of marks attained for mathematics has also revealed predictive validity for student performance at tertiary level (Van der Flier, Thijs, & Zaaiman, 2003). However, Azar, Sebt, Ahmadi and Rajaeian (2013) concluded that examination scores in areas such as English, mathematics and general knowledge had no impact on performance and promotion post-employment.

Education is regarded as a key determinant of the job level, quality and income an individual can attain (Brewer, 2013; Schmidt et al., 2016). Consistently, therefore, organisations place strong emphasis on the use of educational qualifications as a selection criterion (Wickramasinghe, 2007). Applicants with higher levels of qualification had higher external employability than those with lower qualifications (Juhdi, Pa'Wan, Othman, & Moksin, 2010). In contrast, Nunley, Pugh, Romero and Seals (2016) found no evidence to support the assertion that higher educational attainments increased employment prospects. Similarly, Azar et al. (2013) also established that increased educational levels only lead to some promotional upgrades post-employment.

CVs that included the grade point average obtained by applicants were assessed more favourably than those that did not include this information (Oliphant & Alexander, 1982). Furthermore, CVs that revealed higher grade point average results were evaluated as better than CVs with lower scores (Thoms, McMasters, Roberts, & Dombkowski, 1999). These findings are probably due to the beliefs of HRS practitioners that grade point average scores reflect intelligence, motivation as well as other competencies required in the workplace (Roth & Bobko, 2000; Schmit, Ryan, Stierwalt, & Powell, 1995; Wolfe & Johnson, 1995).

However, future job performance cannot be successfully predicted based on the years of education obtained. On average, the job performance of those with 12 years of education is only slightly higher than those with nine to 11 years of education (Schmidt et al., 2016). Psychological tests, especially cognitive ability tools, are deemed as more reliable and valid predictors of the future performance of applicants than their attained qualifications (Berry, Gruys, & Sackett, 2006; Jenkins & Wolf, 2002). An increase in the manipulation of qualifications by applicants has however made the use of CVs as a selection method more difficult (Cook & Cripps, 2005; Wolf & Jenkins, 2006).

The second type of information gained from a CV is years of job experience, specifically in a position similar to the vacant job. Applicants with both high levels of work experience and academic achievement are most likely to be hired (Azar et al., 2013). However, applicants with only a few years of working experience and high academic qualifications are least likely to be hired (Singer & Bruhns, 1991). According to Nunley et al. (2016), experience significantly enhances employment prospects. In comparison to only having post-secondary level qualifications, internship experience was found to enhance hiring opportunities by at least 14%. This increase is even larger if applicants had both experience and high academic abilities. Experience appears to operate as a signal of other unobservable qualities for employers (Juhdi et al., 2010; Nunley et al., 2016). Applicant work experience appears to act as a signal of perceived person–organisation fit. Furthermore, the work experience and educational background held by an applicant increases their perceived person–job fit. Both of these then result in improved hiring recommendations (Tsai et al., 2011).

Regardless of the form, experience is valued by recruiters. Relevant experience is rated the highest, with a combination of volunteer and paid experience also being perceived favourably. There were no significant differences between the ratings provided for paid versus volunteer experience (Wilkin & Connelly, 2012). However, the key to maximising the value of part-time work is being able to determine the learning gained to potential employers during the recruitment and selection process. It is recommended that students reflect on and record (i.e., in a logbook) their work experience in order to provide specific examples of the skills gained (Evans & Richardson, 2017).

However, the impact of job experience on job performance is regarded as indirect, mediated through job knowledge (Schmidt, et al., 2016). Job performance tends to linearly increase in the first five years of job experience but thereafter flattens horizontally with little increase in job knowledge, skills or performance (Schmidt & Hunter, 1992; Schmidt, Hunter, & Outerbridge, 1986). This window period for gaining optimum exposure from job experience may be longer than five years in professional, scientific and high level managerial positions (Schmidt et al., 2016). A study investigating the relationship between previous work experience and the subsequent academic success of students in a post-graduate programme found little support for the notion that prior work experience led to enhanced academic achievement. There was only a slight variance in first-semester grades and the two factors were unrelated at second semester (Dreher & Ryan, 2000).

The third category of information gained from CVs pertains to the extracurricular activities enjoyed by applicants. The perceptions of recruiters on the academic qualifications, work experience and extracurricular activities documented by job applicants in their CVs interact and accurately predict the employability of these individuals (Cole et al., 2007). The number of activities, professional versus social types of activities, as well as the number of leadership positions held by an applicant, positively influenced the judgements made by reviewers on the CV (Nemanick & Clark, 2002). Furthermore, the applicants' membership in professional and social societies or fraternities improved reviewers' overall impression ratings and their likelihood of further consideration (Campion, 1978). These positive ratings may be linked to the attribution of interpersonal skill, leadership and high motivational qualities to applicants with several extracurricular activities (Brown & Campion, 1994; Rubin, Bommer, & Baldwin, 2002). Recreational activities can assist individuals to develop competencies similar to those required within the business context. For example, playing and coaching sports develops communication, team-building and leadership capacities. Through these activities people develop their confidence and learn how to effectively deal with competition. Volunteer work, especially to people with disabilities or special needs, develops skills in problem-solving, communication, planning and organising (Duggan, 2017).

Recruiters make inferences regarding the personality profile of applicants from the structure, layout and content of CVs. These inferences were found to accurately predict the subsequent employability results of the applicants. This is specifically the case if recruiters infer extraversion, openness to experience and conscientiousness from the CV (Cole, Feild, & Giles, 2003; Cole, Feild, Giles, & Harris, 2009; Burns, Christiansen, Morris, Periard, & Coaster, 2014). Furthermore, the actual content and aesthetics of a résumé influences the hiring recommendations made by recruiters. Recruiters made inferences regarding the professional knowledge, interpersonal skills and general mental ability of the applicant from the résumé information (i.e., content and aesthetics), which influences the type of hiring recommendation given on the applicant (Chen, Huang, & Lee, 2011). The layout of a résumé has a significant impact on short-listing opportunities. Formal layout designs (i.e., printed on white paper) are preferred over more creative options (i.e., printed on coloured paper or an informal layout). Non-professional recruiters were only slightly more influenced by the graphical design of the résumé than professional recruiters (Arnulf, Tegner, & Larssen, 2010). The ratings given to résumés with an informal e-mail address were significantly lower than the ratings for résumés that contained a formal e-mail address. The impact of e-mail address on hireability ratings was as strong as the impact of spelling errors and was even stronger than that of typeface (Van Toorenburg, Oostrom, & Pollet, 2015).

Information on applicants gained from CVs has been shown in previous research to be highly predictive of employee performance and turnover. However, Breaugh (2009) cautions against blindly following this research and highlights that the validity, reliability and generalisability of this research may be questionable. Rather, he suggests that making use of advanced technological tools can enhance the accuracy of biodata information. Furthermore, given the high volumes of CVs being up-loaded onto the recruitment webpages of companies, researchers are seeking to find more time and cost-effective methods of dealing with this information. A technique called competency management allows recruiters to upfront specify the competencies required for a specific position on their website. Job seekers are then tasked to explicitly link their knowledge, skills, motives and personality attributes to these identified competencies. This form of CV design facilitates refinement of the matching process between job and applicants (Harzallah, Leclère, & Trichet, 2002). Other similar technologies and portals have been designed to facilitate the effective matching of advertised positions with CVs submitted by applicants (García-Sánchez, Martínez-Béjar, Contreras, Fernández-Breis, & Castellanos-Nieves, 2006; Hawkes, Cek, & Handler, 2017; Amdouni & Ben Abdessalem

Karaa, 2010). Realistic job preview tools are also being used to provide applicants with accurate and realistic information about an advertised position. Subsequently, applicants make more informed decisions regarding proceeding with the application process or not. This is specifically useful for positions that traditionally attract high volumes of applications (Lachu, 2014). On-line technology has also been suggested in tracking CVs during the recruitment and selection process. Following the applicant uploading their CV on the company website, the applicant is allocated a tracking code. The applicant can then follow the processing of their CV at any time. Applicants know if their CV is under consideration or not, as well as the result to date of this consideration (Perinot, 2016).

Misrepresentation and/or lying on job applications or CVs is a major talent management risk. A global survey of 3 000 organisations, from various sectors and with differing sizes, revealed that 86% had discovered this form of fraud (Trindale, 2015). Another criticism is the time-consuming nature of manually processing the large volume of information contained in CVs. Selectors also generally use their subjective opinion in this process and the identification of the best candidates is not guaranteed (Kalugina & Shvydun, 2014). This subjectivity was also noted in the impact of physical attractiveness and/or gender on the evaluation of CVs (Steinpreis, Anders, & Ritzke, 1999; Van den Brink, Brouns, & Waslander, 2006; Watkins & Johnston, 2000).

### 4.4.3. Reference checking and verification

This section covers step four of the selection process shown in Figure 4.1. However, Cooper (2001) states that reference checking is usually done as one of the final steps in the screening of candidates, immediately prior to a job offer being extended. Other companies conduct reference checking after the preliminary interviews but prior to the final interview (Wickramasinghe, 2007).

There is widespread usage of reference checks as a selection tool (Heraty & Morley, 1998; Stewart & Knowles, 2000; Zottoli & Wanous, 2000). Both employers and prospective employees deem reference checking as valuable. Employers specifically believe that vital information is gleaned from this selection method if reliable and detailed information is provided (Cooper, 2001). Over 84% of South African organisations employ this technique as part of their selection procedure, making it the third most popular selection method (Booi, 2005; Louw, 2013). However, reference checking is predominantly used in conjunction with other selection methods, such as application blanks and interviews (Louw, 2013).

Reference checks should be used to evaluate whether applicants have essential qualities such as honesty and integrity. However, they should also be used to ascertain whether there is a match between their personal values and those of the organisation. Leadership abilities can also be assessed through reference checks, establishing whether the applicant has displayed the skills in the past, under similar conditions (Fernández-Aráoz, 2014).

There are several vital aspects to implementing effective background checking. Firstly, the enquiries conducted must relate to, and be relevant to, the position the applicant applied for. Secondly, it is imperative that firms disclose the intent to perform background checks and obtain consent from the applicants. This can be done orally or in writing (Trindale, 2015). The imposition of structure has also been found to be useful. When conducted in a structured telephone-based format, reference checks were able to significantly predict supervisory ratings (Taylor, Pajo, Cheung, & Springfield, 2004).

A challenge with the use of reference checking as a selection method is the increased trend towards limited reference policies (Schmidt et al., 2016). The increased number of highly publicised international defamation cases has resulted in many businesses indicating only the name, job title and employee number as standard practice in their job referencing. This is especially the case when information is requested in writing. Despite reference immunity laws, past employers remain reluctant to provide detailed information of their employees (Cooper, 2001; Schmidt et al., 2016).

Besides reference checking, various other types of verification can be conducted by organisations in order to minimise risk and ensure compliance to certain regulations. Criminal searches and identity verification are most commonly performed. Past employment, motor vehicle record, professional licence and education verification are also conducted depending on the nature of the position and level (Trindale, 2015). The next section discusses the techniques and range of attributes analysed through testing and assessment of potential employees.

### 4.4.4. Testing and assessment methods

There is a well-documented increase in organisations using formal tests in their selection activities (Lievens et al., 2002; Louw, 2013; Wolf & Jenkins, 2006). Psychometric testing was deemed the fourth most popular selection method in a survey of South African organisations (Louw, 2013). However, Grobler et al. (2018) established that only 26.7% of local firms are using psychometric testing for the professional category of workers, whilst 45% made use of these selection measures for the managerial category. Psychological assessments are generally more regularly used in larger organisations due to the cost implications (Branine, 2008; Greenidge et al., 2012; Zibarras & Woods, 2010).

A wide range of factors, both external and internal to the organisation, is driving this increased usage of testing in the selection process. External issues include economic variables driving the amount of training needed, the nature of the labour market, and the type of position being filled as well as the rate of pay. Internal organisational issues such as, the role of the union, the existence of personnel staff and whether it is a public or private sector firm also play a role in the decision to use selection tests (Jenkins & Wolf, 2002). A British study established that the most important factor driving this increase was the regulatory environment. Tests are increasingly being used as a precautionary measure to circumvent challenges of selection decisions (Wolf & Jenkins, 2006). A similar trend has been identified in the USA (DeCenzo & Robbins, 2007) and within SA (Louw, 2013).

As discussed in section 4.4.2.2, increasingly on-line technology is being used to assist in the screening of CVs and their matching to advertised positions. This has extended into the use of gamification, where selection questionnaires and assessments operate like a game. These tools may have a scoring element and/or require interaction with other on-line applicants (Lachu, 2014). Gamification has been listed as one of the top 10 human capital trends of the future (Deloitte, 2018). There are various forms of gamification being used in talent management projects. Customisable situational judgement games on WhatsApp and Facebook Messenger are available for mobile devices (Grosvenor, 2017). Recruitment *chatbots* are interacting with applicants, identifying and scoring video interviews. Examples include Ari used by Textrecruit, Mya employed by Hiremya.com and Olivia used by Paradox.ai (Deloitte, 2018). The benefits of gamification are higher levels of involvement, longer attention and participation rates as well as investigating the competitive nature of the applicants (Lachu, 2014). These assessments have strong appeal for the youth as they are comfortable with using these forms of technology (i.e., instant messaging) in their everyday life (Grosvenor, 2017). In comparison to traditional methods of testing, gamification is time and cost effective, for both the applicants and the recruiting company (Giffi et al., 2014; Hawkes et al., 2017; Joy, 2017; Perinot, 2016). However, designing these gamification tools to meet the expectations of recruiters can also be costly (Deloitte, 2018; Hamari, Koivisho, & Sarsa, 2014).

Despite its increased usage, there are several criticisms of on-line psychological testing. Psychologists may have made the use of testing overly technical at the expense of industry needs. Research indicates that most organisations prefer selection methods that require little technical capability to develop and implement (Anderson et al., 2001). However, given the advancements in technology, the wide availability of many psychological tests on-line, the rapid reduction in the cost of on-line psychological tests and the need for increased speed in selection decisions, these tools may be open to abuse (Kwiatkowski, 2003; Lievens, et al., 2002; McHenry, 2001). Specifically, there is a high incidence of faking, the risk to test security and confidentiality, especially in proctored settings, as well as the impact of coaching effects (Bartram, 2004; Burke, 2009; Kuncel & Hezlett, 2007; Schmitt, 2014; Tippins, 2009). Nevertheless, this proliferation of internet-based measures also has its benefits – efficiency given that neither party has to be simultaneously present at the same venue, wider access to a geographically diverse applicant pool and the provision of a *high tech* image (Joy, 2017; Ployhart, 2006; Sackett & Lievens, 2008).

#### 4.4.4.1. Aptitude and intelligence

More than any other area, the measurement of intelligence is one of psychology's most significant achievements. However, it is simultaneously also the domain most fraught with controversy and difficulties (Deary, Strand, Smith, & Fernandes, 2007; Foxcroft & Roodt, 2013; Nisbett, 2013). Cognitive test scores are not the simplistic outcome of the intrinsic abilities of individuals. Rather, they are the complex reflection of a sum of talents, learned knowledge and skills, and other environmental factors such as past experience, education, and training (Kuncel & Hezlett, 2010; Wicherts, Dolan, & Van der Maas, 2010).

Despite the debate on the intricacies of the subject, there are decades of empirical research showing the relationship between cognitive ability and other measures of psychological performance (Macpherson & Stanovich, 2007; Schmitt, 2014). This body of evidence has consistently revealed the significance of cognitive ability tests in predicting academic success, such as grades and outcomes beyond these; work success, such as job performance assessments; and everyday life, such as divorce and mortality (Deary et al., 2007; Heaven & Ciarrochi, 2012; Kuncel & Hezlett, 2010; Kuncel, Ones, & Sackett, 2010; Luo, Thompson, & Detterman, 2003; Nisbett, 2013; Schmitt, 2014; Van der Flier et al., 2003).

GMA has a significant causal relationship with the acquisition of job knowledge. Improved job performance is therefore often seen in those with higher levels of intelligence. They acquire more job knowledge faster than others and this results in higher job performance (Hunter, 1986). This implies an indirect relationship between GMA and job performance, mediated by job knowledge (Schmidt et al., 2016). However, other researchers have established a small yet direct relationship between mental ability and job performance independent of job knowledge. In supervisory positions, the direct impact is about 50% as large as the indirect effect, with only about 20% as large in nonsupervisory positions (Borman, White, Pulakos, & Oppler, 1991; Schmidt, et al., 2016). This was supported by more recent studies where GMA tests demonstrated significantly higher operational validity for more complex job families and occupations assessed (Bertua, Anderson, & Salgado, 2005; Salgado et al., 2003).

There is widespread support that the majority of the validity of GMA tests comes from general intelligence or general cognitive ability (Carroll, 1993; Ree & Carretta, 2002). However, given Gardner’s (1999) multiple intelligences model, there is increasing focus on the specific abilities or aptitudes and their usage in combination with GMA (Campbell & Catano, 2004; Mount, Oh, & Burns, 2008). Psychomotor and dexterity testing has also successfully been used in the selection of candidates for surgical training (Gallagher, Leonard, & Traynor, 2009). Experienced surgeons and medical students were tested on three aptitude tests. The surgeons had higher than average eye-hand co-ordination and dexterity but lower visual-spatial abilities than the medical students (Francis, Hanna, Cresswell, Carter, & Cuschieri, 2001). Two specific aptitude tests, namely, two-hand coordination and complex coordination, assisted in the selection of pilots and accurately differentiated between those that were ultimately recommended to fighter pilot status (Bordelon & Kantor, 1984).

Specific cognitive abilities, such as spatial and psychomotor aptitudes, fulfil a key role in academic achievements and innovations within the STEM areas (Johnson & Bouchard, 2005; Kell & Lubinski, 2013; Wai, Lubinski, & Benbow, 2009). Higher performance levels in three specific aptitudes, namely, Verbal reasoning, Non-verbal Reasoning and Visual

Perceptual Speed was established amongst automotive operator candidates with a matriculation certificate incorporating mathematics or both mathematics and science (Puchert et al., 2017a). Significant relationships were also established between these matriculation types and two technically-oriented aptitudes, namely, Eye-hand Coordination and Spatial Visualisation (Puchert et al., 2017b). Furthermore, four aptitudes, Verbal Reasoning, Numerical Ability, Mechanical Reasoning and Space Visualisation, accurately predicted the job performance of apprentices in eight trade occupations (Hattrup & Schmitt, 1990).

Many selection methods, whilst valid predictors of job performance, have little or no incremental validity over assessments of GMA (Schmidt & Hunter, 1998). Furthermore, the incremental validity contribution made by specific abilities to general intelligence also continues to be investigated (Schmitt, 2014). A meta-analysis of 100 years of research studies has affirmed the dominance of GMA in terms of its validity ($r$ = .65) and utility as a selection tool. Specifically, when hiring individuals with no previous experience in a particular job, the most valid predictor of future performance and learning is GMA (Schmidt et al., 2016). Even the use of specific aptitude tests that closely match the core aspects of job performance, such as spatial perception for mechanical positions, will not yield more valid results than GMA measures (Schmidt, 2011). According to leading experts on the subject, it is wisest to use measures of general intelligence whenever possible in selection (Schmidt & Hunter, 1998; Schmitt, 2014). However, substantial differences in the results obtained for GMA and specific aptitude measures were found in a study documenting the selection of automotive operators. Stanine scores of three and below were regarded as low average, meaning that the pool of candidates would be outperformed by at least 60% of the national population. For the GMA measures, 17.1% scored at this level in the Verbal Reasoning sub-test and 44.5% in the Non-verbal Reasoning sub-test. In the specific aptitude measures, this performance level was attained by 11% for Assembly, 30.5% for Coordination, 80.9% for Dexterity, 19.7% for Spatial Perception 2-D, 13.2% for Spatial Perception 3-D and 41.3% for Visual Perceptual Speed (Puchert et al., 2014).

Despite this proliferation of evidence supporting the validity of GMA in predicting job performance, the majority of global HR practitioners are not employing the tool as a primary selection measure. The assessment of values and conscientiousness are regarded as better predictors of high performance. A significant portion of HR practitioners also falsely believe that GMA is a disadvantage for effective performance at a low-skill level (Rynes et al., 2002a).

Locally, only seven percent of organisations employ intelligence testing in their selection procedures. HR practitioners may be hesitant to use this tool given the large mean differences found across racial and ethnic subgroups in SA (Krause et al., 2011). Certain applicants may also be hesitant to have their cognitive abilities assessed. High level managers and skilled tradespeople, such as machinists, computer programmers and machine repairmen, may insist on their past achievements rather being assessed (Schmidt et al., 2016).

#### 4.4.4.2. Competencies

A lack of workplace competencies was cited as the fifth most common reason for difficulty in filling vacant positions. Besides technical competence and general workplace experience, there is also a pervasive lack of the softer skills required by firms (ManpowerGroup, 2016). Several tools can be used to assess skill levels. Two broad forms of competency testing are discussed here, namely, assessment centres (ACs) and work sample tests.

According to Schlebusch and Roodt (2008), ACs involve participants undertaking simulation exercises that are based on pre-determined job-related behavioural competencies. ACs are generally formal and multi-day in nature (Campbell & Bray, 1993). The exercises employed are observed and evaluated by trained assessors. These assessors, through a process of consensus, agree on the scores or the scores can also be derived through statistical integration (Ballantyne & Povah, 2004). Muleya, Fourie and Schlebusch (2017) recently published an article providing 93 concrete recommendations to various stakeholders involved in AC usage. These recommendations aimed to increase awareness of the possible risk involved in ethical AC use.

ACs have a lengthy and effective track record as a screening mechanism for selection, diagnosis and developmental purposes. This is due to their numerous strengths, including apparent fairness, practical utility and an established relationship with actual performance on-the-job (Meiring & Buckett, 2016; Thornton & Rupp, 2005). Skills such as influence, persuasion, competitiveness, motivation and leadership can be observed in various situations (Branine, 2008; Krause & Gebert, 2003; Lievens, Harris, Van Keer, & Bisqueret, 2003). South African research revealed that over 73% of organisations make use of ACs. Another 21.05% used presentations and 10.53% in-basket exercises separate to a fully-fledged AC (Louw, 2013). In contrast, Grobler et al. (2018) found that only 20.8% of firms used this selection method for professionals and 30.8% for the managerial category.

There is no consensus in the literature regarding the minimum or maximum number of competencies that should ideally be measured in an AC exercise. However, current guidelines are that between four and six competencies per behavioural simulation exercise is optimal (Meiring & Buckett, 2016). In a survey of 54 American organisations, more than half indicated that they assessed between six and 10 dimensions and less than 10% employed more than 15 dimensions in their ACs (Eurich, Krause, Cigularov, & Thornton, 2009). Nevertheless, better prediction of on-the-job performance arises when fewer competencies are assessed per exercise (Bowler & Woehr, 2006; Krause et al., 2011; Lievens & Conway, 2001; Thornton & Mueller-Hanson, 2004).

Certain competencies assessed in ACs yield more validity than others. Specific competencies, such as communication, influence, planning and organising as well as problem solving, are more construct valid than others, such as drive and awareness of others (Bowler & Woehr, 2006). In terms of construct and criterion validity, other researchers have agreed that six AC dimensions can be regarded as valid. These are: communication, consideration of others, drive, influencing others, organisation and planning as well as problem solving (Arthur, Day, McNelly, & Edens, 2003; Eurich et al., 2009; Ployhart, 2006; Woehr & Arthur, 2003).

The predictive validity of an AC increases with the number of exercises utilised (Gaugler, Rosenthal, Thornton, & Benson, 1987). Researchers concur that the exercises employed in ACs are more significant than the actual constructs measured (Bowler & Woehr, 2006; Lance, Lambert, Gewin, Lievens, & Conway, 2004). The majority (64%) of American organisations use between four and five exercises per AC. The most popular exercises are: role-playing (76%), presentations (64%) and an in-basket exercise (57%) (Eurich et al., 2009). A wide variety of exercises are used in ACs conducted in South African organisations. These include in-baskets, presentations, role-plays, case studies, planning exercises and group discussions (Eurich et al., 2009; Krause et al., 2011; Wickramasinghe, 2007). The majority of local organisations use less than three exercises per AC (Krause et al., 2011), which is lower than that employed globally (Krause & Thornton, 2009). There is therefore a need for improvement in this aspect (Krause et al., 2011).

There is consistent empirical evidence highlighting the higher predictive validity of ACs when used in conjunction with cognitive ability tests (Dayan, Fox, & Kasten, 2008; Dilchert & Ones, 2009; Meriac, Hoffman, Woehr, & Fleisher, 2008). However, Krause et al. (2011) established that only the minority of national organisations employed one other assessment method. In order to improve overall predictive validity, national organisations are therefore encouraged to integrate at least one additional selection tool into their ACs. A well-designed AC is regarded as key to enhancing the construct validity of the AC (Arthur, Woehr, & Maldegen, 2000; Lievens & Conway, 2001; Ployhart, 2006).

The number and type of assessors overseeing the AC is regarded as an important moderating variable of an AC's validity. The recommended ratio of participants to assessors is 1:2 with the majority of assessors in South African organisations being HR professionals (Krause et al., 2011). The use of line managers as assessors has revealed an increase in the construct validity of the AC (Lievens, 2002). However, line managers are used significantly less as assessors in SA in comparison to organisations in North America and Western Europe (Krause & Thornton, 2009). This is most likely due to local practitioners being highly sensitive to the labour legislation in the country and their understanding that they may need to defend the legality of their selection actions in this context (Krause et al., 2011). Whilst there is no minimum academic qualification stipulated to become an assessor nationally, it is widely recommended that assessors are adequately trained in the various simulation exercises of an AC (Krause et al., 2011; Meiring & Buckett, 2016; Muleya et al., 2017). However, should the AC incorporate additional psychological tests, there are more stringent guidelines regarding minimum qualifications of the assessor (Meiring & Buckett, 2016).

Despite its many advantages, ACs have also been criticised. ACs are time-consuming and expensive selection measures to employ (Schmidt et al., 2016; Thornton, Murphy, Everest, & Hoffman, 2000; Wickramasinghe, 2007). It is also highlighted that whilst ACs have significant criterion-related validity, they have only slight incremental validity (i.e., two percent increase) over GMA in predicting job performance (Schmidt et al., 2016). Overall assessment ratings, which is scoring using a combination of assessments on various dimensions across diverse exercises, in comparison to its individual predictors, have also come under criticism. Whilst practically important, employing a composite of the individually assessed dimensions results in higher validity than the overall assessment ratings (Arthur et al., 2003).

Work sample tests are regarded as practical simulations of part or most aspects of the tasks expected of the employee and are regularly used in the hiring of skilled workers, such as machinists, welders and carpenters (Jenkins & Wolf, 2002; Ployhart, 2006; Schmidt et al., 2016). These tests are often implemented when employers have the expectation that applicants already possess the competencies required to perform the job adequately (Jenkins & Wolf, 2002). Some knowledge and a certain level of skill is therefore necessary in order to be able to adequately complete this form of selection technique (Schmidt et al., 2016). Work sample tests are regarded as one of the optimal methods of concurrently achieving validity and diversity (Ployhart, 2006).

ACs and work sample tests have been praised for their contextualisation. They provide an indication of behavioural consistency between behaviour displayed during the selection process and expected job behaviour (Sackett & Lievens, 2008). Competency-based assessments can also assist with compliance issues. A strong commitment to equal opportunities and the prevalence of grievance procedures plays a significant role in the regular use of competency tests in British organisations. These tests were linked to organisational efforts to ensure fairness in their selection practices (Jenkins & Wolf, 2002).

Work sample tests, however, are not as valid as was previously indicated in research findings. The incremental validity of these selection measures over GMA is almost zero (Schmidt et al., 2016). Another problem with this method are the large sub-group differences (Ployhart, Weekley, & Baughman, 2006). This may explain why South African organisations seldom employ work sample tests (Krause et al., 2011), despite the fact that applicants evaluate them favourably (Anderson et al., 2010). This section has discussed two testing and assessment methods employed in HRS. In the section that follows the interviewing approach is discussed, which fulfils steps six and seven of the selection process indicated in Figure 4.1.

#### 4.4.5. Interviewing methods

Interviews are the most frequently used selection method and are regarded as standard practice in HRS (Anderson & Witvliet, 2008; El-Kot & Leat, 2008; Louw, 2013). The frequency of their use is probably due to interviews being perceived by organisations as the cheapest, easiest and quickest selection method to employ (Stewart & Knowles, 2000). Globally, interviews are a preferred selection method as selection is more person than job-specific. Recruiters are mostly interested in the attitudes, personality and portable skills of applicants, in comparison to the level or type of qualification (Branine, 2008). According to Azar et al. (2013), interview scores are highly predictive of on-the-job performance and the likelihood of promotion post-employment. These researchers therefore suggest the training of applicants before conducting interviews.

Over 94% of South African organisations employ interviews as part of their selection procedure. This selection technique is therefore the second most popular method utilised, with the application blank being the most popular (Louw, 2013). In another local study, interviews were rated the most popular by applicants, in comparison to nine other assessment methods (Anderson & Witvliet, 2008). Structured interview ratings and verbal reasoning were found to be predictive of the work performance of retail managers (Nzama, De Beer & Visser, 2008).

Most organisations use a series of interviews, with each stage resulting in fewer candidates being selected for the next stage. The preliminary stages are usually conducted by line management, sometimes with assistance from HR. However, final interviews are traditionally done by a panel of three to four line managers and the HR manager. A pre-interview discussion is usually conducted with the panel prior to facilitating the interviews (Wickramasinghe, 2007). Scoring systems are also commonly employed in interviews when more than one person is assessing the candidate (Stewart & Knowles, 2000).

The primary goal of interviews is to assess the consistency of the applicants' knowledge, skills, abilities and other characteristics against those required for the position (Straus, Miles, & Levesque, 2001). Interviews are hence a reliable source of additional information on the candidate. Key qualities such as honesty and integrity can be gleaned as well as leadership abilities. A match between the personal values of the applicants and those of the organisation can also be established (Fernández-Aráoz, 2014). According to Huffcutt, Conway, Roth and Stone (2001), seven latent elements are assessed in interviews: cognitive ability, interests and preferences, fit, knowledge and skills, physical abilities and attributes, personality and social skills. Most importantly, however, interviews indicate whether applicants have displayed the key skills required for a position in the past, under similar conditions (Fernández-Aráoz, 2014).

Employment interviews are either structured or unstructured. A job analysis determines the questions to be asked in structured interviews, which may not be altered by the interviewer (Schmidt et al., 2016). Structured interviews primarily assess four constructs, namely, cognitive ability, behavioural skills, person-organisation fit and tacit knowledge (Harris, 1999). They are regarded as better performance predictors, as measured by job knowledge, interpersonal skills and organisational fit (Cortina, Goldstein, Payne, Davison, & Gilliland, 2000; Huffcutt et al., 2001; Nzama et al., 2008; Salgado & Moscoso, 2002; Ziegler, Dietl, Danay, Vogel, & Bühner, 2011). Structured interviews are, however, significantly costlier to design and implement than unstructured interviews (Schmidt et al., 2016). Nevertheless, they are a more popular selection method than their unstructured counterpart (Zibarras & Woods, 2010). The combination of GMA and a structured interview has substantial predictive power in hiring decisions (Ziegler et al., 2011).

Typically, interviewers dislike using structured interview formats given the restriction on format and question bank (Schmidt & Zimmerman, 2004). However, at least 70% of HR practitioners surveyed concurred that the most valid interviews are structured and are consistently applied across all the applicants applying for a job (Rynes et al, 2002a). Through using three or more interviewers, and averaging their ratings, an unstructured interview provides the same level of validity ($r$ = .58) for predicting job performance as a structured interview with one interviewer (Schmidt & Zimmerman, 2004). Regardless of whether structured or unstructured, interviews then accurately predict performance and add to prediction over and above GMA tools (Schmidt et al., 2016).

Interviews have been critiqued as unreliable and subjective (Louw, 2013). This is due to the faking and impression management potentially inherent in this selection measure (McFarland, Yun, Harold, Viera, & Moore, 2005; Van Iddekinge, Raymark, & Roth, 2005). It is suggested that these disadvantages can be minimised through the use of panel interviews and successive stages of interviews (Wickramasinghe, 2007). In this section four central kinds of HRS techniques were discussed. These were the preliminary screening methods, reference checking and verification, testing and assessment and interviewing methods. The next section provides an account of the challenges experienced within HRS.

### 4.5. Challenges in human resource selection

Section 4.4 highlighted the various challenges inherent within the four selection methods discussed. This section introduces three other broad challenges pertaining specifically to the task of selection. The section is initiated with a discussion on the evaluation challenge within

HRS. Section 4.5.2 examines the problems inherent in the labour market with section 4.5.3 outlining the impact of national legislation on HRS.

### 4.5.1. Evaluation of human resource selection

The significant role of HRM and HRS in various aspects of organisational performance has been confirmed in several studies (Liu et al., 2007; Ployhart, 2006; Schmidt et al., 2016). However, the scepticism regarding the value of HRS remains, especially amongst senior executives of businesses. As pertinently summarised by Pfeffer (1998), half of executives deem HR as useful and only a quarter actually put that belief into practice in their actions. These decision-makers need to move from a micro perspective on recruitment and selection to engage at a macro and multi-level understanding of the impact of staffing practices on the holistic functioning of the organisation (Ployhart, 2006).

Liu et al. (2007) propose that this scepticism may be due to HR investments being difficult to measure. Whilst progress has been made in designing and conducting return on investment initiatives, conflicting results have led to confusion and a continued lack of confidence in the merit of HRM. Pietersen (2018) has highlighted that local HRM needs to provide practical solutions to the problems being experienced within the workplace. In her analysis of research articles being produced she concluded that the research-practice gap is still too large within South African research, with a need for more practical advice being generated.

Louw (2012), however, believes that most evaluations of HR practices done within SA organisations remain in-house and are not published. This knowledge of good practices, reliable relationships and strong links between HR practices and outcomes is hence not shared. Besides the HR programme evaluations done by Edwards and his peers (Edwards, Scott, & Raju, 2003, 2007), research in this area is scarce. A special edition of articles documenting the evaluations of South African HR interventions was published in 2012. This edition was regarded as the first compilation of HR programme evaluations in SA (Louw, 2012). Articles were produced documenting evaluations of programmes within the five phases of the HR value chain. These were recruitment and selection, pay and reward, training and development, performance management and employee relations. For the first phase, the evaluation of an induction programme was provided. However, Louw-Potgieter (2012) notes, in the rationale for this special edition, that an evaluation of a selection programme was missing from this recruitment and selection category. This omission was regarded as being noteworthy given that the HR intervention of recruitment and selection is a high-cost one.

In the next volume of the respective journal, Azar et al. (2013), published a case study documenting a personnel selection model using a data mining approach. The article documented the value of using this decision-making technique in recruitment. Covert patterns of relationship between entrance test scores and work performance were established for five variables, namely, employment province, educational level, work experience as well as exam and interview scores.

Lodovici et al. (2013) concur that, internationally, there are limited studies on apprenticeships that employ an impact evaluative approach. They cite several potential reasons for this, including the newness of the approach, difficulties in sourcing retrospective data and the large-scale nature needed for such studies. The lack of research evaluating the impact of selection practices is therefore the first challenge documented in this section.

### 4.5.2. Labour market challenges

As discussed in section 2.4.1, the South African automotive industry has been criticised for not being as competitive as its global counterparts. In order for the national manufacturing sector, and specifically the automotive industry, to remain viable its human capital needs to have the necessary knowledge and skills (Deloitte, 2013). Whilst there are potentially many areas to discuss, this section deals with two primary challenges to the efficient sourcing of human capital. These are the current educational profile and skill deficiency within the applicant pool.

#### 4.5.2.1. Educational profile of applicants

In comparison to other middle-income countries, SA has the poorest education system. SA also performs worse than many low-income African countries in educational achievement assessments (Spaull, 2013). As discussed in section 3.7.1, the national education system is faced with several gaps and misalignments. Specifically, a mismatch of technical skills with an inadequate focus, level and quality of the training has been identified (Mayer et al., 2011; Ramdass, 2009; Smith, 2011).

When confronted with a mass educated labour force, especially when supply exceeds demand, employers need to employ additional selection criteria beyond educational attainments. This has become known as credential inflation (Van de Werfhorst, 2014). The low quality of education obtained from certain types of secondary education in SA is a cause for concern amongst HR practitioners (Ramdass, 2009; Spaull, 2013; Van der Berg et al., 2011; Van de Werfhost, 2014). In light of this, researchers have recommended educational institutions update their current programmes and create better alignment to the specific aptitudes required by industry (Puchert et al., 2017a, 2017b).

Researchers have suggested that the traditional staffing methods used by the private sector should be reformed. Shankar et al. (2016) have proposed that the screening and selection tools, emphasising educational attainments, currently being used are filtering out the disadvantaged youth in the country. This challenge is, however, not unique to SA. Similar problems are being experienced in America (Giffi et al., 2014; 2015), Brazil (Gray & Wragg, 2015), China (OECD, 2011) and Switzerland (Mueller & Wolter, 2014). The second challenge experienced within HRS, namely, skill deficiency, is discussed in the next section.

#### 4.5.2.2. Skill deficiency of applicants

Traditionally, HR practitioners benefitted from the long-standing assumption that they were able to identify the best candidates for a vacancy from a large pool of applicants. However, this belief can no longer be taken for granted in the current labour market (Lievens et al., 2002). Employers have become deliberate regarding the skills, attributes and behaviours they expect from applicants, whether through academic studies or work experience (Evans & Richardson, 2017). However, there is a global shortage of qualified and competent applicants given the widespread societal, cultural and demographic changes (Ployhart, 2006; Trindale, 2015).

The majority of global employers therefore cite their most significant current business challenge being sourcing, developing and/or keeping human talent (Shankel, 2010; Trindale, 2015). Almost 70% of Brazilian employers' experience difficulty in recruiting an adequately skilled workforce, citing an average of 150 days to complete a recruitment cycle (Gray & Wragg, 2015). With China becoming one of the fastest growing economies in the world, and its large modern establishments with high technology levels, firms are experiencing difficulty in sourcing skilled labour (Li et al., 2014; Risler & Zhiqun, 2013).

Within SA, there is an undersupply of suitably skilled applicants to fill job vacancies as well as an oversupply of unskilled workers (Louw, 2013; Masibigiri & Nienaber, 2011; Shankar et al., 2016). Over a quarter of local organisations indicate a lack of hard skills as the source of their human capital problems (ManpowerGroup, 2016). The South African talent pool is also limited by equity legislation and the emigration of skilled workers. Furthermore, there is a high labour turnover of Black African employees as they move rapidly between organisations to optimise their career and financial prospects (Nzukuma & Bussin, 2011). From this it can reasonably be assumed that organisations need to be very cautious when selecting future employees (Louw, 2013).

Researchers cite a discrepancy between the self-perception of students and the perceptions of employers regarding preparedness for work. Due to an inability to articulate and make meaning of their education and acquired skills, students may actually be more prepared than they reveal. Whilst they may have participated in meaningful educational initiatives, they are not able to explain what they have learnt and/or achieved (Fox, 2018). This inability to confidently interpret the value of their skills and experiences is known as the interpretation gap. This contributes to the beliefs held by employers that students have a deficiency in the skills they desire (DuRose & Stebleton, 2016). However, whether a skills gap or a gap in interpretation, there is room for improvement in the manner in which students prepare for the world of work (Fox, 2018; DuRose & Stebleton, 2016). Various suggestions are offered to potential employers to assist in the recruitment and retention of the youth in their organisations. Amongst others, these include conducting orientation sessions, providing career guidance and fostering socialisation (Hessler & Ritchie, 2006; merSETA, 2016).

The imminent retirement of baby-boomers (i.e., born between 1946 and 1964) will also have a significant impact on businesses. As these older, more experienced employees retire, businesses will lose their embedded knowledge and find replacing their talent pool onerous. Given that skilled production positions account for over 50% of the total manufacturing workforce, shortages within this category will be a major problem for companies. The manufacturing industry will need to consider ways to overcome the exodus of personnel in the areas of skilled production (e.g., machinists, operators and artisans) as well as highly specialised and innovative workers, such as scientists and design engineers (Giffi et al., 2014). Section 4.5.2 has commented on the likely problems for HRS in SA given the current labour market. Section 4.5.3 introduces another challenge, being the legislation within SA.

### 4.5.3. Impact of legislation

With the changes in the South African political landscape post-apartheid, several pieces of legislation were promulgated by the new government. One of these pieces of legislation, the EEA (1998), and the later Employment Equity Amendment Act (No. 47 of 2013) (EEAA), has bearing on the task of HRS. The purpose and impact of this national act is discussed in the paragraphs that follow.

The EEA (1998) provides clear specific stipulations to eliminate and prohibit the practice of unfair discrimination in the workplace. One of these stipulations is that job applicants can only be assessed against the inherent requirements of a job. Furthermore, the EEA (1998, p. 7) provides stipulations pertaining to psychological testing and other assessments:

*Psychometric testing and other similar assessments of an employee are prohibited unless the test or assessment being used-*

- *a) has been scientifically shown to be valid and reliable;*
- *b) can be applied fairly to all employees; and*
- *c) is not biased against any employee or group.*

The EEAA (2013, p. 6) added a fourth condition, clause (d), into Section 8, namely, that:

- d) *has been certified by the Health Professions Council of South Africa, established by section 2 of the Health Professions Act, 1974 (Act No. 56 of 1974), or any other body which may be authorized by law to certify those tests or assessments.*

Besides providing specific guidelines on testing and assessments, the EEA (1998) also makes clear the need to appoint certain ethnic groups in preference to other groups (Nzukuma & Bussin, 2011). However, this is made challenging given that several personnel selection instruments, whilst valid, can still present large racial score differences in test results (Hough, Oswald, & Ployhart, 2001; Ployhart & Holtz, 2008; Sackett, Schmitt, Ellingson, & Kabin, 2001). In the literature this occurrence has been labelled "the diversity-validity dilemma' (Ployhart & Holtz, 2008; Pyburn, Ployhart, & Kravitz, 2008). In selection exercises, this dilemma implies that the goals of performance and validity do not always converge (De Soete, Lievens, & Druart, 2013).

From six issues potentially effecting their choice of selection methods, HR practitioners rated the perceived legality of procedures as a significant factor. This was rated at the same level of importance as the method's predictive validity and utility in organisational self-promotion. However, three other variables (i.e., applicant reactions, cost and the diffusion of the measure in the field), were rated as being marginally more important (König et al., 2010). The value of good selection practices in increasing job performance, however, significantly outweighs the potential costs that can result from defending selection-related lawsuits (Pyburn et al., 2008; Schmidt et al., 2016).

The legal risk of using GMA testing in selection exercises is fairly low. These measures are highly defensible given the significant evidence of their validity as predictors of job performance (Schmidt et al., 2016). Despite this high degree of legal defensibility, the issue of increased workplace diversity still remains. A lower ratio of non-Whites are typically hired in selection practices where GMA assessment results are used. However, refraining from employing GMA tools in order to increase workplace diversity has been found to result in decreased work performance (Sackett et al., 2001). Other forms of testing have therefore become increasingly significant (Ployhart, 2006; Ployhart & Holtz, 2008). Ployhart (2006) recommends that organisational decision-makers need to recognise the implausibility of fairly hiring a diverse workforce through the sole use of cognitive ability tests.

A proposed solution is the implementation of a composite battery of tools that could reduce group differences linked to GMA measures, whilst still being effective predictors of job performance. The idea is to supplement GMA tools with non-cognitive measures such as interviews, integrity and conscientiousness tests that reveal only very small group differences (Schmidt et al., 2016). Smaller subgroup differences are also found in structured interviews, in comparison to unstructured ones. Subgroup differences can also be further reduced through the employment of panel interviews with a variety of interviewers (McFarland, Ryan, Sacco, & Kriska, 2004). This proposed solution, however, has shown only slight reductions in differential hiring rates (Sackett et al., 2001).

Staffing decision-makers, who seek the best balance between prediction and diversity, should potentially make use of selection tools such as ACs and work sample tests. Evidence indicates that they reveal comparable levels of validity, more favourable user reactions and smaller subgroup differences than cognitive testing (Ployhart, 2006). The use of other selection tools, besides expensive and often time-consuming psychological tests, could also be of value to HR practitioners. Type of secondary education, inclusive of subject choice, could be specifically valuable as a preliminary screening technique. The concerns linked to psychological testing and the associated compliance with the EEAA (2013) regulations can then be alleviated (Puchert et al., 2017a, 2017b).

It has been recommended that labour legislation be relaxed in order to facilitate the use of creative initiatives in recruitment and selection practices. This is specifically required in the poorer provinces of the country, such as the Eastern Cape, in order to stimulate job creation (Louw, 2013). Other national researchers have highlighted that organisations need a clear recruitment and selection policy, with specific procedures. In a context where all HR tasks are closely examined by equity legislation, these policies and procedures will afford the organisation some protection against legal errors in the selection process (Nzukuma & Bussin, 2011).

Another identified labour legislation blockage is the fact that apprentices are regarded as employees in terms of both the Labour Relations Act (No. 66 of 1995) (LRA) and the Skills Development Act (No. 97 of 1998). Once apprentices commence the workplace component of the programme, the organisational disciplinary process has to be applied. Employers have indicated that if apprentices were excluded from the employee category, more employers would consider opening up their workplaces to apprentices (Pandor, 2018). Section 4.5 has considered three broad categories of likely challenges within HRS in SA. In the section that follows the selection practices employed for apprentices are described.

### 4.6. Selection of apprentices

In section 3.2, the four phases of the apprenticeship life cycle were illustrated and described. The first phase involves recruitment, selection, induction and contracting arrangements (Smith, 2010). This section will elucidate the processes and techniques employed to operationalise one aspect of the first phase, namely the selection of apprentices. This section builds on the information provided in section 3.7.3 where the selection challenges within the implementation of apprenticeship programmes were discussed. Initially the different methods employed globally are discussed in section 4.6.1. This is followed by a review of those used in the national context, specifically within the manufacturing sector.

### 4.6.1. Global apprentice selection practices

Selecting apprentices is more difficult than the screening of other employees. The applicants mostly all have the same qualifications and are inexperienced. Answering competency-based interviews questions is therefore very difficult for them. Global recruiters, such as in Germany and the UK, are finding the solution to be the use of assessments (Grosvenor, 2016; NAS, 2017). The choice on offer within apprenticeship programmes is often challenging for these young and inexperienced applicants. To deal with this problem the UK-based firms of Siemens and Meiko created on-line 'pre-application' assessments that helped them populate the applicant pool for each apprenticeship type with better-suited candidates. These tools analysed the strengths and preferences of each applicant and then guided them by suggesting which apprenticeship programme was better suited to them (Grosvenor, 2017; Langner, 2015). The Australian and New Zealand-based plants of Komatsu also make use of an on-line application form. However, applicants are also required to attach their current CV (Komatsu, 2013). The Australian National Electrical and Communications Association uses an on-line pre-selection tool that assesses numeracy, literacy and mechanical reasoning. Their website offers sample papers to review prior to taking the assessment (NECA, 2018).

The UK's National Apprenticeship Scheme (NAS) recently generated a 10-step employer guide on apprentice recruitment. This booklet aims to stimulate good practice amongst British firms deciding to embark on apprenticeship programmes. The steps range from writing the person and job specification to creating an apprentice agreement. Templates for job adverts and application forms are provided as well as an interview question bank. This organisation has recommended the use of on-line applications to facilitate the easy comparison of applicants. This on-line tool facilitates the capturing of the basic entrance requirements but also allows for additional probing into the applicants' passion and interests (NAS, 2017). A similar guideline document was developed by the University of Cumbria (n.d.).

Most countries have specified the entrance requirements into TVET in their national policies (COTVET, 2014). Scholastic achievement is given high priority in the selection of apprentices (ABCMA, 2018; Forsblom et al., 2016; Imdorf & Leemann, 2012; Lodovici et al., 2013; Moser, 2004). A strong base of literacy and numeracy skills is required for entering into vocational training (Brewer, 2013). The age of apprenticeship commencement has risen as some employers, for example in Germany, Austria and Denmark are becoming more discriminate in only selecting apprentices with good or very good school results. Less-qualified applicants are needing to complete remedial education to increase their chances of acceptance onto the programme (Steedman, 2012). An Australian study investigated the factors that supported the continuation of apprenticeship studies during the first year. Apprentices that had completed 12 years of schooling and had studied VET subjects at school had an increased likelihood of surviving the first year of their apprenticeship (Hill & Dalley-Trim, 2008). The increased usage of higher educational achievements as a screening mechanism may also be due to the large number of applicants and the need for low cost pre-selection methods (Imdorf & Leemann, 2012).

However, in countries (i.e., Switzerland and UK) with education systems that lack consistent standards and examinations comparability of applicants using this method is difficult (Langner, 2015; Mueller & Wolter, 2014). Whilst making employment decisions using scholastic achievement may seem cheap, in the apprenticeship training context this may be regarded as erroneous. Unlike ordinary employment contracts, apprenticeship contracts in some countries cannot be terminated without difficulty and wages are fixed for a defined period. A poor selection decision could mean a significant loss for the firm (Mueller & Wolter, 2014). Furthermore, schooling systems have also been criticised for not adequately exposing students to manufacturing skills and encouraging a career in this field (Giffi et al., 2014).

Recruiters in the manufacturing sector regularly make use of covering letters in their screening practices. This assists to determine the best candidates in terms of a match between the job requirements and the skills and experience of the applicant. Specifically, applicants are expected to tailor their covering letters to highlight these aspects to the recruiter (Ogden, 2016; Tomaska & Nosek, 2018). Drug tests and physical examinations may also be requested to ensure the applicant is capable of completing certain key tasks within the apprenticeship (Torpey, 2013). Core skills required of an apprenticeship applicant are algebra, geometry, mechanical comprehension, spatial visualisation, technical reading and interpersonal relations (Martin, 2016; Torpey, 2013). Good performance or aptitude in technical courses as well as mathematics and science are also recommended (COTVET, 2014). The interest of students in mathematics and science as well as their confidence in their ability to succeed are significant factors in their success on the programme (Besterfield-Sacre, Atman, & Shuman, 1997). Reading literacy is also deemed an essential competency in successfully dealing with the theoretical part of apprenticeship training as well as being able to effectively manage work life (Mueller & Wolter, 2014).

Employability and teamwork skills are regarded as important attributes facilitating the adaption of technical students to workplace demands (De Guzman & Ok Choi, 2013; Goastellec & Ruiz, 2015; Grosvenor, 2017). This could explain why Hill and Dalley-Trim (2008) established that apprentices who had completed a related job placement programme, prior to registering for their apprenticeship, were more likely to progress post the first year of their studies. Worthen and Haynes (2009) documented the selection process for a pre-apprenticeship programme in the construction trades of Chicago, North America. Initially, the applicants were requested to fulfil various hurdles, such as, appearing at a distant unknown address, completing a lengthy mathematics, mechanical reasoning and reading test and drawing road maps in groups. Besides also investigating the social skills of the applicants in the latter exercise, all three hurdles aimed to assess the level of commitment and motivation the applicants held for the programme. Once this process had terminated the less interested applicants, the last phase of the selection process commenced. Here, the remaining applicants were screened using an interview, drug test and physical ability test.

A battery of tests measuring some of these fundamental entry requirement skills is usually administered as part of the selection process (Martin, 2016; Torpey, 2013). Globally, standardised aptitude tests have increasingly been used as a selection measure for apprentices. This is mostly due to employers distrusting school grades (Siegenthaler, 2011). Aptitude testing is used to detect under-achievers, rather than over-achievers, in order to de-select them out of the training programme and prevent these high-risk and high-cost eventualities (Grosvenor, 2017; Mueller & Wolter, 2014). Through these standardised tests the cognitive abilities of applicants can be effectively compared to their scholastic achievement and hence provide additional useful information (Siegenthaler, 2011). A Ghanaian study established that applicants that performed better on cognitive ability tests were more likely to progress and enter the apprenticeship programme (McCasland, 2015). However, a study on a mandatory aptitude test revealed that the aptitude test results did not accurately predict the training success of students in the first and third semester of their first year of training (Siegenthaler, 2011). Another criticism of this paper-based assessment phase is the lengthy processing time in short-listing applicants before group assessments can commence. On-line assessments are therefore preferred (Langner, 2015). The prevalence of gamification tools in selection was discussed in section 4.4.2.2. One such tool, *chatAssess*, has been used in the selection of apprentices. The communications assessment is a situational judgement test in the form of an instant messenger (Hawkes et al., 2017).

Applicants may also be expected to undertake one or several interviews with the prospective sponsor. These interviews are to confirm the applicant's qualifications, level of interest in the programme as well as assess their reliability as students (ABCMA, 2018; Goastellec & Ruiz, 2015; Grosvenor, 2016; Komatsu, 2013; Torpey, 2013; Worthen & Haynes, 2009). A structured interview format was used to screen applicants for a shipyard apprenticeship programme. Dimensions identified as key to the retention of these apprentices were incorporated into the interview schedule to decrease attrition on the programme (Baker & Spier, 1990). When screening for technical positions, 97% of manufacturing executives stated that face-to-face interviews were the most effective method of filtering applicants for technical positions. CV reviews were rated as the second most popular method with 78% of the respondents stating they use this screening practice. However, both of these screening methods are time consuming (Giffi et al., 2015). The use of scoring grids in interviews is recommended to ensure a fair and equitable assessment process, thereby complying with relevant legislation (NAS, 2017). The overall 'personal impression' of apprentice applicants is also regarded as significant in their selection (Schmid & Storni, 2004; Stalder, 2000). Companies using job interviews and company visits have significantly less premature terminations than those that do not utilise these selection methods (Forsblom et al., 2016; Tang, 2015).

The use of rigorous practices in the recruitment and selection of apprentices is encouraged (Goastellec & Ruiz, 2015; Imdorf, 2017; Lovender, 2015). A key theme in the successful management of apprenticeship programmes is the implementation of effective employer-driven recruitment and selection processes. Intense processes result in the correct individuals being identified upfront (Employing apprentices, n.d.; Rowe et al., 2017; US DoL, n.d.). Within Germany, the use of personality tests is recommended in apprentice selection. The Big Five personality facets of openness and conscientiousness are predictive of performance on the apprenticeship programmes. German apprentices are expected to display the attributes of dutifulness and deliberation, whilst minimising their compulsion to follow their own thoughts. Within this context, therefore, personality assessment is regarded as a key contributor to apprentice selection (Ziegler et al., 2014).

In pursuit of a fair selection process, international organisations have implemented a four phase selection process, comprised of application form review, aptitude testing, face-to-face interviews and finally a short internship in the training organisation (Imdorf & Leemann, 2012).

Applicants that meet these various hurdles in the selection process are then ranked. Aptitude test results, interview performance, educational level and work experience are the factors used to calculate the ranking order of applicants. The applicants with the highest scores are chosen first (Torpey, 2013). Larger, more experienced employers with well-established staffing systems for apprentices, have a higher apprenticeship completion rate. Smaller and less experienced employers in HR matters tended to have more drop-outs (Lovender, 2015; McCasland, 2015). Anderson (2001) empirically confirmed that a significant delay in the hiring and/or training completion time of apprentices would be detrimental to organisational performance levels. He therefore suggests the streamlining of staffing policies to minimise these risks. In contrast, Horn (2016) established that individuals with personal links to firms are more likely to obtain apprenticeship positions within these firms.

Some countries, such as Germany, Australia and Canada, make use of pre-apprenticeship programmes as part of their selection process (Smith & Kemmis, 2013). These off-the-job programmes incorporate a wide variety of tasks to assist and prepare the individuals wanting to pursue an apprenticeship. An additional benefit of these programmes is that people that may have misunderstood the nature of an apprenticeship and/or being an artisan exit before the main programme commences (Forsblom et al., 2016; Smith & Kemmis, 2013). It is often this pre-completion exiting that make employers risk-averse to apprenticeships. The main challenge to increasing apprenticeship enrolments in England is convincing more employers to participate. Gambin and Hogarth (2017) conclude their article by stating that "if the financial risk to the employer could be reduced in some way then this should increase the demand for this type of training" (p. 19). Several options are then proposed to reduce these costs, however, no mention is made of improving the selection of apprentices as the potential solution to this challenge.

An extensive literature review on apprenticeship programmes by Fazio et al. (2016) concluded that global innovative and efficient apprenticeship programmes contained ten core elements. This list includes aspects such as curriculum design, quality control to employer engagement and funding and incentive structures. It is noteworthy that this broad study made no mention of the selection criteria nor the optimal methods for the selection of individuals to attend these apprenticeship programmes. This is similar to other studies on technical and vocational programmes. For example, none of the following documents gave due consideration to staffing issues: the role of TVET in the national development of Bangladesh (Alam, 2008), a review of the state of TVET in Pakistan (Allam, 2015), a review of technical education in

America (Rojewski, 2002), a review of the European TVET research (Mulder & Roelofs, 2012) and a review of the Nigerian apprenticeship scheme (Evawoma-Enuku & Mgbor, 2005). Furthermore, of the 39 presentations covering eight broad topics within the 2015 International Network for Innovative Apprenticeships conference, two made mention of the skills needed by applicant apprentices and two briefly mentioned selection techniques to be employed (Smith, Gonon, & Foley, 2015). None of the 39 presentations, spanning eight topics, from the 2017 International Network for Innovative Apprenticeships conference covered any aspect of the apprentice staffing (Lerman & Okoli, 2017). A recent comprehensive study, drawing on 337 initiatives across Europe, investigated the role of TVET in the early leaving of students from apprenticeship programmes. One of the documented critical success factors is the identification and recruitment of learners. This section discussed issues such as early detection, monitoring, developing trustful relationships and outreach activities (Cedefop, 2016a). However, no information is provided on student selection into these TVET programmes. The preventative measures section did not even make mention of the sourcing or selection of students.

When there is discussion of apprentice recruitment and selection, research then often refers to the staffing of graduate apprentices not student apprentices (e.g., Mohrenweiser, 2016; Rasul, et al., 2012; Smith, Comyn, Kemmis, & Smith, 2011). It is noteworthy that even within one of these aforementioned papers, the author mentions the scant research in this area by stating "I am not aware of any empirical paper analysing a firms' demand for apprenticeship graduates or firms' recruiting strategy in regards to apprenticeship graduates" (Mohrenweiser, 2016, p. 11). Mulder and Roelofs (2012) summarised the conference and research journal publications of 2011 pertaining to the field of TVET. Of the 119 documents reviewed, only one (i.e., Siegenthaler, 2011) discussed issues pertaining to the staffing of applicant apprentices. Despite the large amount of TVET research, these authors concluded that it is "quite diverse and fragmented . . . there are various urgent topics for further research, which are not being discussed" (p. 19). Imdorf and Leemann (2012) also conclude that to date, within Swiss and German research, there has been "very little about the issue of recruitment and selection" (p. 59). Whilst there are several studies documenting the selection process for other training programmes, with regards to apprenticeships the "actual selection criteria applied . . . have hitherto hardly been subject to any investigation" (p. 60). Forsblom et al. (2016) further adds that "few studies exist that systematically examine the selection methods of training companies" involved in apprenticeship programmes (p. 403). Horn (2016) has also voiced his concern by recently documenting that there "is only anecdotal evidence about the process of apprenticeship selection” (p. 144). The next section describes the selection methods used for apprentices within the national context.

### 4.6.2. South African apprentice selection practices

The bulk of local artisans are underqualified, with over half (59%) having obtained less than a matriculation qualification and 26% holding a Grade 12 secondary education. A post-matric qualification is only held by eight percent of the artisans, which may be due to the latest trend of Grade 12 being the entrance requirement into an apprenticeship programme (Vass & Raidani, 2016). Within the manufacturing sector, the principle entry requirement for a learnership and an apprenticeship is either a Grade 10 or a Grade 12 educational certificate depending on the type of learnership or apprenticeship. There are no age restrictions for gaining entry into a learnership (Mummenthey et al., 2012). Individuals are unlikely to enter an apprenticeship from an unemployed position. Whilst regarded as ideal that individuals enter the apprenticeship directly after school, job experience tends to facilitate access onto an apprenticeship programme (Wildschut et al., 2012). This is particularly evident in registrations for a section 28 apprenticeship. This form of apprenticeship is designed for older individuals who have obtained work experience (Janse van Rensburg et al., 2012).

The manufacturing sector is seeking technical graduates that have skills in three primary areas. Firstly, they seek individuals with strong thinking and academic skills; enhanced technical skills within their specific field, and thirdly, employability skills such as effective communication and teamwork skills (Nomvete et al., 2017). Within the employability skills, interpersonal skills such as coaching others, working within culturally diverse teams, as well as leadership abilities are the most valued (Rasul et al., 2013). Apprenticeship programmes develop both the technical and teamwork skills of participants. One of the employability benefits of participation on the programme is the boost to the self-confidence of participants (Wildschut et al., 2012). In addition to these, work safety, customer service, integrity, creative/innovative thinking and problem solving are also prized (Nomvete et al., 2017; Rasul et al., 2012).

Hiring within the automotive industry is currently especially challenging. Not only does the industry have specific standards and processes, there is also a high demand for skilled technical professionals whose loyalty is often not linked to salary nor prestige (Bodnár, 2016). An academic-type Grade 12 qualification, inclusive of the subject(s) mathematics and/or science, has been recommended to the automotive industry as a preliminary screening mechanism. It is postulated that this form of secondary education will facilitate the acquisition of the aptitudes required within the sector, specifically as they aim to optimise their capacity within the STEM areas (Puchert et al., 2017a, 2017b). However, in contexts where supply exceeds demand and the applicant pool has been educated through mass education, additional information sources are required to effectively screen through the pool (Kuncel et al., 2010; Van de Werfhorst, 2014). In-depth selection techniques are employed by most manufacturing employers in their selection of apprentices (merSETA, 2016; Mummenthey et al., 2012). Apart from aptitude and ability, an assessment of the motivation, personality and learning ability of individuals are regarded as key. Employers are searching for learners with the right attitude for success in the development programme (Mummenthey et al., 2012; Nomvete et al., 2017). A multiple, rather than a singular phase selection process for entry-level operators was therefore recommended (Puchert et al., 2017a, 2017b).

The Holburn (1992) paper, called *Recommendations for fair and unbiased apprentice selection*, is the only available national analysis on apprenticeship staffing practices. Whilst significantly outdated, this paper nevertheless still contains relevant advice for today's firms on recruiting and selecting apprenticeship students. A brief summary of this information is provided. Firstly, Holburn recommends the use of a multi-phase selection process. Secondly, given that apprentices are selected for the sole reason of being trained, the assessment of potential should be a key criterion. Employing cognitive ability tests, especially a non-verbal test, should screen out applicants who do not have the potential to succeed on the training programme. Thirdly, psychomotor tests (i.e., eye-hand and two-hand coordination) were recommended as a selection method. Fourthly, application forms can be useful in initially dealing with large volumes of applicants. Fifthly, trainability tests were strongly recommended for use after the application form and psychometric selection phases. Whilst the latter two phases would screen out those who clearly did not have the potential to succeed, the former test would assist the organisation to identify the best candidates from the remaining pool.

National studies have consistently and comprehensively investigated the local TVET system (DHET, 2014; Manuel, 2011; Mayer et al., 2011; Pandor, 2018; Ramdass, 2009; Smith, 2011; Spaull, 2013; Van der Berg et al., 2011; Van de Werfhost, 2014). These studies have revealed the lack of success of the system and continuously attempt to identify the reasons for this (e.g., early leavers, lack of retention, poorly trained, lacks responsiveness of labour market needs). The focus of these studies is also to propose remediation methods (e.g., curriculum redesign, upskilling of trainers' skills, upgrading of machinery and equipment, better remuneration packages and working conditions for apprentices, enhanced funding, effective governance, intensified quality assurance). However, none of the recommendations or conclusions derived from these studies investigate the role of staffing practices (i.e., beyond minimum recommended entrance requirements).

A recent national tracer study has recommended that more longitudinal studies be conducted on apprenticeship programmes in order to systematically measure the progress of apprentices over time (merSETA, 2016). Furthermore, several national articles (e.g., Jordaan & Barry, 2009; Shabane et al., 2017; Van Rooyen et al., 2010) discuss the retention of artisans at great length without referring to apprentice selection. In the recently released Draft National Artisan Development Strategy and Implementation Plan 2017, the seven steps to becoming an artisan in SA were described as the vision of the DHET in achieving the goals of the NDP. The first of these steps is career development and the Plan mentions a selection and recruitment tool as part of the implementation of this step (Pandor, 2018). However, as found with the Government Gazette (2015a), there was no additional information or clarification on what this tool should encompass. Based on the literature reviewed, it is apparent there is a lack of questioning of apprentice selection as a possible cause for the lack of success of apprenticeship programmes.

### 4.7. Summary

Chapter Four has summarised the literature pertaining to the theoretical framework, namely the human capital theory, underpinning this study. Various perspectives of this theory were offered as well as the significance of the theory to the HRM field. A brief overview of some of the critiques of the theory were also provided. HRS was defined and the relevance of this practice for organisations discussed. An empirical literature review of four broad selection methods was presented. Three challenges implicit in HRS, namely, evaluation, labour market issues and the impact of national legislation were discussed. The final section of the chapter outlined the processes and methods employed in the selection of apprentices and artisans, both globally and nationally. This chapter has highlighted the need for more research into the role of staffing practices in apprenticeship programmes. Through engineering an effective selection process, firm-specific human capital can be sourced to generate competitive advantage for the employers of these artisans.

The next chapter presents the research process followed within this study. Chapter Five outlines the research problem, with resultant objectives and hypotheses. The research paradigm, design and methodology are discussed as well as the data collection method. A distinction is made between the primary and secondary data stages. The data analysis strategies employed in this study are also presented.

# CHAPTER FIVE
# RESEARCH METHODOLOGY

## 5.1. Introduction

The purpose of the previous three chapters was to review the literature underpinning the study. Chapter Five outlines the research methodology used in the form of the 10 steps of the research process. This chapter, therefore, presents the selected research paradigm, the research design and approach. The methodology used in the primary data stage of the study is clarified as well as that used in the secondary data stage. The methodology takes into account the sampling plan, instrument design, data collection and data analysis strategies. Section 5.2 commences the chapter with an outline of the particular research process adopted for this study.

## 5.2. The research process

Research assists in solving problems in managerial practices and enhances the efficiency of managerial decisions (Bryman & Bell, 2015b). Personal choice and random decision-making can be replaced with professional decisions that are based on expertise and judgement derived from scientific evidence (Cooper & Schindler, 2014). This formation of new knowledge, however, needs to be a scientific process (Fraser, 2013; Rukwaru, 2015). A research process is usually highly structured and involves a sequence of interrelated activities (Collis & Hussey, 2014; Zikmund, Babin, Carr, & Griffin, 2013). Nevertheless, it is cyclic, rather than linear, in nature (Bless et al., 2013).

The research process followed in this study is depicted in Figure 5.1. It commenced with the identification of the global and local need for artisans as a broad area of study and the recognition of apprenticeship programmes as a key factor in the development of artisans. The literature review focussed the research area to the profile of apprentices and the HRS practices used on apprenticeship applicants within the automotive industry. The third step specified the research objectives and hypotheses of the study, with a positivist research paradigm being chosen in the fifth step. This informed the choice of a quantitative research approach in step five.

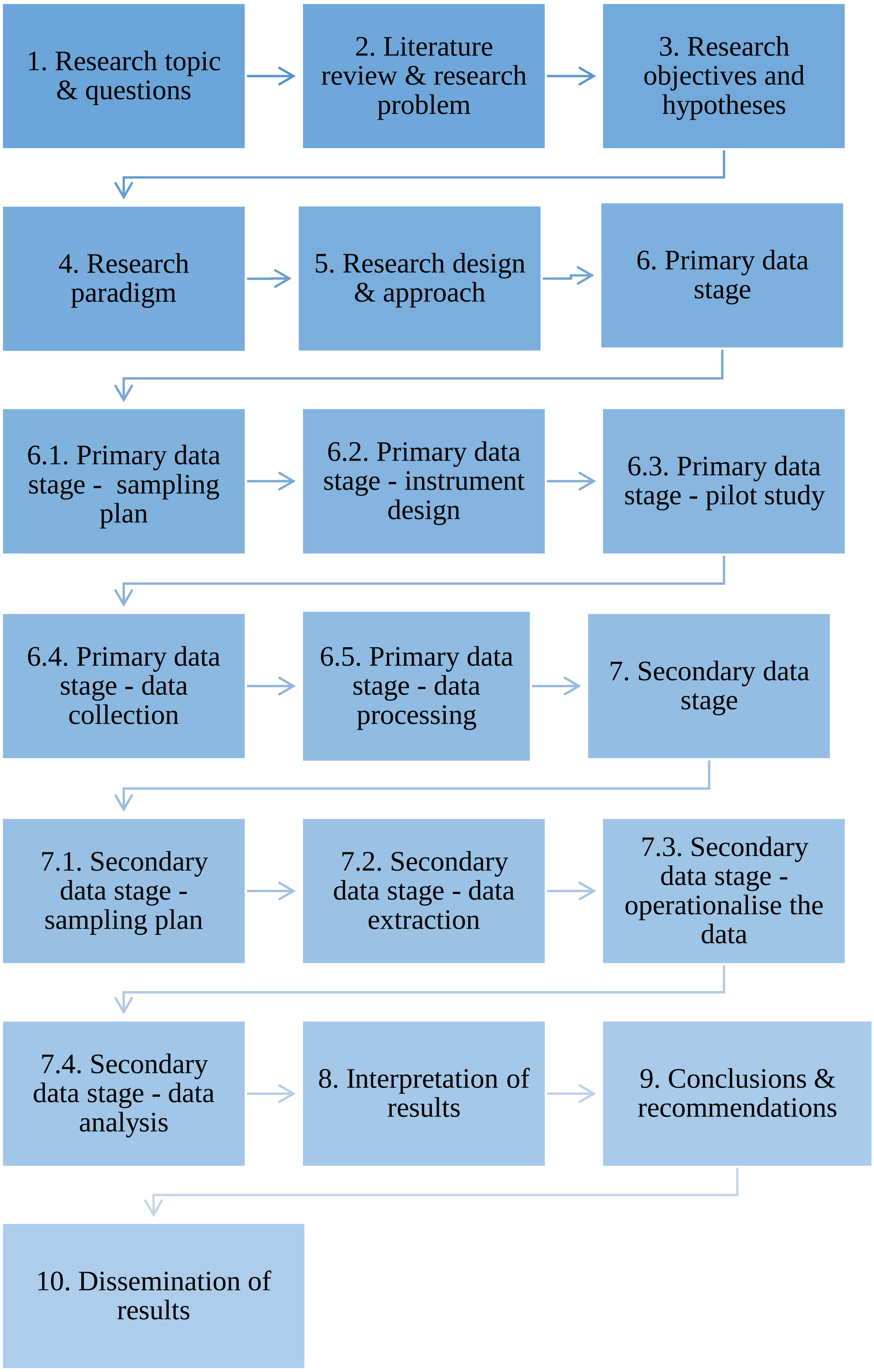


*Figure 5.1.* The research process followed in the study. Adapted from *Fundamentals of social research methods: An African perspective* (5th ed., p. 20-21), by C. Bless, C. Higson-Smith, & S. L. Sithole, 2013, Cape Town, South Africa: Juta & Company Limited. Copyrighted 2013 by Juta & Company Limited.

Following step five of the research process, the design is split into two components, namely, the primary and secondary stages. In step six, the primary data stage was the HRS method used by a particular automotive firm, referred to as the Client. In steps 6.1 to 6.5, the associated sampling plan, instrument design, pilot study, data collection method and data processing techniques of the primary data stage are discussed. Secondary data was extracted from the Client in the seventh step of the research process. Steps 7.1 to 7.4 document the sampling plan, extraction method and data analysis of this secondary data. The culmination of this led to the completion of the research process through steps eight to 10. The next section outines the research topic and questions, which is the first step of the research process.

## 5.3. Step one: Research topic and questions

In this step a researcher selects an area of study and formulates research questions in this area (Bryman & Bell, 2015a). During the completion of a masters' dissertation within the automotive industry, the author was exposed to the increased need for artisans both nationally and internationally. The quest to understand what contributes to the successful completion of an apprenticeship programme prompted the formulation of three broad research questions:

1. What is the demographic and educational profile of an apprentice?
2. What is the aptitude and competency profile of an apprentice?
3. What is the impact of HRS in an apprenticeship programme?

## 5.4. Step two: Literature review and research problem

This section begins with a discussion on the types of literature consulted in the review. In section 5.4.2 the research problem is considered with the constructs of the study being identified.

### 5.4.1. Types of literature reviewed

Bless et al. (2013) suggest that through reviewing the current theory and research within the broad topic area, the researcher will acquire knowledge and insight into the field. This will inform the identification and operational description of the research variables, leading to testable hypotheses (Cant et al., 2012; Krishnaswami & Satyaprasad, 2010). This movement from the known to the unknown may result in the discovery of new knowledge within an existing branch of knowledge (Supino & Borer, 2012). In operationalising this aspect of step two, the author reviewed both primary and secondary literature sources. There were three clear themes in the literature review, namely, artisans, apprentices and apprenticeship programmes, the human capital theory and thirdly, HRS.

### 5.4.2. Defining the research problem

Chapter Two reviewed the challenges faced by the national automobile manufacturing sector, such as significant growth, increased technological change and globalisation (Deloitte, 2009; Mashilo, 2010; Nzimande & Patel, 2012). The need for core technical competencies, particularly at the level of technician and artisan, has hence become important (Brown, 2013; merSETA, 2016; Peo, 2013). Chapter Three emphasised that this demand for artisans is, however, not particular to the automotive industry. Rather the need for this scarce and critical skill is a widespread national and international priority. Organisations are struggling to attract, select and retain adequately skilled individuals to fill vacant technical positions (ManpowerGroup, 2016; Prising, 2016; Vass & Raidani, 2016). Furthermore, it was highlighted that this challenge is expected to worsen (Cedefop, 2016a; Jacoby, 2014).

Chapter Four documented the significant role staffing practices fulfil in organisational success and survival (Ployhart, 2006; Schmidt et al., 2016). Specifically, improved screening and selection techniques for apprentices are required to assist in their retention and reduce drop-out rates (Lovender, 2015; Smith & Kemmis, 2013). However, contrary to national and industry needs, the value of staffing is often disregarded by decision-makers. Furthermore, this chapter highlighted the noteworthy decrease in staffing research. Whilst the literature review revealed comprehensive research into vocational training there is currently a lack of information pertaining to the role of staffing practices in apprenticeship recruitment and development (Forsblom et al., 2016; Imdorf & Leemann, 2012). There is also a dearth of studies evaluating the impact of staffing practices (Louw, 2012; Louw-Potgieter, 2012). As discussed in section 1.3.1, it is important to determine the optimal profile of successful apprentices and the most influential methods in their selection. Having provided a brief synopsis of the research problem, the associated objectives and hypotheses are discussed in the next section.

## 5.5. Step three: Research objectives and hypotheses

The primary objective of the study was to evaluate a profiling and selection process for apprentices in the South African automotive industry.

Four secondary objectives were also ascertained:

a) To assess the contribution of the educational profile on apprenticeship programme selection
b) To appraise the value of the generic application profile on apprenticeship programme selection
c) To evaluate the influence of aptitude and teamwork profile on apprenticeship programme selection
d) To assess the impact of interview profile on apprenticeship programme selection.

In order to operationalise these objectives, 13 hypotheses were formulated in the study. These hypotheses are documented in section 1.3.3. A conceptual framework, portraying the hypotheses within each of the selection phases are provided in Appendix A.

## 5.6. Step four: Research paradigm

It is essential for researchers to understand their philosophical approach and assumptions with regards to research (Johnson & Christensen, 2014; Saunders, Lewis, & Thornhill, 2012). The research paradigm adopted will have an ontological and epistemological viewpoint which will influence the researcher's perspective whilst conducting research (Collis & Hussey, 2014; Johnson & Christensen, 2014).

Ontology is specifically concerned with the nature of being and reality. The main issue is whether social units can and should be regarded as objective with a reality external to social actors, or if their reality should be deemed a construction of the social actors' perceptions and actions (Terre Blanche, Durrheim, & Painter, 2006). Two positions on this issue are available, being constructivism and objectivism. From an ontological viewpoint, the objectivistic position was most suited for this study. The primary and secondary objectives of the study aimed to objectively assess the process employed by an automotive industry in their selection of apprentices. However, the author was involved in the design and implementation of this selection process and the apprentice applicants were also assessed and rated by the author and several senior instructors employed by the Client. Whilst using objective criteria to rate these applicants, the author and senior instructors were involved in the data collection. This data can therefore not be regarded as being completely independent of the feelings and opinions of the actors during the selection process. The positioning of this study at the third stage on the continuum of core ontological assumptions is illustrated in Figure 5.2. This positioning accepts reality as a contextual field of information (Collis & Hussey, 2014).

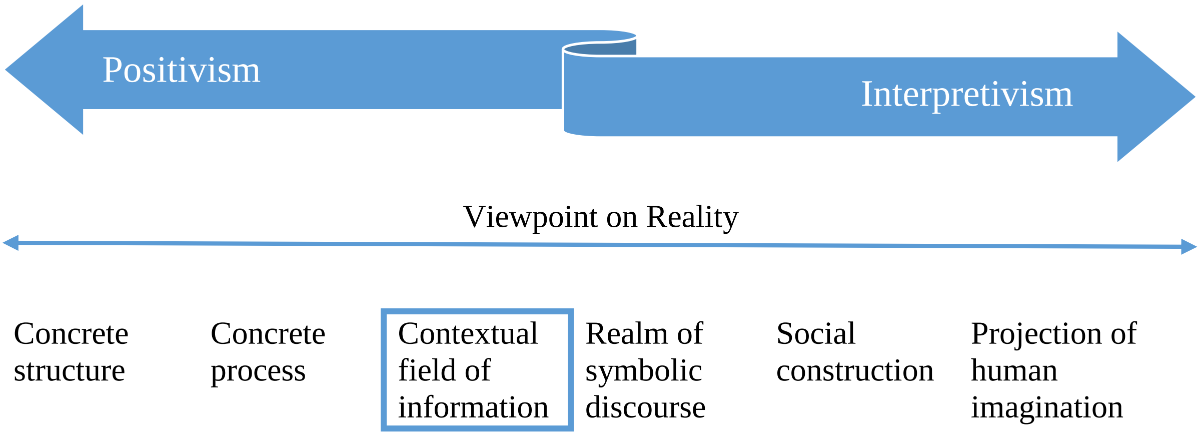


*Figure 5.2.* The core ontological assumption of the study. Adapted from *Business research: A practical guide for undergraduate and postgraduate students* (4th ed.), by J. Collis and R. Hussey, 2014. New York, New York: Palgrave Macmillan. Copyrighted 2014 by Palgrave Macmillan.

Epistemologically, researchers are concerned with the nature of knowledge and what should be regarded as acceptable knowledge within a discipline. A central issue is the degree to which the social world is deemed as being similar in operation (i.e., in terms of ethos, principles and procedures) to that of the natural world (Bryman, 2016). Positivism is the epistemological position that affirms the importance of imitating the natural sciences (Bryman & Bell, 2015a). Positivism advocates for the generation of testable hypotheses that can lead to theories being assessed and explained. This paradigm supports the principles of objectivity and inductivism (Babbie & Mouton, 2012). With its focus on empirical and critical realism, the positivistic paradigm was most suited for this study. The research questions, objectives and hypotheses leaned towards structured measurement with a need for quantification, replicability and objectivity. However, the assessment and rating of the applicants by both the author and senior instructors were meaningful acts and a product of the way they interpret the world. These human actions were therefore subjective and this lends itself towards the interpretivist pole of the continuum depicted in Figure 5.2 (Bryman & Bell, 2015a). Whilst positivism is the predominant paradigm, these subjective acts confirm the positioning of the study at the third stage on the continuum.

## 5.7. Step five: Research design and approach

Section 5.7.1 discusses the explanatory research design adopted for this study and the reasons for this choice. Section 5.7.2 then discusses the quantitative research approach employed.

### 5.7.1. Selection of research design type

The research problem, objectives and hypotheses of this study have been provided in section 5.5. These have given a clear indication of the purpose of the research. With this in mind, as well as the identified positivistic research paradigm, a research design was chosen (Babbie & Mouton, 2012).

Depending on the purpose of a study researchers can adopt various design forms. Within the business and management discipline, three forms are common, namely, exploratory, descriptive and explanatory research (Bless et al., 2013; Bryman & Bell, 2015a; Cant et al., 2012). Explanatory or causal research, unlike the other research design types, aims to discover the cause preceding beliefs, behaviours, events and conditions through testing hypotheses and documenting possible reasons for these phenomena (Babbie & Mouton, 2012; Neuman, 2012). This research design type was selected for this study. The study's objectives and hypotheses aimed to determine whether certain constructs had a significant effect on the selection of applicants onto an apprenticeship programme. This required the evaluation of a structured field study to establish if a change in the value of any of the selection constructs or 'causes' had an effect on the outcome (Cooper & Schindler, 2014).

Other authors use temporal classification to distinguish between research designs (Zikmund et al., 2013). Cross-sectional research seeks to establish patterns of association between variables by collecting data on more than one case, usually at the same point in time. In contrast, longitudinal research seeks to obtain data over a number of years (Bryman & Bell, 2015b). The data is collected several times, usually at the same time of the year in the different years of the study, in order for the results to be comparable. The aim of longitudinal studies is therefore to ascertain if there is a predictable trend in the matter of investigation (Bless et al., 2013). A few longitudinal studies have been completed on artisans and apprenticeship programmes. A large longitudinal administrative dataset, spanning from 1996 to 2010, was used in a study investigating the formal jobs held by Brazilian workers post apprenticeship training (Corseuil, Foguel, Gonzaga, & Ribeiro, 2012). Similar longitudinal data was used to study the career paths of young German apprentices by Von Wachter and Bender (2004) as well as Adda, Dustmann, Meghir and Robin (2006). A French longitudinal study investigated apprentice employment trajectories and the impact of their mobility on their wages post-apprenticeship completion (Lene & Cart, 2018). In the review of the literature (i.e., books, journal articles and on industry-related websites) a longitudinal study done on the outcome of a selection process for apprentices was not found. This study therefore aimed to fill this gap in the literature. With the research design type selected, the next issue within step five of the research process was the decision on research approach, which is discussed in the next section.

### 5.7.2. Identification of research approach

Historically, two broad research approaches, namely, quantitative and qualitative, have been distinguished (Babbie & Mouton, 2012; Collis & Hussey, 2014). Table 5.1 indicates the main differences between these two approaches.

Table 5.1

*Differences between Quantitative and Qualitative Research Approaches*

| | Quantitative | Qualitative |
|---|---|---|
| Ontological orientation | Objectivism | Constructionism |
| Epistemological orientation | Positivism | Interpretivism |
| Orientation to theory | Deductive theory testing | Inductive theory generating |
| Nature of data | Specific | Rich and subjective |
| Data collection techniques | Structured, objective ratings | Unstructured, subjective ratings |

*Note.* Adapted from *Business research methods* (1st ed.), by C. Quinlan, B. Babin, J. Carr, M. Griffen, & W. G. Zikmund, 2015, Hampshire: South-Western Cengage Learning. Copyrighted 2015 by South-Western Cengage Learning.

Table 5.1 indicates that quantitative research follows a deductive orientation, principally concerned with testing theories. This research approach also adopts a positivistic paradigm. Quantitative researchers hold an objective ontological view believing that social reality is objective, external and singular. The epistemological orientation of quantitative researchers is hence towards a singular, objective social reality that is not affected by the act of investigating it (Burns & Bush, 2014; Collis & Hussey, 2014).

The objective of this study was to quantitatively evaluate a selection process for apprentices employed by an automotive firm. Furthermore, the study aimed to establish whether the 13 hypotheses derived from this objective could be proven. To determine variation and examine relationships between variables in a longitudinal research design, quantitative data is required (Quinlan et al., 2015). Furthermore, the nature of the data derived from the structured and objective ratings of the apprenticeship applicants in this study were specific. A quantitative research approach was therefore appropriate for this study.

## 5.8. Step six: Primary data stage

Traditionally, primary data is known as that collected and analysed by the researcher and secondary data being that collected by others and analysed by the researcher (Zikmund et al., 2013). However, Bryman (2016) indicates that there are many scenarios where such a distinction between primary and secondary data collection and analysis is not clear. In this study the author was involved in both the primary and secondary data stages. Her role in these two stages is provided as the research process is discussed in this chapter.

The primary data stage of this study was based on the annual selection process for apprentices employed by the Client. Following an advert placed in a local newspaper and on internal organisational noticeboards, applicants were required to submit the mandatory application documentation via FaxtoMail. The selection process commenced thereafter. This annual recruitment drive is usually conducted during April, with the subsequent five selection phases being conducted from May to November each year. The author is contracted by the Client as a human resource consultant to assist in the design and implementation of this annual selection process. The author's involvement in these five selection phases are clarified in Appendices N and O as well as in the sections that follow.

There were five tasks within step six of the research process. From the first task, documented in section 5.8.1, the sampling plan was realised. The second task involved instrument design, whilst the third task was the implementation of the pilot study. In the fourth task, discussed in section 5.8.4, the data was collected, with the fifth task being preparation and data processing.

### 5.8.1. Step six: Task one - Sampling plan

Having selected a research paradigm, design and approach to follow, the next task is the identification of the elements from which the information will be collected. In order for this to be fulfilled, a sample plan needs to be compiled (Iacobucci & Churchill, 2010). The six aspects followed in developing the primary data sampling plan are presented in Table 5.2 and discussed thereafter.

Table 5.2

*Sampling Plan for the Primary Data Stage of the Study*

| No | Aspect | Intake Year | Description | |
|---|---|---|---|---|
| 1 | Determining the target population | | Apprenticeship-seekers | |
| | • Elements | | Job applicants | |
| | • Sampling unit | | Apprenticeship programme trainees | |
| | • Context | | South Africa | |
| 2 | Timeframe | | May 2011 to November 2017 | |
| 3 | Determine the sampling frame | | Applicant database | |
| 4 | Select sampling techniques | | Non-probability convenience sampling | |
| 5 | Determine the sample size | 2012 | 1 047 candidates | |
| | | 2013 | 1 258 candidates | 3 453 |
| | | 2014 | 1 148 candidates | |
| 6 | Execute the data collection | | Follow the sampling plan | |

*Note.* Adapted from *Marketing research* (7th ed., p. 259), by A. C. Burns & R. F. Bush, 2014, Harlow, England: Pearson Education Limited. Copyrighted 2014 by Pearson Education Limited.

The overall population for the primary data stage of this study were work-seekers, with the target population being applicants for the automotive electrical and millwright apprenticeship trainee positions in SA. The primary sampling frame was generated as part of the annual recruitment process for an apprenticeship programme at the training centre of a automobile plant. The primary sampling frame was hence all the applicants applying for the position of apprenticeship trainee within the Client during the 2012 to 2014 intake years. The timeframe for this sampling was therefore between May 2011 to November 2017.

As indicated in Table 5.2, the primary data stage employed a non-probability convenience sampling technique. As its name implies, convenience sampling entails selecting participants based on their willingness and availability. This technique is regarded as a weaker form of sampling as it is difficult to generalise findings from the sample to the broader population (Gravetter & Forzano, 2015; Hair, Celsi, Money, Samouel, & Page, 2011). However, the availability of the large sample size across the three intake years served as justification for the use of this sampling technique (Struwig & Stead, 2013; Zickmund et al., 2013).

In non-probability sampling the sample size is defined by the researcher. Judgement is used to determine the value of the information obtained versus the cost thereof (Burns & Bush, 2014; Cant et al., 2012). To enhance the accuracy of the study's findings, the complete sampling frame constituted the sample size. The sample size of the primary data stage of the study, as depicted in Table 5.2, was 3 453 work-seeking applicants for an apprenticeship programme with the Client. This total sample size was derived across the three intake years. The execution of data collection, aspect six of the sampling plan process, is covered in detail in sections 5.8.3 and 5.8.4.

### 5.8.2. Step six: Task two – Instrument design

Bryman (2016) distinguishes between two techniques used for collecting data, namely structured or unstructured. Table 5.3 documents the six structured instruments designed and/or chosen to be utilised in the primary data stage of the study.

Table 5.3

*Research Instruments used in the Primary Data Stage of the Study*

| Number | Phase | Instrument |
|---|---|---|
| 1 | Two | Secondary Curriculum Vitae Review Screening Guidelines document |
| 2 | Three | DAT sub-tests: Vocabulary, Verbal reasoning, Non-verbal Reasoning, Reading Comprehension, Comparison and Memory |
| 3 | | Trade Aptitude Test Battery sub-tests: Dexterity, Coordination, Assembly, Calculations, Spatial Perception 2-D and Spatial Perception 3-D |
| 4 | | Teamwork Competency Assessment |
| 5 | Four | Planned Behavioural Questionnaire |
| 6 | Five | Trade Test |

A brief overview of each research instrument is provided in the paragraphs that follow. Furthermore, Appendix N provides comprehensive information on each instrument.

#### 5.8.2.1. Research instrument one

The first research instrument, used in the second selection phase, is a structured guideline document for reviewing a CV. The document is provided as Appendix C. Developed by the Client, in consultation with the author, this tool rates a CV on 12 criteria using five-point Likert scales. The criteria include quality of motivational letter and CV, type of secondary education obtained, performance in specific subjects, as well as additional qualifications attained, practical experience and leadership potential.

#### 5.8.2.2. Research instrument two

As indicated in Table 5.3, three research instruments were employed within the third phase of the selection process. The first of these instruments was the DAT-K battery, which assessed the applicants’ general aptitude. This battery consists of nine sub-tests, from which six were chosen for use in this study’s selection process. These were: Vocabulary, Verbal Reasoning, Non-verbal Reasoning, Reading Comprehension, Comparison and Memory. The author proposed this compilation of sub-tests to the Client. Appendix E summarised the aim of these sub-tests, the number of items as well as the allocated timing of each sub-test.

#### 5.8.2.3. Research instrument three

The second instrument used in the third phase of the selection process was the TRAT battery. This battery is comprised of 11 sub-tests, with six being employed in this study. These were: Dexterity, Coordination, Assembly, Calculations, Spatial Perception 2-D and Spatial Perception 3-D. The author recommended these sub-tests to be employed in this selection phase. Appendix F provides a summary of the key differences between these sub-tests in terms of purpose, number of items per sub-test as well as the allocated timing per sub-test.

The DAT-K battery was selected to ascertain the identified general aptitudes and the TRAT battery for the specific techical aptitudes required for an apprentice within the Client. These two psychological test batteries meet the EEA (1998), the EEAA (2013) and the LRA (1995) requirements. These test batteries are registered and approved psychological tests by the Health Professions Council of SA (HPCSA, 2006; 2010).

#### 5.8.2.4. Research instrument four

An AC type tool was the third instrument used in the third phase of the selection process. Nine competencies were assessed as outlined in Appendix G. Given the lack of these competencies in previous applicants and in apprentices within previous intake years, the Client specifically requested the assessment of these nine skills. The author designed and employed competency-based assessment techniques and guidelines to develop a number of suitable exercises to assess these competencies (Foxcroft & Roodt, 2013). Applicants were observed and scored by trained assessors using a five-point Likert scale ranging from significantly below average to significantly above average.

#### 5.8.2.5. Research instrument five

In the fourth phase of the selection process another internal instrument was developed by the Client in consultation with the author. The Planned Behavioural Questionnaire, provided as Appendix D, was used in the facilitation of the interviews of the applicants. This document details seven standard category questions, with three to four options per category. The applicants’ responses to these structured questions were scored on a four-point Likert scale. Within the eighth category, five general post-interview impression ratings were required, with the applicants again being rated on a four-point Likert scale.

#### 5.8.2.6. Research instrument six

The sixth and final instrument used in this study is the national trade test. Table 5.3 indicates that the trade test was operationalised in phase five of the selection process. All trade tests in SA are approved by section 26D (4) of the SDA (1998) and outlined in the Trade Test Regulations document. They are also regulated by the QCTO. All trade tests are integrated and simulated summative assessments that can only be conducted by an accredited trade test centre (Government Gazette, 2015b). The internally designed assessments for the automotive electrical and millwright apprenticeships have been approved by the QCTO and the Client is an accredited trade test centre for these specific trades. There is a practical as well as a theoretical aspect to these assessments (Anonymous within the Client, personal communication, February 7, 2018).

### 5.8.3. Step six: Task three – Pilot study

According to Quinlan (2011), a pilot study indicates the rigour and validity of the research instruments selected to be employed in a study. One pilot test was conducted with the initial five research instruments employed in the primary data stage of this study. This was implemented from May to November 2011. The participants of this pilot study were 1 047 job applicants for the 2012 apprenticeship programme intake year. The author, with guidance from the senior instructors at the Client, completed the scoring of the Secondary CV Review Screening Guidelines documents used in the second phase of the pilot study. The author, a registered Psychometrist (Independent/Private Practice) administered and scored the third stage of the selection process. The fourth phase was conducted by the senior instructors at the Client, with observation and moderation by the author. The pilot study confirmed the face validity of the selected research instruments, and was thus conducted as is, for the next two intake years.

### 5.8.4. Step six: Task four - Data collection

Data collection is the process of gathering information in a systematic and logical manner (Ruane, 2015). The methodical process followed in the collection of this primary type of data is documented in Appendix O. This provides detail on the administration and scoring of the five phases of the selection process. The role of the author in this primary data collection is highlighted in the paragraphs that follow.

For the 2013 intake year, the author screened and scored all of the applications using the Secondary CV Review Screening Guidelines document. The author also administered and scored the third stage of the selection process. However, the fourth phase was solely conducted by the senior instructors at the Client. The senior instructors and the author screened the applications in the second phase for the 2014 intake year. The author completed approximately half of the applications with the rest being completed by five senior instructors. Once again, the third phase was conducted by the author and the fourth phase by the senior instructors.

#### 5.8.5. Step six: Task five - Data processing

After collection, the data needs to be transformed into a format that will assist in answering the questions posed. The raw data needed to be mined in order to extract the specific information required (Zikmund et al., 2013). The data processing resulted in two groups, either successful or rejected. This data was then captured onto a Microsoft Excel spreadsheet in May each year by the in-house administrators. All the information on each applicant (i.e., whether successful in this phase or rejected) was captured, including the reason(s) for their rejection from this phase. Post the scoring of the CVs in phase two, the applications were sorted into five groups based on the total percentage score attained on the Secondary CV Review Screening documents. These groups were created per apprenticeship type. Applicants in the top scoring categories progressed to the next phase. The overall decision plus the scores attained by each applicant on the 12 criteria in this CV review were captured onto the same Microsoft Excel spreadsheet used in phase one. Whether successful or rejected in this phase, the information pertaining to all the applicants as well as the reason(s) for their rejection were captured. Information obtained from phase two was managed in June annually.

Following phase three, the stanine scores attained for each aptitude sub-test and the raw scores for the teamwork competency assessment were captured, per applicant, on a separate Excel spreadsheet by the author. Reviewing all the information provided across the various tools used in this phase, the author used clinical judgement to determine the suitability of each applicant and captured a recommendation category for each applicant. Reason(s) for rejection were also captured on this spreadsheet. Processing and capturing of the phase three data was done in July each year. Data from phase four was handled annually between August and September. The information, scores and judgements attained per applicant in phase four remained on the hard copy interview sheets and were not yet electronically captured. Two groups (i.e., successful or rejected) were created per apprenticeship type.

The data from phases one through four were processed in the year prior to the apprenticeship intake. The data stemming from the completion of phase five, the national trade test, was processed at apprenticeship programme completion, usually four years later. The trade test information was on hard copy certificates and were not electronically captured.

This data processing stage resulted in the sample realisation rate depicted in Table 5.4. This table presents the total number of applicants that entered phase one in the three years of apprenticeship intake investigated in this study. For the 2012 intake year, 1 047 applicants applied for the advertised apprenticeship positions. With successive fall-outs per phase, 28 individuals or 2.7% of the initial applicants sat for their apprenticeship programme trade test in 2015. A similar trend occurred for the 2013 and 2014 intake years. More applicants applied for the 2013 apprenticeship intake, with 1 258 applicants entering phase one. Post the successive hurdles of the selection process, 22 individuals from the 2013 intake year sat for their respective apprenticeship trade test in 2016. This was an intake drop of one percent on the previous years' intake numbers. Whilst less applicants applied for the 2014 intake, more apprenticeship positions were available in this year. From the initial 1 148 applicants entering phase one in this year, 27 or 2.4% were successful in their application and completed the respective trade test of their apprenticeship in 2017.

Table 5.4

*Sample Realisation Rate in the Primary Data Stage of the Study*

| Intake Year | Number of Initial Applicants | Number of Candidates that Wrote the Trade Test | Percentage that Wrote the Trade Test |
|---|---|---|---|
| 2012 | 1 047 | 28 | 2.7% |
| 2013 | 1 258 | 22 | 1.7% |
| 2014 | 1 148 | 27 | 2.4% |
| Totals | 3 453 | 77 | 2.2% |

Sections 5.8.1 to 5.8.5 have documented the five tasks covered in the primary data stage of the research process. The next section documents the tasks fulfilled in the seventh step of the research process, being the secondary data stage of the study.

### 5.9. Step seven: Secondary data stage

The primary data had been collected as part of the selection process for apprentices by the Client. This primary data was used by the Client to analyse trends and to make predictions regarding future apprenticeship intakes. This data was readily available to the author to use. Through further research the author was able to realise the benefits of this secondary data. These included high-quality data, the opportunity for longitudinal and subset analysis as well as the advantages of new interpretations from the re-analysis of the data (Bryman & Bell, 2015b). Sections 5.9.1 to 5.9.4 outline the four tasks implemented by the author to gather this secondary data for analysis purposes. Sampling, data collection and the final sample realisation rate are also documented in these sections.

#### 5.9.1. Step seven: Task one - Sampling plan

The sampling plan for the secondary data stage was very similar to that indicated for the primary data stage, as set out in Table 5.2. The elements, sampling unit and context of the target population were the same, being applicants for an apprenticeship programme in SA. However, the sampling timeframe was different in that the secondary data stage of the study took place during February to May 2018, whilst the primary data stage occurred during 2011 to 2017.

The sampling frame used in the secondary data stage was the same as used in the primary stage, namely, the applicant database. A non-probability convenience sampling technique was also used for the secondary data stage. This meant that every element of the sampling frame became part of the sample.

#### 5.9.2. Step seven: Task two – Data extraction

A large amount of information was available from the Client. As highlighted in the section 5.9, there are several benefits to using secondary data. However, there are also several disadvantages. One of these disadvantages is the complexity of the data. The large volume of information can be problematic to manage (Bryman & Bell, 2015b). The subject matter of secondary data may also not be consistent with the researcher’s needs and problem definition (Zikmund et al., 2013). To avoid these potential disadvantages certain information from the data was regarded as necessary for further secondary data extraction. This data was aligned to the research questions and objectives of the study as well as the hypotheses posed. The categories of information and detail on the 19 constructs selected for secondary data analysis purposes are documented per phase in Table 5.5 and discussed thereafter.

Table 5.5

*Detail on the Information Extracted for Secondary Data Analysis Purposes*

| Phase | Category | Construct Description | Measurement Level |
|---|---|---|---|
| 1 | Preliminary curriculum | Apprenticeship type | Nominal |
| | vitae review | Recommendation status | Ordinal |
| 2 | Secondary curriculum | Secondary education type | Nominal |
| | vitae review | Mathematics performance | Ratio |
| | | Science performance | Ratio |
| | | Motivational letter | Ordinal |
| | | Curriculum vitae | Ordinal |
| | | Practical experience | Ordinal |
| | | Qualification | Ordinal |
| | | Leadership potential | Ordinal |
| | | Recommendation status | Ordinal |
| 3 | Psychological | General aptitude | Interval |
| | assessment | Technical aptitude | Interval |
| | | Teamwork competence | Interval |
| | | Recommendation status | Ordinal |
| 4 | Panel interview | Standard interview | Interval |
| | | General impression | Interval |
| | | Recommendation status | Ordinal |
| 5 | Trade test | Competency level | Ordinal |

An understanding of the measurement level of these 19 constructs is important. The purpose of measurement is two-fold, namely categorisation and qualification. Within this, four forms of relationship can be derived from numbers that have more than two categories. These are termed levels of measurement. They are: nominal or categorical, ordinal, interval and ratio. Each level has different properties and this has implications for the statistical tests that can be operationalised on the data (Bryman & Bell, 2015b). The measurement level of the information employed in the secondary data stage has also been provided in Table 5.5 and will be described in the paragraphs that follow.

From the first phase of the selection process, the information regarding whether the applicants were recommended or not to progress to phase two as well as the type of apprenticeship the applicants had applied for were chosen for further analysis. This information needed to be extracted from the three Microsoft Excel spreadsheets used per intake year to capture the phase one results. This information needed to be retrieved from the Client’s intranet back-up system. Being rank-ordered, this information is ordinal in nature.

Nine constructs were selected from phase two for secondary data analysis. This information was initially collected from the Secondary CV Review Screening documents. This information needed to be retrieved from the same three spreadsheets used per year to capture the phase one information. This information also needed to be retrieved and extracted from the Client. The applicant’s type of secondary education is a nominal measure, with the mathematics and science performance being ratio measures. As portrayed in Table 5.5, the other six constructs analysed from this phase were ordinal in nature.

From the third phase, the psychological assessment, four constructs were identified for secondary analysis. This information was available on three different spreadsheets, one per intake year. These spreadsheets were electronically stored by the author and she needed to retrieve them from her archiving system for analysis purposes. Three constructs pertaining to performance in these assessments were selected, namely, average general aptitude, average technical aptitude and average teamwork competence. These three are interval measures. The overall recommendation from this phase is an ordinal measure.

The overall ratings achieved in the two categories within the interview phase are interval measures. The recommendation status (i.e., either recommended or not) construct from the fourth phase was an ordinal measurement. This information was available in hard copy format, archived in the Client’s storeroom. The boxes of scripts were retrieved and captured electronically onto three Microsoft Excel spreadsheets, one per intake year. The information extracted was taken from the interview sheets that held the combined ratings of the two instructors. The trade test result information was also archived on the company’s intranet system and needed to be retrieved and captured. The information was taken from the trade test reports and captured onto three spreadsheets, one per intake year. This information was ordinal in nature.

The secondary data on the five selection phases obtained from the Client was available in various formats. The data subsequently needed to be prepared for data analysis purposes. This required several aspects to be completed, namely, coding, editing and tabulation (Zikmund et al, 2013). The fulfilment of these aspects is documented in the sections that follow. Section 5.9.2.1 discusses the initial preparation of this data with section 5.9.2.2 considering the data coding method used. Section 5.9.2.3 describes the editing mechanisms employed and 5.9.2.4 the sample realisation rate.

#### 5.9.2.1. Data preparation

The data had been captured onto four different sets of spreadsheets, per intake year. Spreadsheets A1, A2 and A3 contained the information from phase one and two, a spreadsheet per intake year. Spreadsheets B1, B2 and B3 had the third phase assessment results, a spreadsheet per intake year. Spreadsheets C1, C2 and C3 contained the interview phase results and spreadsheets D1, D2 and D3 the trade test results, a spreadsheet per intake year. These 12 spreadsheets were merged into one consolidated spreadsheet to facilitate further data preparation and analysis.

#### 5.9.2.2. Data coding

The next step in data preparation is coding. Coding is the process of applying rules to data in order to transform the information from one format to another (Terre Blanche et al., 2006). A data code book was generated to ensure the accurate assignment of values to the data collected (Burns & Bush, 2014). It was determined that the racial categories from the national 2011 census, namely, Black African, Coloured, Indian/Asian and White, were to be applied. Furthermore, the age categories from the same census were slightly manipulated for implementation in this study (Lehohla, 2015). The naming regulations for preparing a codebook, stipulated within the technical manual of the Statistical Package for the Social Sciences (SPSS), were also followed (Pallant, 2013).

#### 5.9.2.3. Data editing

Having generated the code regulations, the data was ready for the cleansing and sorting process to be applied. For the 2012 intake, there were initially 1 047 applicants that were entered as having applied for the apprenticeship training programme. However, during data validation, seven duplicate applications were found. These seven duplicate applications were cleansed from the data. It was also established whilst working through the hard copy documentation that one applicant had died during the time of the selection process. Whilst there was phase three assessment results captured, the phase two results of three applicants could not be found and these three were also cleansed from the data. This editing resulted in 1 036 applicants being the total 2012 sample size for the study.

Six duplicate applications were found in the initial 2013 intake data. After cleansing these from the spreadsheet, the intake numbers were reduced from 1 258 to 1 252 applicants. Two applicants were also cleansed from the data as there was no phase two information captured for them, despite there being phase three assessment results for them. This cleansing resulted in 1 250 constituting the total 2013 intake sample for the study.

Eight duplicate applications were found in the 2014 intake data and were cleansed from the data. This resulted in the initial total changing from 1 148 to 1 140 applicants entering phase one. However, a further 14 entries were terminated from the data after cleansing. One row of data contained incomplete information and was deleted. Thirteen applicants were cleansed from the data as there was no recorded phase two results for them, despite there being phase three assessment results for them. This editing resulted in 1 126 applicants being the total 2014 sample size for the study. In the section that follows detail is provided on the final sample size realised for this study.

#### 5.9.2.4. Data tabulation

Tabulation is counting the number of cases that are applicable to each category (Zikmund et al., 2013). This aspect was operationalised through the generation of a detailed sample realisation table provided in Appendix P. This table provides the survival rate per phase of the selection process, per intake year, which are discussed in the paragraphs that follow.

Of the 1 036 applicants that applied for the 2012 apprenticeship programme intake, 484 were successful in phase one. Of these, 100 were selected to progress from phase two into the assessment phase. Of the 40 successful in this third phase and interviewed, thirty were successful and were initially accepted onto the apprenticeship programme. However, one applicant had already gained work elsewhere and did not accept the position. Another applicant failed the medical testing and was therefore not accepted onto the programme. This resulted in 28 apprentices commencing their apprenticeship in 2012 and passing their trade test in 2015.

For the 2013 apprenticeship programme intake, 1 250 applicants applied and 493 of these were successful in the first screening phase. Following phase two 119 applicants remained, with a significant drop-out in the third phase. Only 27 applicants were considered for the interview phase with 22 of these being considered eligible for commencement of the apprenticeship programme. In 2016, 21 of these apprentices passed the trade test. Despite numerous attempts, one apprentice was unable to prove competence.

There were 1 126 applications submitted for the 2014 apprenticeship programme intake. Of the 519 successful in phase one, 205 were eligible for the assessment phase. Seventy-six applicants were interviewed in the fourth phase, with 28 being initially accepted onto the apprenticeship programme. However, one of these applicants failed the medical testing. This resulted in 27 apprentices commencing the programme in 2014 and passing their trade test in 2017.

Data tabulation is further operationalised in the summary sample realisation rate provided in Table 5.6. Taking into account the terminations outlined in the previous paragraphs, this table summarises the total number of applicants entering and surviving each selection phase across the three intake years.

Table 5.6

*Summary Sample Realisation Rate per Phase: 2012 - 2014*

| Selection Phase | Total Number Entering the Selection Phase | Total Number Surviving the Selection Phase | Percentage Surviving the Selection Phase |
|---|---|---|---|
| 1 | 3 412 | 1 496 | 43.8% |
| 2 | 1 496 | 424 | 28.3% |
| 3 | 424 | 143 | 33.7% |
| 4 | 143 | 80 | 55.9% |
| 5 | 77 | 76 | 98.7% |

Thus far the two initial tasks of the secondary data stage have been discussed. The first task was realising the sampling plan. The second task was completing the four aspects of data extraction employed within the secondary data. The section that follows considers the third task, namely, the operationalisation of the 19 constructs investigated in the study.

### 5.9.3. Step seven: Task three – Operationalisation of the constructs

Table 5.5, in section 5.9.2, provided initial details of the 19 constructs extracted for secondary analysis purposes. Prior to actual analysis these constructs needed to be tactically operationalised. This aspect is documented, per selection phase, in the five sections that follow.

#### 5.9.3.1. Operationalisation of the phase one constructs

Two constructs were extracted from phase one. Applicants were required to indicate the type of apprenticeship applied for on their motivational letter. Furthermore, this phase involved determining if the required documentation had been submitted and whether the minimum educational requirements had been achieved. If the applicants complied with these requirements they were recommended into phase two.

#### 5.9.3.2. Operationalisation of the phase two constructs

Nine constructs from phase two were extracted for further analysis. This phase pertains to the information gained from the Secondary Curriculum Vitae Review document. The operationalisation of these constructs are indicated in Table 5.7.

The mathematics and science performance of the applicants were operationalised through the percentage obtained for these subjects in their secondary education. Five categories were used to rate the quality of the motivational letters and CVs submitted by the applicants. The practical experience construct was operationalised through including high school exposure, hands-on experience (e.g., fixing home appliances) and actual work experience. A higher rating was given to applicants that had experience related to the apprenticehip type applied for. The level of qualification construct took into account the age of the applicants and the qualifications attained by the applicants, specifically relevant to the apprenticeship applied for. The leadership potential construct also considered age and the leadership positions the applicants had documented in their CV. The latter three constructs were operationalised using the rating categories indicated in Table 5.7. Finally, the survival or termination of the applicants in phase two were clarified through the recommendation status.

Table 5.7

*Operationalisation of Phase Two Constructs*

| Construct | Description | Rating Categories | Rating Range |
|---|---|---|---|
| Secondary education type | Type | 2 | Technical or non-technical |
| Mathematics performance | Percentage | 5 | 1-19% to 80+% |
| Science performance | obtained | 5 | |
| Motivational letter | Quality of | 5 | Well below average to |
| Curriculum vitae | submitted documents | 5 | outstanding |
| Practical experience | Amount and | 3 | None to credible |
| Qualification | quality obtained | 5 | Below average to exceptional |
| Leadership potential | | 3 | Below average to above average |
| Recommendation status | Survival or termination | 2 | Yes or no |

Having operationalised the constructs from phase one and two, the next section summarises the operationalisation of the constructs within the psychological phase of the selection process.

**5.9.3.3. Operationalisation of the phase three constructs**

There were four constructs extracted for further analysis from phase three. Table 5.8 provides a description of these constructs as well as the number and range of rating categories used. The scores obtained by the applicants in the six general aptitudes were averaged and rated according to nine categories indicated in Table 5.8. The same practice was used for the six technical aptitudes and the nine teamwork competencies.

Table 5.8

*Operationalisation of Phase Three Constructs*

| Construct | Description | Rating Categories | Rating Range |
|---|---|---|---|
| General aptitude | Six aptitudes: Vocabulary, Verbal Reasoning, Non-verbal Reasoning, Reading Comprehension, Comparison and Memory | 9 | Significantly below average to outstanding |
| Technical aptitude | Six aptitudes: Dexterity, Coordination, Assembly, Calculations, Spatial Perception 2-D and 3-D | 9 | Significantly below average to outstanding |
| Teamwork competence | Nine competencies: Assertiveness, Conflict Management, Feedback, Influence, Initiative, Listening, Questioning, Problem-solving and Teamwork | 4 | Significant development area to above average area |
| Recommendation status | Survival or termination | 2 | Yes or no |

Phase three was concluded through a recommendation status being allocated to each applicant. This resulted in the applicant either surviving or being terminated from the selection phase. The Client instructed the author to prioritise, in descending order, the teamwork competence, the technical aptitude and the general aptitudes demonstrated by the applicant when making this recommendation.

#### 5.9.3.4. Operationalisation of the phase four constructs

Three constructs were extracted for further analysis from phase four, the interview selection phase. Table 5.9 indicates the details of these three constructs. Appendices D and N provide specifics on the questions asked, items per question, criteria, rating categories and range thereof. Finally, the survival or termination of the applicants in phase four were confirmed through the recommendation status obtained.

Table 5.9

*Operationalisation of Phase Four Constructs*

| Construct | Description | Rating Categories | Rating Range |
|---|---|---|---|
| Standard interview | Seven standard questions: Initiative, Practical Learning, Problem-solving, Quality Orientation, Teamwork, Motivational Fit, Buy-time Questions | 4 | Well below average to excellent |
| General impression | Five criteria: Presentability, Communication, Understanding, Culture and Task Fit, Punctuality | 4 | Well below average to excellent |
| Recommendation status | Survival or termination | 2 | Yes or no |

Having survived the apprenticeship selection process, the applicants completed the apprenticeship programme and were required to sit for the national trade test. Their potential results in this assessment are operationalised in the section that follows.

#### 5.9.3.5. Operationalisation of the phase five constructs

One construct was extracted for further analysis from phase five. Applicants were either rated as competent or not on the trade test.

### 5.9.4. Step seven: Task four – Data analysis

According to Quinlan et al., (2015), data analysis entails breaking down the obtained data into its basic elements in order to gain possible answers to the research questions posed within a study. The five stages of the data analysis strategy implemented in this study are tabulated in Table 5.10.

Data preparation was conducted in stage one. Before data can be analysed, data preparation is required (Gravetter & Forzano, 2015). Sections 5.9.2 and 5.9.3 clarified the processes employed to obtain the sample realisation rate and operationalise the 19 constructs investigated in the study. Stage one of the data analysis strategy depicted in Table 5.10 was fulfilled within the primary data stage.

Table 5.10

*Secondary Data Analysis Strategy*

| Stage | Description | Statistical Procedures Used | Names of Techniques Used |
|---|---|---|---|
| 1 | Data preparation | Not applicable | Importing, coding, editing and tabulating |
| 2 | Description of data | Descriptive statistics | Frequency distributions, cross-tabulations, cumulative percentages, measures of central tendency, specifically medians |
| 3 | Reliability testing | Inferential analysis | Kuder-Richardson formula 14 and 21 |
| 4 | Validity testing | Inferential analysis | Pearson product moment correlation co-efficient and confirmatory factor analysis |
| 5 | Hypotheses testing | Inferential statistics | Survival analysis |

Stage two required the description of the data via the use of various descriptive statistics. The specific procedures used in this study are detailed in section 5.9.4.1, whilst the third stage, substantiating the research instruments' reliability, is outlined in section 5.9.4.2. The fourth stage of the data analysis strategy, confirming the validity of the instruments, is discussed in section 5.9.4.3, with the last stage, the assessment of the research hypotheses, being considered in section 5.9.4.4.

#### 5.9.4.1. Descriptive statistics

In order to provide a detailed account of the gathered data, descriptive statistics were used. In this part of the data analysis strategy, univariate analysis was employed as one variable was analysed and discussed at a time (Bryman, 2016). Frequency tables were created to indicate the number and percentage of people that belonged to each category of variable discussed (Bryman & Bell, 2015b). The demographic details (i.e., age, race and gender) of the applicants are provided in this format, along with their geographical location, in section 6.2. Frequency distribution tables are also used to indicate the outcomes of the 14 constructs profiled in section 6.4.

Cross-tabulations are able to simultaneously reflect two or more variables that have a few categories each (Zikmund et al., 2013). In section 6.3 this form of descriptive statistic was used to depict the survival rates of the applicants across the five selection phases. Phases one, two and four had two outcomes each, either survival or termination. However, phase three had five outcome values and phase five had four outcome categories.

Another element of descriptive statistics is the distribution of the data. Measures of central tendency summarised and compressed the information to confirm its overall meaning for the study. One type of central tendency measure, namely, the median, was used to précis the ST of the applicants (Hair et al., 2011). In section 6.5, the median STs are provided in tabular format according to the selection phases. The eight constructs within phase two, the three constructs within phase three and the two constructs within phase four are provided in this format.

#### 5.9.4.2. Reliability of measuring instruments

The third aspect of the data analysis strategy necessitates the establishment of reliability within the instruments of the study. Reliability is "the extent to which the observable (or empirical) measures that represent a theoretical concept are accurate and stable over repeated observations" (Bless et al., 2013, p. 221). Five techniques for measuring the reliability of instruments are commonly used. These are: test-retest reliability, parallel-forms reliability, internal consistency, split-halves reliability and inter-rater reliability (Collis & Hussey, 2014; Quinlan et al., 2015). This section discusses the fulfilment of this requirement for the six instruments used in this study.

The purpose of the Secondary CV Review Screening Guidelines document, used in phase one, was to improve objectivity in the screening process. An applicant was independently assessed in part A and B by the author or two senior instructors. The second assessor would therefore provide a double-check on the suitability of the applicant and the judgement made by the first assessor in part A. This would provide inter-rater reliability and thereby avoid subjective judgement and a lack of consistency in decision-making (Bryman & Bell, 2015b).

The two selected aptitude instruments comply with the requirements of the EEA (1998), EEAA (2013) and the LRA (1995). These two aptitude measures are also registered and approved psychological tests by the HPCSA. Furthermore, the reliability status established for these aptitude instruments is outlined in the subsequent paragraphs. Initially, the reliability of the DAT-K sub-tests is deliberated, followed by that of the TRAT measures.

The reliability of the DAT-K sub-tests were established with the aid of the Kuder-Richardson formula 14. This statistic measures the internal consistency of items through averaging all the correlations beteween the items (Vehkalahti, 2000). The reliability coefficients of these DAT-K measures in respect of Grade 12 candidates are indicated in Appendix Q. These coefficients are reasonably consistent with those realised for the Grade 10 and 11 groups. The reliability coefficients of the Vocabulary and Verbal Reasoning sub-tests are on the low side (i.e., at 0.75), however, the reliability of the DAT-K is still regarded as being at an acceptable standard (Coetzee & Vosloo, 2000). Given that the Comparison sub-test is a speed test, the Kuder-Richardson formula 14 was not applicable.

The reliability of the TRAT sub-tests used in this study are tabulated in Appendix R. The reliability of four measures within the TRAT battery were determined by the Kuder-Richardson formula 21. The coefficients range from 0.72 to 0.92 and are regarded as being satisfactory (Taljaard, 1983). The Dexterity and Coordination sub-tests are speed tests and the Kuder-Richardson formula 21 was therefore not applicable.

In terms of the teamwork assessment, also used in phase three, Appendix N outlined the necessity for the assessors conducting this assessment to be trained in its facilitation and scoring. A standardised instruction pack, including a clear scoring sheet, was used. Assessors were also required to regularly engage in standardisation practices, with the author, to ensure similar ratings were consistently obtained across applicant groups. Similarly, Appendix N indicated that two senior instructors should simultaneously interview and independently score an applicant in phase four of the selection process. Following discussion and negotiation, a final score should then be allocated on a third Planned Behavioural Questionnaire document. There is a rigorous quality assurance and verification process inherent within national trade testing, phase five of the selection process. Assessors are required to have specific qualifications and/or experience and their assessment judgements are verified through moderators confirming a sample of the assessor’s decisions (QCTO, 2013). These steps facilitate the inter-rater reliability for these research tools and processes. With the reliability requirements of the six instruments having being clarified, the second aspect of inferential statistics, the validity of these measures, is investigated in the next section.

#### 5.9.4.3. Validity of measuring instruments

In the fourth aspect under consideration within data analysis, the validity of the measuring instruments needed to be confirmed. According to Babbie and Mouton (2012, p. 122), validity is concerned with "the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration". There are several forms of validity that assist researchers to ascertain the success of tools in attaining this criterion. These are face validity, concurrent validity, predictive validity, construct validity, convergent and discriminant validity (Bryman & Bell, 2011).

Face validity refers to the empirical measure accurately reflecting the true meaning of the construct or concept under investigation. This is established through confirmation of common agreement on the measure of a concept (Babbie & Mouton, 2012). Within Appendix N details were provided on the development of the Secondary CV Review Screening Guidelines document and the Planned Behavioural Questionnaire. These instruments were used in phase one and four, respectively, of the selection process. Both of these tools were initially developed, in consultation with the author, by the training centre manager within the Client, based on what was considered valuable criteria for the selection of apprentices within the organisation. Following affirmation from other senior instructors within the training centre these tools were confirmed as valid.

Independent of the test developers the content validity of the DAT-K battery was confirmed by a committee of experts. The construct validity of the sub-tests was confirmed by the test developers. The established predictive validity of the six DAT-K sub-tests used in this study are recorded in Appendix Q. The significant Pearson product moment correlation coefficients realised between the sub-tests and two year-end school subject results, namely, English and mathematics, are provided. For the Vocabulary, Reading Comprehension, Verbal and Non-verbal Reasoning measures, correlations with a $p$-value $\leq .01$ were established for both these subjects. The Comparison sub-test obtained a correlation with a $p$-value of $\leq .05$ for English and a correlation with a $p$-value $\leq .01$ for mathematics. The Memory sub-test obtained a correlation with a $p$-value of $\leq .01$ for English and a correlation with a $p$-value $\leq .05$ for mathematics (Coetzee & Vosloo, 2000).

Whilst the TRAT battery manual specifically mentions that no validity data was available at the time of printing, it also indicates that a comprehensive validity investigation was planned (Taljaard, 1983). Subsequent to following-up on this issue it was confirmed that this validation study had still not been done (F. Kriek, personal communication, March 9, 2018). Nevertheless, the TRAT battery is a registered and approved psychological test (HPCSA, 2010). Given the status of the test it was agreed that the information gleaned from this instrument could still be utilised in this study.

Prior to the implementation of the teamwork assessment, the Client's training centre manager confirmed to the author that the nine competencies, listed in Appendix G, were required by apprentices. Furthermore, as part of the pilot study, this manager also observed the initial teamwork exercises conducted to confirm whether the exercises were measuring the teamwork competencies required by the firm and at the required complexity level. Therefore, as a subject matter expert, this manager endorsed the face validity of the teamwork assessment.

In order to become an accredited assessment centre of artisan training, providers are required to submit their curricula for evaluation and record keeping to the NAMB. Failure to do this can result in forfeiture of the accreditation status awarded to a provider (Government Gazette, 2015b). This facilitates the establishment of the curriculum's face validity. Furthermore, NAMB verifies all trade test results, ensuring that the applicable moderation criteria and guidelines have been adhered to (QCTO, 2013). This enables the body to confirm the convergent and discriminant validity of these assessments. Having confirmed the reliability and validity of the six research instruments, the next section outlines that the data analysis techniques to be employed for the assessment of the hypotheses.

#### 5.9.4.4. Assessment of research hypotheses

The 13 hypotheses of the study were provided in section 1.3.3. To assess these hypotheses, draw inferences and make predictions concerning the sample, inferential statistics were employed (Quinlan, 2011). The SPSS software package was used for statistical analyses. Within this package a type of regression analysis, named the survival analysis procedure, was used. This is the "analysis of time-to-event data" (Kartsonaki, 2016, p. 263). This statistical procedure describes the data from an origin point to a fixed endpoint in time, known as the measurement window (Hosmer et al., 2011; Morita et al., 1993). Table 5.11 provides explanations of the key survival analysis terms used in Chapters Six, Seven and Eight pertaining to the survival analysis of the applicants.

Table 5.11

*Explanation of Survival Analysis Terms*

| Term | Explanation |
|---|---|
| Hazard | The event of interest |
| Hazard rate | Estimate of experiencing the terminal event during the interval |
| Interval | The term could be replaced with the word ‘phase’ for this thesis |
| Interval start time | The beginning value for each interval |
| Number withdrawing during interval | The number of censored cases in this interval |
| Number exposed to risk | The number of surviving cases minus one half the censored cases |
| Number of terminal events | The number of cases that were not successful in this interval. |
| Proportion terminating | The ratio of terminal events to the number exposed to risk |
| Proportion surviving | One minus the proportion terminating |
| Cumulative proportion surviving at end of interval | The proportion of cases surviving from the start of the table to the end of the interval |
| Probability density | An estimate of the probability of experiencing the terminal event during the interval. Higher value means higher probability of failure. |

*Note.* Adapted from *Applied survival analysis: Regression modelling of time-to-event data* (2nd ed.), by D. W. Hosmer, S. Lemeshow, & S. May, 2011, Chichester: John Wiley & Sons. Copyrighted 2018 by John Wiley & Sons, Inc.

Survival analysis is widely used within the medical field. Studies abound on the survival rates of patients post, amongst others, the diagnosis of tuberculosis, cancer and heart disease as well as the time until death of the elderly, those with heart transplants and neurological diseases (Agarwal, 2012; Ajagbe, Kabair, & O’Connor, 2014; Barraclough et al., 2009). However, Singh and Mukhopadhyay (2011) point out that survival analysis is also increasingly being used to predict the onset of areas outside the medical field including the onset of stock market crashes, earthquakes and the reliability of military equipment. Shakar and Hűllermeier (2014) used the survival analysis technique to study data streams obtained from earthquakes and Twitter. Chung, Schmidt, Witte and Witte (1991) documented the application of survival analysis in criminology, specifically in predicting the time until recidivism amongst prison releasees.

This procedure was employed to analyse the progression of the applicants through the five phases or hazards of the selection process. This statistical procedure was useful in this study as it facilitated an understanding of the applicant drop-out rate per phase in the selection process. The assumption of survival analysis is that the probability of the event of interest (i.e., being successful or not in a selection phase) occurring depends only on time. It is the evaluation that occurs at a particular phase that results in the applicant being successful or not. Cases that enter the study at different times should then behave similarly (Hosmer et al., 2011).

The Gehan-Wilcoxon proportional hazards statistical tool provided an indication of the survival probability of the applicants, that is, their likelihood of staying beyond a specific time or phase implementation (Austin, 2017; Morita et al., 1993). The Gehan-Wilcoxon statistic, a linear-rank statistic, is a non-parametric paired differenced statistical test. It compares related or matched samples, or repeated measurements on a single sample to compare the survival distribution amongst the groups and to determine if the population mean ranks differ. The test statistic is based on the differences in group mean scores and ascertains if two or more samples were selected from populations with the same distribution (Lou & Lan, 1998). The statistical significance level was set at .05.

Within survival analysis, life tables are the descriptive procedure used to examine the distribution of time-to-event variables. Life tables subdivide the period of observation into smaller time intervals to estimate the probability of survival for each hazard. When testing hypotheses, a comparison of the distribution of levels (e.g., probability density value) across the different categories of the factor variable is useful (Hosmer et al., 2011). Life tables provide the survival function of candidates without controlling for any factor variable or hazard. Any point on the survival curve shows the probability that the candidate will remain under consideration post the phase (Hosmer et al., 2011).

Section 5.9.2 indicated that 19 constructs were extracted from the primary data for secondary analysis purposes. Thirteen of these 19 constructs pertained to the hypotheses of the study. In section 6.6 life tables are used to depict the survival function of the applicants across these 13 constructs. The findings derived from the life tables, and the associated descriptive statistics, are then discussed per selection phase in Chapter Seven. In section 6.6.14 the life table depicting the overall selection process as well as the associated survival chart are offered and then discussed in section 7.8. This section has detailed the data analysis strategy employed in the study. The sixth step in the research process has hence been fulfilled. The following section document steps eight to 10 of the research process.

### 5.10. Step eight: Interpretation of results

This step in the research process pertains to reviewing the findings from the statistical analysis with the view to drawing potential answers to the initial research questions posed in step one. The reliability and validity of these findings in providing these answers is a vital component of this step (Bless et al., 2013). Both of these issues are accomplished in Chapters Six and Seven of this document.

According to the definition of evaluation provided in section 1.6, this action involves the judgement or determination of the merit of something (Louw-Potgieter 2012; Rossi, Lipsey, & Freeman, 2004). Section 4.5.1 discussed the challenge of sporadic evaluation studies investigating the impact of HR staffing practices. The step-wise model of evaluation, developed by Rossi et al. (2004), can be used to evaluate HR practices. The five-step hierarchy assesses the need for the programme, the design and theory, process and implementation and fourthly, outcome or impact. The final step is an evaluation of the cost and efficiency of the programme. All five aspects can be evaluated simultaneously or they can be isolated and evaluated independently of one another. In a review of the available research, Liu et al. (2007) found fifteen studies that evaluated the effect or impact of various staffing practices on performance, thus using the fourth step of the five-step hierarchical model. Outcomes refers to some form of change, either in the short, medium or long-term. Impact, however, denotes a causal relationship. When evaluating HR activities using this fourth step, one is determining whether the HR practice has resulted in the change or not (Rossi et al., 2004).

Monitoring or evaluation tracks the implementation, outcomes or both of a practice over time. In order to do this, the best representation of the outcome, or indicators, need to be evaluated (Kusek & Rist, 2004). With regard to the selection of apprentices, the pass rate of these students could be a valuable measure of the impact of the staffing practice. In section 7.8

the trade test pass rate achieved by the 77 apprentices within the study was compared to the baseline indicator proposed by government and the pass rate documented in other industry-related reports.

### 5.11. Step nine: Conclusions and recommendations

This step requires the development of conclusions and recommendations being drawn from the interpretation of the results (Bryman & Bell, 2015b). Thirteen conclusions were derived from the primary and secondary objectives as well as the various hypotheses within the study. Eleven recommendations, to various stakeholders, were then extracted from these conclusions. The fulfilment of the requirements of this step are provided in Chapter Eight of this document.

### 5.12. Step ten: Dissemination of results

This step invites the presentation and sharing of the results, conclusions and recommendations derived from the research to be shared in various formats (Bless et al., 2013). The completion of this thesis is the first realisation of this step. Conference papers and journal articles are anticipated further outcomes of this dissemination.

### 5.13. Ethical considerations

Ethics is a broad term, widely used by various individuals in quite different contexts. Within research, though, the concept of ethics offers guidelines and behavioural expectations regarding the correct conduct towards the various stakeholders involved in any study (Ruane, 2015). In this study, ethical considerations were realised in various ways with the different stakeholders in the research process. This study was subject to research ethics approval procedures at the Nelson Mandela University. Ethical clearance was gained from the relevant bodies as it was understood that no harmful or adverse effects would be experienced by the applicants. This approval is documented in Appendix J.

In terms of the right to confidentiality, permission to gain access to the primary data used in this study was obtained from the Client. With the names excluded, the approval from this sponsor to conduct the research is documented in Appendix I. This aspect also highlights the right of anonymity of this sponsor. Permission to use the applicants' data was obtained through requesting the applicants to complete a consent form (Appendix H). This consent form informed the applicants of the nature of the research and highlighted that they were under no obligation to participate in the study. These two steps fulfilled the right to anonymity and the right to voluntary participation (Bryman & Bell, 2015a; Quinlan et al., 2015).

Several steps were taken to ensure the privacy of the data gained from the applicants was protected. Researchers need to ensure that the personal information of respondents is not publically disclosed, without the consent of these individuals (Ruane, 2015). Besides obtaining consent from the applicants to use their data in this study, the capturing and transformation of the data was done on-site at the Client. A specific securely locked venue was allocated to the author for this purpose and all archived and other data had to remain within this venue. The final spreadsheet sent for analysis purposes did not include any identifying information, thereby ensuring the privacy and anonymity of the applicants.

According to Zikmund et al. (2013), researchers need to guard against the misrepresentation of their research results. The author therefore made use of an experienced statistician to ensure the integrity of the results presented in Chapter Six and discussed in Chapter Seven and Eight. Neither of the two supervisors of this thesis are involved in the author's consulting business and there was hence no conflict of interest.

### 5.14. Summary

This chapter has provided a detailed account of the 10 steps of the research process followed in this study. The research topic and related questions have been indicated along with a refinement of the research problem. The selected research paradigm, design and approach have been considered and the motivation for their selection provided. The sampling plan employed as well as the rationale for the development and/or choice of the research instruments were discussed. The methods employed in the primary and secondary data collection inherent in the study have been documented as well as the data analysis strategy. The ethical issues requiring consideration in this study have also been outlined.

Whilst a brief account of steps eight to 10 of the research process have been indicated in this chapter, the chapters that follow provide a detailed report on these. Chapter Six presents the descriptive and inferential findings of the study, with Chapter Seven interpreting these findings. Chapter Eight then draws conclusions and recommendations from these findings.

# CHAPTER SIX
# PRESENTATION OF EMPIRICAL FINDINGS

## 6.1. Introduction

Chapter Five documented the 10 steps in the research process followed for this study. Chapter Six commences the fulfilment of step seven in this process through the presentation and interpretation of the empirical findings obtained from the data analysis. The initial four sections of this chapter offer the findings obtained from the descriptive statistics. The demographic profile of the applicants is clarified in section 6.2 with the survival rate outcomes for the five selection phases examined in section 6.3. The profile results of the applications from the five selection phases are then discussed in section 6.4 and section 6.5 provides the median STs of the 13 constructs investigated in this study. The final section examines the results obtained for the 13 hypotheses. Section 6.2 commences the chapter with an appraisal of the demographic profile of the applicants.

## 6.2. Demographic profile of applicants

The information pertaining to four demographic constructs are offered in this section. The race, gender and age of the applicants, provided in sections 6.2.1 to 6.2.3, were obtained in phase one of the selection process. The total sample for this first phase was 3 412 applicants. The geographical location of the applicants was obtained in phase two, where there were 1 496 survivors. This demographic aspect is discussed in section 6.2.4.

### 6.2.1. Race profile

Table 6.1 portrays the frequency distribution of the race of the initial 3 412 applicants within the study. In terms of race distribution, a noteworthy proportion (90.6%) of the applicants were Black African. The second highest race distribution category was the Coloured category at 7.3%. The remainder of the candidates were Indian/Asian (0.2%) and Whites (1.9%).

Table 6.1

*Frequency Distribution of the Race of the Applicants*

| | Race | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Black African | 3 090 | 90.6 | 90.6 | 90.6 |
| | Coloured | 250 | 7.3 | 7.3 | 97.9 |
| | Indian/Asian | 7 | .2 | .2 | 98.1 |
| | White | 65 | 1.9 | 1.9 | 100.0 |
| | Total` | 3 412 | 100.0 | 100.0 | |

### 6.2.2. Gender profile

Table 6.2 depicts the frequency distribution of the gender of the total sample of 3 412 applicants within the study. The considerable majority (67%) of the applicants were male, whilst 33% were female.

Table 6.2

*Frequency Distribution of the Gender of the Applicants*

| | Gender | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Male | 2 286 | 67.0 | 67.0 | 67.0 |
| | Female | 1 126 | 33.0 | 33.0 | 100.0 |
| | Total | 3 412 | 100.0 | 100.0 | |

### 6.2.3. Age profile

The frequency distribution of the 3 412 applicants across the seven age categories are presented in Table 6.3. The majority (37%) of the applicants were between 25 and 29 years old. The second largest age distribution category (25.7%) was found in the 20 to 24-year old category, whilst applicants who were between 30 and 34 years old occupied the third largest age distribution category (19.6%). The remaining respondents (17.2%) were between the ages of 15 and 19 years (3.8%), 35 and 39 years (10.2%), 40 and 44 years (2.6%) and 45 years and older (0.6%). A minority (0.4%) did not provide an identity document or it could not be read resulting in the age of these applicants not being determined.

Table 6.3

*Frequency Distribution of the Age of the Applicants*

| | Age | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | 15 – 19 | 131 | 3.8 | 3.8 | 3.8 |
| | 20 – 24 | 877 | 25.7 | 25.7 | 29.5 |
| | 25 – 29 | 1 263 | 37.0 | 37.0 | 66.6 |
| | 30 – 34 | 670 | 19.6 | 19.6 | 86.2 |
| | 35 – 39 | 348 | 10.2 | 10.2 | 96.4 |
| | 40- 44 | 88 | 2.6 | 2.6 | 99.0 |
| | 45+ | 22 | .6 | .6 | 99.6 |
| | Missing* | 13 | .4 | .4 | 100.0 |
| | Total | 3 412 | 100.0 | 100.0 | |

* No identification number was provided or it could not be read.

### 6.2.4. Geographical location profile

Table 6.4 shows the frequency distribution of the geographical location of the 1 496 applicants at the time of their application for the apprenticeship programme. This information was obtained from the applications that had survived into phase two of the selection process and is hence on a smaller sample size (i.e., the missing category accounts for those that were not successful in the first selection phase).

As portrayed in Table 6.4, a large portion (81.4%) of the applicants were located within the Buffalo City Metropole. This is a small metropole within the Eastern Cape, one of the nine provinces in SA. The second highest category (9.6%) were from within the Eastern Cape (i.e., but outside the Buffalo City Metropole) and the remaining 9% were from outside the Eastern Cape.

Table 6.4

*Frequency Distribution of the Geographical Location of the Applicants*

| | Geographical Area | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Outside Eastern Cape | 134 | 3.9 | 9.0 | 9.0 |
| | Eastern Cape | 144 | 4.2 | 9.6 | 18.6 |
| | Buffalo City | 1 218 | 35.7 | 81.4 | 100.0 |
| | Total | 1 496 | 43.8 | 100.0 | |
| | Previously eliminated | 1 916 | 56.2 | | |
| Total | | 3 412 | 100.0 | | |

Table 6.4 concludes the demographic profiling of the applicants. The next section considers the survival rate outcomes for the five selection phases.

## 6.3. Survival rates in selection phases

Transition matrices tabulating the survival rates of the applicants are introduced in this section. Sections 6.3.1 to 6.3.5 discuss the outcomes realised in the five selection phases.

### 6.3.1. Phase one survival rate

Table 6.5 provides the outcomes of the first selection phase for the total sample ($N$ = 3 412). Applications that did not confirm the attainment of the minimum educational requirements and/or did not include all the required documentation were terminated (i.e., no outcome) at this phase.

Table 6.5

*Cross Tabulation of Phase One Survival Rate Outcomes*

| | | Phase One Outcomes | | |
|---|---|---|---|---|
| | | Yes | No | Total |
| Phase One Outcomes | Count | 1496 | 1916 | 3412 |
| | % within Phase 1 Outcome | 43.8% | 56.2% | 100.0% |

Of the total sample, 43.8% were successful in the first selection phase and survived into phase two. The outcome for the remaining 56.2% of the applicants was that they were terminated from the selection process as their application for the apprenticeship programme was declined.

### 6.3.2. Phase two survival rate

This phase was the secondary CV review, where applications were rated according to eight constructs. Details of these constructs were provided in section 5.9.3.2. Table 6.6 presents the survival rate outcomes from this second selection phase. The vast majority (71.7%) of the applicants (*n* = 1 496) were not successful in the phase. This meant that only 28.3% of the candidates met the criteria of this selection phase.

Table 6.6

*Cross Tabulation of Phase Two Survival Rate Outcomes*

| | | Phase Two Outcomes | | |
|---|---|---|---|---|
| | | Yes | No | Total |
| Phase Two | Count | 424 | 1072 | 1496 |
| Outcomes | % within Phase 2 Outcome | 28.3% | 71.7% | 100.0% |

### 6.3.3. Phase three survival rate

The outcomes of the third selection phase are depicted in Table 6.7. Phase three refers to the psychological assessment phase of the selection process. The three constructs (i.e., general aptitude, technical aptitude and teamwork competency testing) within this phase were outlined in section 5.9.3.3.

As indicated in Table 6.7, a significant portion (63.4%) of the sample (*n* = 424) were not successful in this third selection phase. Of those invited to attend this screening phase, 33.7% were successful and survived into phase four. Across the three intake years, five applicants did not attend the assessments despite being invited, six were disqualified for cheating in the assessments and one was no longer available to participate in the selection process.

Table 6.7

*Cross Tabulation of Phase Three Survival Rate Outcomes*

| | | Phase Three Outcomes | | | | | |
|---|---|---|---|---|---|---|---|
| | | Yes | No | No show | Dis-qualified | Not available | Total |
| Phase Three Outcomes | Count | 143 | 269 | 5 | 6 | 1 | 424 |
| | % within Phase 3 Outcome | 33.7% | 63.4% | 1.2% | 1.4% | 0.2% | 100.0% |

### 6.3.4. Phase four survival rate

Table 6.8 shows the cross tabulation of the outcomes for the fourth selection phase. The phase four outcomes are derived from the two constructs within the interview selection phase, being the standard questions and the general impression of the applicants. These two constructs were documented in section 5.9.3.4.

The majority (55%) of the 140 applicants were successful in this phase and hence survived into phase five. A further three applicants were successful but did not pass the required medical testing and were therefore terminated from the selection process. Sixty-three applicants (45%) were unsuccessful in the fourth selection phase.

Table 6.8

*Cross Tabulation of Phase Four Survival Rate Outcomes*

| | | Phase Four Outcomes | | |
|---|---|---|---|---|
| | | Yes | No | Total |
| Phase Four Outcomes | Count | 77 | 63 | 140 |
| | % within Phase 4 Outcome | 55.0% | 45.0% | 100.0% |

### 6.3.5. Phase five survival rate

Phase five pertains to the trade test results, in which apprentices were given three opportunities to prove their competence. Table 6.9 displays the cross-tabulation of the outcomes from this selection phase. The vast majority (98.7%) of the applicants were successful. Of the 77 applicants who undertook the trade test, 42.9% passed after the first attempt, 49.4% following their second attempt and 6.5% after the third attempt. As depicted in Table 6.9, one candidate was deemed not competent following the three trade test attempts.

Table 6.9

*Cross Tabulation of Phase Five Survival Rate Outcomes*

| | | Phase Five Outcomes (Trade Test Attempts) | | | | |
|---|---|---|---|---|---|---|
| | | First | Second | Third | Not Competent | Total |
| Phase Five Outcomes | Count | 33 | 38 | 5 | 1 | 77 |
| | % within Phase 5 outcome | 42.9% | 49.4% | 6.5% | 1.3% | 100.0% |

The survival rate of the applicants, across the five selection phases, have been deliberated in this section. In the section that follows more detail on the performance of the applicants is mined from these five selection phases.

## 6.4. Profile results from selection phases

Frequency distribution tables detailing the profile of the applications are provided in this section and are categorised according to the selection phases. Sections 6.4.1 and 6.4.2 describe the results obtained from the first and second phases respectively. The details obtained within the third selection phase are provided in section 6.4.3 and those of the fourth phase in section 6.4.4.

### 6.4.1. Phase one: Preliminary curriculum vitae review

From the first selection phase the construct detailing the type of apprenticeship the applicants had applied for was extracted for further analysis.

#### 6.4.1.1. Selected apprenticeship type

Applicants applied for either the automotive electrical or millwright apprenticeship programme. The frequency distribution for the 3 412 applicants across these two apprenticeship types are presented in Table 6.10. The majority (51.4%) of the applicants applied for the automotive electrical apprenticeship programme, whilst 34.4% applied for the millwright version. The remaining 14.2% of the applicants did not specify on their application documentation which of the apprenticeship programmes they were applying for.

Table 6.10

*Frequency Distribution of Selected Apprenticeship Type*

| | Apprenticeship Type | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Automotive electrical | 1 753 | 51.4 | 51.4 | 51.4 |
| | Millwright | 1 175 | 34.4 | 34.4 | 85.8 |
| | Not specified | 484 | 14.2 | 14.2 | 100.0 |
| | Total | 3 412 | 100.0 | 100.0 | |

### 6.4.2. Phase two: Secondary curriculum vitae review

There were 1 496 applicants that survived phase one and entered phase two. Eight constructs from this phase were analysed.

#### 6.4.2.1. Secondary education type

Table 6.11 portrays the frequency distribution of the type of secondary education obtained by the applicants. This was either a technical or a non-technical type of secondary education. A significant portion (65.4%) of the sample ($n$ = 1 496) obtained their secondary education at a non-technical school, with only 34.6% attending a technical school.

Table 6.11

*Frequency Distribution of Secondary Education Type*

| | Secondary Education Type | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Non-technical school | 979 | 28.7 | 65.4 | 65.4 |
| | Technical school | 517 | 15.2 | 34.6 | 100.0 |
| | Total | 1 496 | 43.8 | 100.0 | |
| | Previously eliminated | 1 916 | 56.2 | | |
| Total | | 3 412 | 100.0 | | |

#### 6.4.2.2. Mathematics performance

Table 6.12 offers the frequency distribution of the mathematics performance of the 1 496 applicants across the five rating categories. In Grade 12, or the equivalent thereof, 7.9% obtained between one to 19% for the mathematics subject and a further 27.9% achieved between 20 to 39%. The largest grouping of applicants (49.4%) obtained percentage marks from 40 to 59%, with 12.8% obtaining percentage marks ranging from 60 to 79%. The residual two percent of the applicants achieved 80% or more for this subject.

Table 6.12

*Frequency Distribution of Mathematics Performance*

| | Mathematics Performance | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | 1 – 19% | 118 | 3.5 | 7.9 | 7.9 |
| | 20 – 39% | 418 | 12.3 | 27.9 | 35.8 |
| | 40 – 59% | 739 | 21.7 | 49.4 | 85.2 |
| | 60 – 79% | 191 | 5.6 | 12.8 | 98.0 |
| | 80%+ | 30 | .9 | 2.0 | 100.0 |
| | Total | 1 496 | 43.8 | 100.0 | |
| | Previously eliminated | 1 916 | 56.2 | | |
| Total | | 3 412 | 100.0 | | |

#### 6.4.2.3. Science performance

The frequency distribution of the science performance attained by the applicants is presented in Table 6.13. The number and percentage of applicants that performed within each of the five rating categories are indicated. Slightly less than half (47.3%) of the sample ($n$ = 1 496) performed between 40 to 59% for the science subject in Grade 12, or the equivalent thereof. The second largest grouping (36.4%) was within the 20 to 39% scoring category. More than ten percent (11.1%) obtained scores between one to 19% and 4.7% passed with marks from 60 to 79%. The final group of 0.5% passed the subject with a mark in the 80 to 100 percentage category.

Table 6.13

*Frequency Distribution of Science Performance*

| | Science Performance | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | 1 – 19% | 166 | 4.9 | 11.1 | 11.1 |
| | 20 – 39% | 545 | 16.0 | 36.4 | 47.5 |
| | 40 – 59% | 707 | 20.7 | 47.3 | 94.8 |
| | 60 – 79% | 70 | 2.1 | 4.7 | 99.5 |
| | 80%+ | 8 | .2 | .5 | 100.0 |
| | Total | 1 496 | 43.8 | 100.0 | |
| | Previously eliminated | 1 916 | 56.2 | | |
| Total | | 3 412 | 100.0 | | |

**6.4.2.4. Motivational letter**

Table 6.14 shows the frequency distribution of the ratings obtained by the 1 496 applicants for the motivational letters submitted. The quality of the letters was rated across the five categories as indicated within section 5.9.3.2.

Table 6.14

*Frequency Distribution of Motivational Letter*

| | Motivational Letter | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Well below average | 36 | 1.1 | 2.4 | 2.4 |
| | Below average | 663 | 19.4 | 44.3 | 46.7 |
| | Successful | 586 | 17.2 | 39.2 | 85.9 |
| | Excellent | 203 | 5.9 | 13.6 | 99.5 |
| | Outstanding | 8 | .2 | .5 | 100.0 |
| | Total | 1 496 | 43.8 | 100.0 | |
| | Previously eliminated | 1 916 | 56.2 | | |
| Total | | 3 412 | 100.0 | | |

Just under half (46.7%) of the sample ($n$ = 1 496) performed below the successful level in terms of the rating obtained for their submitted motivational letter. Of this amount, 44.3%

scored at a below average level and 2.4% at the well below average level. For the remaining rating categories, 39.2% of the applicants achieved a successful rating, 13.6% obtained an excellent rating and 0.5% an outstanding rating for their motivational letter. This means that the majority (53.3%) of the applicants had their motivational letters rated as successful and above.

#### 6.4.2.5. Curriculum vitae

The frequency distribution of the ratings obtained by the 1 496 applicants for the quality of the CVs submitted are provided in Table 6.15.

Table 6.15

*Frequency Distribution of Curriculum Vitae*

| | Curriculum Vitae | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Well below average | 17 | .5 | 1.1 | 1.1 |
| | Below average | 439 | 12.9 | 29.3 | 30.5 |
| | Successful | 867 | 25.4 | 58.0 | 88.4 |
| | Excellent | 164 | 4.8 | 11.0 | 99.4 |
| | Outstanding | 9 | .3 | .6 | 100.0 |
| | Total | 1 496 | 43.8 | 100.0 | |
| | Previously eliminated | 1 916 | 56.2 | | |
| Total | | 3 412 | 100.0 | | |

Just under a third (30.5%) of the sample (*n* = 1 496) were rated as having a CV in one of the two below average categories. As depicted in Table 6.15, 29.3% of the CVs were rated below average and a further 1.1% were rated as well below average. The majority (58%) of the CVs submitted by the applicants were rated as successful and 11% were rated as excellent. The remaining 0.6% of the applicants achieved an outstanding rating for their CV. The vast majority (69.5%) of the applicant pool were therefore rated as having submitted above average curriculum vitae.

#### 6.4.2.6. Practical experience

Table 6.16 provides the frequency distribution of the ratings obtained by the 1 496 applicants on their background or practical experience. The three rating categories were employed to assess the amount and quality of experience obtained by the applicants. Only 19.8% of the sample (*n* = 1 496) had credible experience or had been to a technical school. The vast majority (63.5%) were rated as having some experience but it was not regarded as substantial and/or relevant. A smaller portion (16.7%) were rated as having no experience that was substantial and/or relevant.

Table 6.16

*Frequency Distribution of Practical Experience*

| | Practical Experience | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | None | 250 | 7.3 | 16.7 | 16.7 |
| | Some but not substantial/relevant | 950 | 27.8 | 63.5 | 80.2 |
| | Credible experience | 296 | 8.7 | 19.8 | 100.0 |
| | Total | 1 496 | 43.8 | 100.0 | |
| | Previously eliminated | 1 916 | 56.2 | | |
| Total | | 3 412 | 100.0 | | |

#### 6.4.2.7. Qualification

The frequency distribution of the rating of the 1 496 applicants' level of qualifications are presented in Table 6.17. Less than half (43.6%) of the sample (*n* = 1 496) obtained a below average or average rating for the level of qualification obtained at the time of their application. The largest (36.4%) frequency grouping had achieved a Grade 12 or equivalent level of qualification but had not studied further despite having some time available to do so. A further 7.2% of the applicants had not studied beyond their Grade 12 or equivalent qualification despite having a significant amount of time to do so. As depicted in Table 6.17, 35.8% of the candidates were currently studying to obtain their Grade 12 or equivalent in the year of their application. Consistent development in the same or related field to their application was found within 19.9% of the sample with a further 0.7% being rated as exceptional in terms of the additional qualifications they had achieved within a similar field to their application.

Table 6.17

*Frequency Distribution of Qualification*

| | Qualification | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Below average | 108 | 3.2 | 7.2 | 7.2 |
| | Average | 544 | 15.9 | 36.4 | 43.6 |
| | Currently in matric | 536 | 15.7 | 35.8 | 79.4 |
| | Consistent development | 298 | 8.7 | 19.9 | 99.3 |
| | Exceptional development | 10 | .3 | .7 | 100.0 |
| | Total | 1 496 | 43.8 | 100.0 | |
| | Previously eliminated | 1 916 | 56.2 | | |
| Total | | 3 412 | 100.0 | | |

#### 6.4.2.8. Leadership potential

Table 6.18 shows the frequency distribution of the ratings obtained by the sample of 1 496 applicants pertaining to the level of leadership potential demonstrated in their CV. Most (81.3%) of the applicants ($n$ = 1 496) were rated as having below average leadership potential and 16.4% were rating as having average potential. As indicated in Table 6.18, only 2.3% were rated as having above average potential in this area.

Table 6.18

*Frequency Distribution of Leadership Potential*

| | Leadership Potential | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Below average | 1 216 | 35.6 | 81.3 | 81.3 |
| | Average | 245 | 7.2 | 16.4 | 97.7 |
| | Above average | 35 | 1.0 | 2.3 | 100.0 |
| | Total | 1 496 | 43.8 | 100.0 | |
| | Previously eliminated | 1 916 | 56.2 | | |
| Total | | 3 412 | 100.0 | | |

The previous two sections have discussed the results realised from the first and second selection phases. Section 6.4.3 provides the results from the third selection phase.

### 6.4.3. Phase three: Psychological assessment

The number of applicants that survived phase two and entered phase three was 412. There are three constructs investigated within phase three.

#### 6.4.3.1. General aptitude

The frequency distribution of the general aptitude test results achieved by the sample of 412 applicants in the third selection phase are indicated in Table 6.19. Only seven of the nine rating categories were utilised. Just over half (55.1%) of the applicants obtained a high average and above average score in the general aptitude assessment. Another 16% of the applicants scored at a superior level and 13.1% within the other three lower scoring categories.

Table 6.19

*Frequency Distribution of General Aptitude*

| | General Aptitude | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Far below average | 4 | .1 | 1.0 | 1.0 |
| | Below average | 14 | .4 | 3.4 | 4.4 |
| | Low average | 36 | 1.1 | 8.7 | 13.1 |
| | Average | 65 | 1.9 | 15.8 | 28.9 |
| | High average | 110 | 3.2 | 26.7 | 55.6 |
| | Above average | 117 | 3.4 | 28.4 | 84.0 |
| | Superior | 66 | 1.9 | 16.0 | 100.0 |
| | Total | 412 | 12.1 | 100.0 | |
| | Previously eliminated | 3 000 | 87.9 | | |
| Total | | 3 412 | 100.0 | | |

#### 6.4.3.2. Technical aptitude

Table 6.20 illustrates the frequency distribution of the results obtained by the sample of 412 applicants pertaining to their technical aptitude. Eight of the nine rating categories were used. Just over half (52%) of the applicants scored within the high and above average categories. Only 0.5% scored at a superior level and no applicants obtained ratings within the outstanding category. Table 6.20 indicates that 26% of the applicants scored at an average level with the other 21.6% scoring significantly below average to low average scores.

Table 6.20

*Frequency Distribution of Technical Aptitude*

| | Technical Aptitude | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Significantly below average | 3 | .1 | .7 | .7 |
| | Far below average | 4 | .1 | 1.0 | 1.7 |
| | Below average | 23 | .7 | 5.6 | 7.3 |
| | Low average | 59 | 1.7 | 14.3 | 21.6 |
| | Average | 107 | 3.1 | 23.0 | 47.6 |
| | High average | 126 | 3.7 | 30.6 | 78.2 |
| | Above average | 88 | 2.6 | 21.4 | 99.5 |
| | Superior | 2 | .1 | .5 | 100.0 |
| | Total | 412 | 12.1 | 100.0 | |
| | Previously eliminated | 3 000 | 87.9 | | |
| Total | | 3 412 | 100.0 | | |

#### 6.4.3.3. Teamwork competence

Table 6.21 shows the frequency distribution of the results obtained by the sample of 412 applicants for the teamwork competency assessment.

Table 6.21

*Frequency Distribution of Teamwork Competence*

| | Teamwork Competence | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Significant development area | 168 | 4.9 | 40.8 | 40.8 |
| | Development skill area | 181 | 5.3 | 43.9 | 84.7 |
| | Competent | 51 | 1.5 | 12.4 | 97.1 |
| | Above average area | 12 | .4 | 2.9 | 100.0 |
| | Total | 412 | 12.1 | 100.0 | |
| | Previously eliminated | 3 000 | 87.9 | | |
| Total | | 3 412 | 100.0 | | |

Most (84.7%) of the applicants were rated below the competent level. The teamwork competencies were rated as being a significant development area for 40.8% of the applicants and as a development area for 43.9%. Only 12.4% of the applicants were regarded as being competent in the teamwork competencies assessed, with 2.9% being rated at an above average level. No scores were obtained in the significantly above average category.

### 6.4.4. Phase four: Panel interviews

The number of applicants that survived phase three and entered phase four was 143. The results from two constructs are clarified in this section.

#### 6.4.4.1. Standard interview

The frequency distribution of the ratings obtained by the applicants during this portion of the interview are shown in Table 6.22. Only three of the rating categories were utilised. Over half (57.3%) the applicants scored at a below average level in the standard interview questions. Whilst 41.3% scored within the successful category, 1.4% obtained an excellent rating. No ratings were provided in the well below average category.

Table 6.22

*Frequency Distribution of Standard Interview*

| | Standard Interview | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Below average | 82 | 2.4 | 57.3 | 57.3 |
| | Successful | 59 | 1.7 | 41.3 | 98.6 |
| | Excellent | 2 | .1 | 1.4 | 100.0 |
| | Total | 143 | 4.2 | 100.0 | |
| | Previously eliminated | 3 269 | 95.8 | | |
| Total | | 3 412 | 100.0 | | |

#### 6.4.4.2. General impression

Table 6.23 provides the frequency distribution of the ratings obtained by the applicants for the post-interview general impression criteria. Only three of these rating categories were used. The well below average rating category was not utilised. Just under two-thirds (62.9%)

of the applicants obtained a rating within the successful category, with 32.2% scoring below average. Table 6.23 depicts that 4.9% scored at an excellent level.

Table 6.23

*Frequency Distribution of General Impression*

| | General Impression | *f* | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Below average | 46 | 1.3 | 32.2 | 32.2 |
| | Successful | 90 | 2.6 | 62.9 | 95.1 |
| | Excellent | 7 | .2 | 4.9 | 100.0 |
| | Total | 143 | 4.2 | 100.0 | |
| | Previously eliminated | 3 269 | 95.8 | | |
| Total | | 3 412 | 100.0 | | |

Table 6.23 concludes the representation of the ratings obtained by the applicants in the fourteen constructs extracted from the four selection phases. In the next section the median ST across the 13 constructs investigated in this study are provided.

## 6.5. Median survival time

The median STs for the eight constructs within the second selection phase are provided in section 6.5.1. The median STs of the three constructs from phase three and the two constructs from phase four are offered in sections 6.5.2 and 6.5.3 respectively.

### 6.5.1. Phase two medians

Table 6.24 portrays the median STs of the eight constructs from the second selection phase, which was the secondary CV review phase. The median ST (i.e., average phases survived) for the technical school applicants is higher at 2.8645 compared to that of the non-technical school applicants (2.6236). On average, applicants with a technical type secondary education progressed further compared to those with a non-technical secondary education.

Table 6.24

*Summary Table of Median Survival Times: Phase Two*

| Constructs | Categories | Median Time |
|---|---|---|
| Secondary education type | Technical | 2.8645 |
| | Non-technical | 2.6236 |
| Mathematics performance | 1-19% | 2.5364 |
| | 20-39% | 2.5989 |
| | 40-59% | 2.7465 |
| | 60-79% | 2.8093 |
| | 80%+ | 3.3333 |
| Science performance | 1-19% | 2.5425 |
| | 20-39% | 2.6069 |
| | 40-59% | 2.7804 |
| | 60-79% | 3.2692 |
| | 80%+ | 3.6000 |
| Motivational letter | Well below average | 2.5625 |
| | Below average | 2.5847 |
| | Successful | 2.7289 |
| | Excellent | 3.2113 |
| | Outstanding | 4.3333 |
| Curriculum vitae | Well below average | 2.5313 |
| | Below average | 2.5433 |
| | Successful | 2.7237 |
| | Excellent | 3.2289 |
| | Outstanding | 3.8333 |
| Practical experience | None | 2.6188 |
| | Some but not substantial/relevant | 2.6325 |
| | Credible | 3.1683 |
| Qualification | Below average | 2.5510 |
| | Average | 2.6296 |
| | Currently in matric | 2.7302 |
| | Consistent development | 2.8187 |
| | Exceptional development | 3.0000 |
| Leadership potential | Below average | 2.6062 |
| | Average | 3.4303 |
| | Above average | 3.3824 |

Applicants with higher mathematics scores survived the longest. This is indicated by the progressively increased median ST as the performance of the applicants in mathematics improved. The applicants with the lowest mathematics marks remained in the selection process for less time than those with better marks. Applicants with mathematics marks of 80% and above survived more phases as seen in the 3.3333 median ST for this grouping in Table 6.24.

Applicants with performance of 80% and above in science had a high median ST of 3.6000 compared to the lowest median ST of 2.5425 for the one to 19% performance interval. This implies that applicants in the 80% and above interval had a better chance of survival, in comparison to those that scored in the lower percentage categories. As mentioned for the mathematics performance construct, applicants with higher science scores survived longer than those with lower marks.

With regard to the quality of the motivational letter submitted, Table 6.24 indicates that those rated as well below average had a lower median ST (2.5625) in comparison to those whose motivational letters were rated as outstanding (4.3333). Applicants with better quality motivational letters survived more selection phases than those with poorer rated motivational letters.

Applicants with CVs rated in the higher scoring intervals had better survival chances than those with lower quality rated CVs. Applicants with CVs rated as being of an outstanding quality had the highest median ST of 3.8333, whilst those with a well below average rating had a lower median ST of 2.5313.

The median ST for applicants that were rated as having credible experience and/or that obtained a technical type secondary education was higher (3.1683) than that of the applicants in the other two rating categories provided in Table 6.24. Those who had no experience obtained a median ST of 2.6188 whilst those with some but not substantial and/or relevant experience obtained only a slightly higher median ST of 2.6325. This means that applicants with credible experience survived more selection phases than those applicants in the other two rating categories.

In terms of rating the level of qualification obtained by the applicants, those within the exceptional category had the highest median ST of 3.000. The applicants that were rated within the other categories did not fare as well, with 2.5510 being the lowest median ST attained. The median ST improved as the rating of the qualification increased.

Table 6.24 reveals that the median ST was higher for the applicants rated as having average leadership potential (3.4303) in comparison to the other two rating categories. Those rated as having above average leadership potential followed with a median ST of 3.3824. Applicants regarded as having below average potential obtained the lowest median time of 2.6062. This concludes the discussion on the median ST findings of the eight constructs within the second selection phase.

### 6.5.2. Phase three medians

The median STs of the three constructs from the third selection phase, the psychological assessment phase, are portrayed in Table 6.25. Overall, applicants with higher general aptitude ratings survived longer. This is indicated by the progressively increased median ST as the general aptitude ratings of the applicants improved. Applicants with superior general aptitude survived more phases as seen in the 4.4138 median ST for this grouping in Table 6.25. The applicants with lower general aptitude ratings remained in the selection process for less time than those with better ratings. The only exception was at the below average rating where the median ST was 3.7778. This was higher than the other rating categories, except for the above average and superior categories.

As shown in Table 6.25, applicants with better technical aptitude ratings had higher median ST as the number of selection phases survived increased as their rating in this aptitude improved. Applicants with superior aptitude obtained a median ST of 5.0000 compared to the lowest 3.5000 median ST for the significantly below average category.

The median ST was higher for the applicants rated as having development areas (4.1563) within their teamwork competencies in comparison to those that scored in the significant development area and competent rating categories. Those rated as having above average teamwork competencies, however, had the highest median ST of 5.0000.

Table 6.25

*Summary Table of Median Survival Times: Phase Three*

| Constructs | Categories | Median Time |
|---|---|---|
| General aptitude | Far below average | 3.5000 |
| | Below average | 3.7778 |
| | Low average | 3.5294 |
| | Average | 3.6373 |
| | High average | 3.6875 |
| | Above average | 3.8357 |
| | Superior | 4.4138 |
| Technical aptitude | Significantly below average | 3.5000 |
| | Far below average | 3.5000 |
| | Below average | 3.5476 |
| | Low average | 3.6556 |
| | Average | 3.6688 |
| | High average | 3.7875 |
| | Above average | 4.2500 |
| | Superior | 5.0000 |
| Teamwork competence | Significant development area | 3.5283 |
| | Development area | 4.1563 |
| | Competent | 4.0556 |
| | Above average area | 5.0000 |

This concludes the discussion on the median ST findings of the three aspects within the third selection phase.

### 6.5.3. Phase four medians

Table 6.26 presents the median STs of the two constructs from the fourth selection phase, being the interview phase of the selection process. With regard to the performance of the applicants in the standard interview questions, Table 6.26 indicated that those rated as below average had a lower median ST (4.8913) in comparison to those rated within the successful and excellent performance levels (5.0000). More applicants with better standard interview performance survived the last selection phase than those that performed at a below average level.

Table 6.26

*Summary Table of Median Survival Times: Phase Four*

| Constructs | Categories | Median Time |
|---|---|---|
| Standard interview | Below average | 4.8913 |
| | Successful | 5.0000 |
| | Excellent | 5.0000 |
| General impression | Below average | 4.9200 |
| | Successful | 5.0000 |
| | Excellent | 5.0000 |

A similar pattern was established in the general impression ratings. Those that were rated as below average had a lower median ST (4.9200) in comparison to those who performed at the successful and excellent level (5.0000). More applicants with better general impression ratings survived the last selection phase than those that performed at a below average level.

Table 6.26 concludes section 6.5 and the examination of the median STs. Section 6.6 proffers the inferential statistical results obtained for the 13 hypotheses of the study. These hypotheses were mentioned in section 1.3.3 of Chpater One.

### 6.6. Assessment of hypotheses

In sections 6.6.1 through to 6.6.13 the life table for the relevant hypothesis is provided with the Gehan-Wilcoxon statistical result being shown within this table. Sections 6.6.1 through to 6.6.8 relate to the second selection phase, the secondary CV review phase. The analysis for the three hypotheses from the third selection phase, which was the psychological assessment phase, is documented in sections 6.6.9 through to 6.6.11. Sections 6.6.12 and 6.6.13 pertain to the two hypotheses derived from the fourth selection phase, which was the interview phase. In the final section the overall results are presented and discussed and a graphic illustration of the survival rates across the five selection phases is provided.

### 6.6.1. Hypothesis one: Secondary education type

The first hypothesis sought to establish whether the type of secondary education had a significant effect or not on the selection of the applicants onto the apprenticeship programme. The type of secondary education was either a technical school or not. The survival analysis results for this hypothesis are provided in Table 6.27.

There were 979 applicants with a non-technical type of secondary education that entered into the second selection phase. A large termination rate of 785 applicants occurred in this phase with a decreasing termination rate for each of the proceeding selection phases. In comparison to the non-technical type of secondary education, there were less applicants (517) with a technical type secondary education that entered the second selection phase. This number decreased at phase three to 218, then 85 and 44 at phases four and five respectively. The number of terminal events at these selection phases were 113, 41 and 0, with 0.16, 0.09 and 0.00 proportion of cases surviving from the start of the selection process to the end thereof. The applicants with a technical type secondary education had a higher cumulative proportion surviving (0.09) at end of the fourth selection phase, than the applicants with a non-technical type secondary education (0.03).

The differences in survival rate, depicted in Table 6.27, represent a true disparity that exists in the data. The Gehan-Wilcoxon value was 87.916 ($p$ = .000). Since the significance value of the test is less than 0.05, it is concluded that the survival curves are different across the groups, with the curve for those who attended technical school being significantly higher.

Table 6.27

*Life Table of Secondary Education Type*

| First-order Controls | | Interval Start Time | No. Entering Interval | No. Exposed to Risk | No. of Terminal Events | Proportion Terminating | Proportion Surviving | Cumulative Proportion Surviving at End of Interval | Probability Density* | Hazard Rate* |
|---|---|---|---|---|---|---|---|---|---|---|
| Secondary education type | Non-technical school | 2 | 979 | 979.000 | 785 | .80 | .20 | .20 | .802 (.013) | 1.34 (.04) |
| | | 3 | 194 | 194.000 | 136 | .70 | .30 | .06 | .139 (.011) | 1.08 (.08) |
| | | 4 | 58 | 58.000 | 25 | .43 | .57 | .03 | .026 (.005) | .55 (.11) |
| | | 5 | 33 | 33.000 | 33 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | Technical school | 2 | 517 | 517.000 | 299 | .58 | .42 | .42 | .578 (.022) | .81 (.04) |
| | | 3 | 218 | 218.000 | 133 | .61 | .39 | .16 | .257 (.019) | .88 (.07) |
| | | 4 | 85 | 85.000 | 41 | .48 | .52 | .09 | .079 (.012) | .64 (.09) |
| | | 5 | 44 | 44.000 | 44 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |

*Standard error in brackets.

*Note.* Gehan-Wilcoxon statistic ($n$ = 1 496) = 87.916, $p$ = 0.000. Comparisons are exact.

### 6.6.2. Hypothesis two: Mathematics performance

The second hypothesis aimed to establish whether the Grade 12 mathematics performance of the applicants had a significant effect or not on their selection onto the apprenticeship programme. The results in Table 6.28 indicate that the survival rates varied significantly across the performance scores obtained in mathematics.

Of the 118 applicants with a mathematics performance score between one to 19%, 110 cases experienced a terminal event in the second selection phase. Therefore, 93% of this proportion of the sample terminated at the end of the second selection phase with only 7% of the proportion surviving. For applicants with mathematics scores in this interval range, the estimate of the probability of experiencing a terminal event during the second selection phase is 0.932. However, this 7% of the applicants survived until the end of the selection process.

For the applicants with mathematics performance between 20% and 39%, 418 entered phase two with 349 cases thereof experiencing a terminal event at the second selection phase. The ratio of terminal events was 0.83, with 0.17 of the proportion surviving. The probability of experiencing the terminal event at this selection phase is 0.835. Within the third selection phase, 69 applicants entered, with 47 terminal events thereafter. The cumulative proportion surviving at the end of the third selection phase was 0.05, with a 0.112 probability density. The cumulative proportion surviving the fourth phase was higher at 0.59 with 13 applicants progressing onto the apprenticeship programme.

There were 739 applicants that entered the selection process with mathematics marks between 40 to 59%. There was a high number of terminal events at phase two with 495 applicants being terminated. This termination trend decreased in phase three and four to 170 and 43 respectively. The cumulative proportion of cases surviving, with this mathematics performance score, from the start of the selection process across the selection phases two to four are 0.33, 0.10 and 0.04, with probability densities of 0.670, 0.230 and 0.058 correspondingly. Thirty-one applicants with this level of mathematics performance survived onto the apprenticeship programme.

Table 6.28

*Life Table of Mathematics Performance*

| First-order Controls | | Interval Start Time | No. Entering Interval | No. Exposed to Risk | No. of Terminal Events | Proportion Terminating | Proportion Surviving | Cumulative Proportion Surviving at End of Interval | Probability Density* | Hazard Rate* |
|---|---|---|---|---|---|---|---|---|---|---|
| Mathematics performance | 1-19% | 2 | 118 | 118.000 | 110 | .93 | 0.7 | .07 | .932 (.023) | 1.75 (.08) |
| | | 3 | 8 | 8.000 | 0 | .00 | 1.00 | .07 | .000 (.000) | .00 (.00) |
| | | 4 | 8 | 8.000 | 0 | .00 | 1.00 | .07 | .000 (.000) | .00 (.00) |
| | | 5 | 8 | 8.000 | 8 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | 20-39% | 2 | 418 | 418.000 | 349 | .83 | .17 | .17 | .835 (.018) | 1.43 (.05) |
| | | 3 | 69 | 69.000 | 47 | .68 | .32 | .05 | .112 (.015) | 1.03 (.13) |
| | | 4 | 22 | 22.000 | 9 | .41 | .59 | .03 | .022 (.007) | .51 (.17) |
| | | 5 | 13 | 13.000 | 13 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | 40-59% | 2 | 739 | 739.000 | 495 | .67 | .33 | .33 | .670 (.017) | 1.01 (.04) |
| | | 3 | 244 | 244.000 | 170 | .70 | .30 | .10 | .230 (.015) | 1.07 (.07) |
| | | 4 | 74 | 74.000 | 43 | .58 | .42 | .04 | .058 (.009) | .82 (.11) |
| | | 5 | 31 | 31.000 | 31 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | 60-79% | 2 | 191 | 191.000 | 118 | .62 | .38 | .38 | .618 (.035) | .89 (.07) |
| | | 3 | 73 | 73.000 | 43 | .59 | .41 | .16 | .225 (.030) | .83 (.12) |
| | | 4 | 30 | 30.000 | 10 | .33 | .67 | .10 | .052 (.016) | .40 (.12) |
| | | 5 | 20 | 20.000 | 20 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | 80%+ | 2 | 30 | 30.000 | 12 | .40 | .60 | .60 | .400 (.089) | .50 (.14) |
| | | 3 | 18 | 18.000 | 9 | .50 | .50 | .30 | .300 (.084) | .67 (.21) |
| | | 4 | 9 | 9.000 | 4 | .44 | .56 | .17 | .133 (.062) | .57 (.27) |
| | | 5 | 5 | 5.000 | 5 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |

*Standard error in brackets.

*Note.* Gehan-Wilcoxon statistic ($n$ = 1 496) = 86.010, $p$ = 0.000. Comparisons are exact.

There were 191 applicants with mathematics performance scores ranging from 60 to 79%. A large proportion (0.62) were terminated at phase three, with a probability density of 0.618. The number of applicants surviving at phase three was 73, then 30 and 20 at phases four and five respectively. The number of terminal events were 43 at phase three and 10 at phase four. Twenty applicants with this level of performance in mathematics survived onto the apprenticeship programme.

Of the 30 applicants with mathematics scores 80% and above, there were 12 terminal events at phase two, nine at phase three and four at phase four. The proportion terminating increased from 0.40 to 0.50, then decreased to 0.44. Five applicants with this level of mathematics performance survived to continue with the programme. As reflected in Table 6.28, the cumulative proportion surviving the entire selection process was higher (0.10 and 0.17 respectively) for those with mathematics marks between 60 to 79% and 80% and above, in comparison to the other performance categories. This cumulative proportion stayed constant, with no further terminations, through the fourth phase for both these mathematics categories.

Given the statistical significance of the Gehan-Wilcoxon value of 86.010 with a *p*-value of 0.000 reflected in Table 6.28, the survival curves are regarded as statistically different across the groups.These survival rates across the groups indicate that applicants with higher Grade 12 mathematics performance had a better chance of surviving onto the next selection phase.

### 6.6.3. Hypothesis three: Science performance

This set of analyses for the third hypothesis sought to determine whether or not the Grade 12 science performance of the applicants had a significant effect on their selection onto the apprenticeship programme. As depicted in Table 6.29, performance pertaining to science as a subject was captured across five categories.

For the performance category ranging from one to 19%, 166 applicants entered the selection process with 153 terminal events at the end of the second phase. The cumulative proportion surviving at the end of this phase was 0.08. The probability density was high at 0.922, which decreased with every additional selection phase. Eight applicants within this rating category survived the selection process and entered onto the apprenticeship programme.

Table 6.29

*Life Table of Science Performance*

| First-order Controls | | Interval Start Time | No. Entering Interval | No. Exposed to Risk | No. of Terminal Events | Proportion Terminating | Proportion Surviving | Cumulative Proportion Surviving at End of Interval | Probability Density* | Hazard Rate* |
|---|---|---|---|---|---|---|---|---|---|---|
| Science performance | 1-19% | 2 | 166 | 166.000 | 153 | .92 | .08 | .08 | .922 (.021) | 1.71 (.07) |
| | | 3 | 13 | 13.000 | 2 | .15 | .85 | .07 | .012 (.008) | .17 (.12) |
| | | 4 | 11 | 11.000 | 3 | .27 | .73 | .05 | .018 (.010) | .32 (.18) |
| | | 5 | 8 | 8.000 | 8 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | 20-39% | 2 | 545 | 545.000 | 449 | .82 | .18 | .18 | .824 (.016) | 1.40 (.05) |
| | | 3 | 96 | 96.000 | 63 | .66 | .34 | .06 | .116 (.014) | .98 (.11) |
| | | 4 | 33 | 33.000 | 15 | .45 | .55 | .03 | .028 (.007) | .59 (.15) |
| | | 5 | 18 | 18.000 | 18 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | 40-59% | 2 | 707 | 707.000 | 453 | .64 | .36 | .36 | .641 (.018) | .94 (.04) |
| | | 3 | 254 | 254.000 | 173 | .68 | .32 | .11 | .245 (.016) | 1.03 (.07) |
| | | 4 | 81 | 81.000 | 41 | .51 | .49 | .06 | .058 (.009) | .68 (.10) |
| | | 5 | 40 | 40.000 | 40 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | 60-79% | 2 | 70 | 70.000 | 28 | .40 | .60 | .60 | .400 (.059) | .50 (.09) |
| | | 3 | 42 | 42.000 | 26 | .62 | .38 | .23 | .371 (.058) | .90 (.16) |
| | | 4 | 16 | 16.000 | 7 | .44 | .56 | .13 | .100 (.036) | .56 (.20) |
| | | 5 | 9 | 9.000 | 9 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | 80%+ | 2 | 8 | 8.000 | 1 | .13 | .88 | .88 | .125 (.117) | .13 (.13) |
| | | 3 | 7 | 7.000 | 5 | .71 | .29 | .25 | .625 (.171) | 1.11 (.41) |
| | | 4 | 2 | 2.000 | 0 | .00 | 1.00 | .25 | .000 (.000) | .00 (.00) |
| | | 5 | 2 | 2.000 | 2 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |

*Standard error in brackets.

*Note.* Gehan-Wilcoxon statistic ($n$ = 1 496) = 127.828, $p$ = 0.000. Comparisons are exact.

Of the 545 applicants with a performance rating between 20 and 39%, 449 cases experienced the terminal event in the second selection phase. Therefore, 82% were terminated at this selection phase with only 18% of the proportion surviving. For applicants with scores in this interval range, the estimate of the probability of experiencing the terminal event during the second selection phase was 0.824. The proportion surviving each subsequent selection phase steadily increased with 18 applicants entering phase five.

For the 40 to 59% performance category, a similar high termination rate was revealed at phase two. Of the 707 applicants entering phase two only 254 progressed to phase three. This was a 64% termination rate. A further 68% were terminated at phase three and 51% at phase four. Forty applicants with science marks between 40 and 59% survived onto the apprenticeship programme.

A lower probability rate of termination is noted during the second phase for the applicants with science performance in the 60 to 79% category. The cumulative proportion surviving at the end of the second selection phase is 0.60, with a 0.400 probability density. However, this trend changed in the third phase where 62% of the applicants were terminated. The termination rate decreased at the fourth phase for this performance category. Nine applicants with this level of performance in science were successful in their application and were accepted onto the apprenticeship programme.

Eight applicants entered phase two with science performance scores of 80% and above. There was only one terminal event at this phase. A lower survival rate is noted at phase three where 71% of the number entering the phase were terminated. The estimate of the probability of experiencing a terminal event at this phase is 0.625. There were, however, no further terminal events for this performance category in the selection process with two applicants being selected onto the programme.

The survival rate of the applicants, documented in Table 6.29, reveals that applicants with better performance in science were able to survive for longer across the five selection phases. A statistically significant result was shown with the Gehan-Wilcoxon statistical value at 127.828, with a 0.000 *p*-value. The test statistic is significant as the *p*-value is less than 0.05.

### 6.6.4. Hypothesis four: Motivational letter

Hypothesis four aimed to ascertain whether the quality of the motivational letters submitted by the applicants had a significant effect on their selection onto the apprenticeship programme. There were five rating levels ranging from well below average to outstanding.

There were 36 applicants that were rated within the well below average category. This category had a high number (89%) of terminal events during the second selection phase. The proportion of cases surviving from the start to the end of the second phase is 0.11, with a high estimate of the probability of experiencing the terminal event during the interval at 0.889. Termination of 50% of the applicants occurred at phase three with the surviving two applicants entering the apprenticeship programme.

A high termination rate at the second selection phase is also noted for the below average rating category. Of the 663 applicants with this rating at the start of the second phase only 96 survived to enter the third phase. This too resulted in a high probability density statistic of 0.855. A steady, yet decreasing, number of terminations continued through the next two phases for this rating category until 38 applicants survived into phase five.

For the applicants with a successful rating for their motivational letter, 586 entered phase two with 402 cases thereof experiencing a terminal event. The ratio of terminal events is 0.69, with 0.31 of the proportion surviving. The probability of experiencing the terminal event at this selection phase is 0.686. Within the third selection phase, 184 applicants entered, with 130 terminal events thereafter. The cumulative proportion surviving at the end of the third selection phase is 0.09, with a 0.222 probability density. Fifty-two percent of these applicants survived phase four, with 28 entering the apprenticeship programme.

There were 203 applicants that entered the selection process with an excellent rating for their motivational letters. Forty percent of the applicants were terminated at phase two. There was a high number of terminal events at phase three with 97 applicants, 80% of those entering the phase, being terminated. This termination rate was double that experienced at the second selection phase. The termination trend, however, slightly decreased in phase four to 64%, with only 16 applicants not progressing to the fifth phase.

Table 6.30

*Life Table of Motivational Letter*

| First-order Controls | | Interval Start Time | No. Entering Interval | No. Exposed to Risk | No. of Terminal Events | Proportion Terminating | Proportion Surviving | Cumulative Proportion Surviving at End of Interval | Probability Density* | Hazard Rate* |
|---|---|---|---|---|---|---|---|---|---|---|
| Motivational letter | Well below average | 2 | 36 | 36.000 | 32 | .89 | .11 | .11 | .889 (.052) | 1.60 (.17) |
| | | 3 | 4 | 4.000 | 2 | .50 | .50 | .06 | .056 (.038) | .67 (.44) |
| | | 4 | 2 | 2.000 | 2 | 1.00 | .00 | .00 | .056 (.038) | 2.00 (.00) |
| | Below average | 2 | 663 | 663.000 | 567 | .86 | .14 | .14 | .855 (.014) | 1.49 (.04) |
| | | 3 | 96 | 96.000 | 39 | .41 | .59 | .09 | .059 (.009) | .51 (.08) |
| | | 4 | 57 | 57.000 | 19 | .33 | .67 | .06 | .029 (.006) | .40 (.09) |
| | | 5 | 38 | 38.000 | 38 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | Successful | 2 | 586 | 586.000 | 402 | .69 | .31 | .31 | .686 (.019) | 1.04 (.04) |
| | | 3 | 184 | 184.000 | 130 | .71 | .29 | .09 | .222 (.017) | 1.09 (.08) |
| | | 4 | 54 | 54.000 | 26 | .48 | .52 | .05 | .044 (.009) | .63 (.12) |
| | | 5 | 28 | 28.000 | 28 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | Excellent | 2 | 203 | 203.000 | 81 | .40 | .60 | .60 | .399 (.034) | .50 (.05) |
| | | 3 | 122 | 122.000 | 97 | .80 | .20 | .12 | .478 (.035) | 1.32 (.10) |
| | | 4 | 25 | 25.000 | 16 | .64 | .36 | .04 | .079 (.019) | .94 (.21) |
| | | 5 | 9 | 9.000 | 9 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | Outstanding | 2 | 8 | 8.000 | 2 | .25 | .75 | .75 | .250 (.153) | .29 (.20) |
| | | 3 | 6 | 6.000 | 1 | .17 | .83 | .63 | .125 (.117) | .18 (.18) |
| | | 4 | 5 | 5.000 | 3 | .60 | .40 | .25 | .375 (.171) | .86 (.45) |
| | | 5 | 2 | 2.000 | 2 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |

*Standard error in brackets.

*Note*. Gehan-Wilcoxon statistic ($n$ = 1 496) = 156.149, $p$ = 0.00. Comparisons are exact.

Of the eight applicants with an outstanding rating for their motivational letter two experienced a terminal event at phase two. The proportion of cases surviving from the start to the end of phase two is high at 0.75 for this rating category in comparison to those with a well below average rating at this phase. However, a higher estimate of the probability (0.375) of experiencing a terminal event is noted at phase four where 60% of the applicants with an outstanding rating were terminated. Two applicants with an outstanding motivational letter survived onto the apprenticeship programme.

For this hypothesis, the Gehan-Wilcoxon value is 156.149 with a *p*-value of 0.000. The differences in survival rate, shown in Table 6.30, denote a true disparity that exists in the data. The survival curves were unique across the five groups, with the curve for those who had better rated motivational letters being significantly higher.

### 6.6.5. Hypothesis five: Curriculum vitae

The fifth hypothesis referred to whether or not the ratings obtained for their CVs had a significant effect on the selection of the applicants onto the apprenticeship programme. The results in Table 6.31 indicate whether the survival rates varied significantly across the ratings attained for the applicants' CVs.

There were 17 applicants with CVs rated in the well below average category at the start of phase two. However, there were 16 terminal events at this phase, with a low proportion surviving (0.06) and a high proportion terminating (0.94). The probability of experiencing the terminal event at this selection phase was high at 0.941. The termination probability decreased with no terminations at phase three. However, this sole survivor was terminated at phase four.

There was also a high proportion (0.92) of terminations during phase two for the below average category of applicants. Of the 439 entering the phase only 404 or 8% survived. In phase three and four the probability of survival increased with only 21 (60%) terminations in phase three and 6 (43%) in phase four. Eight applicants with a below average rating for their CV survived onto the apprenticeship programme.

Table 6.31

*Life Table of Curriculum Vitae*

| First-order Controls | | Interval Start Time | No. Entering Interval | No. Exposed to Risk | No. of Terminal Events | Proportion Terminating | Proportion Surviving | Cumulative Proportion Surviving at End of Interval | Probability Density* | Hazard Rate* |
|---|---|---|---|---|---|---|---|---|---|---|
| Curriculum vitae | Well below average | 2 | 17 | 17.000 | 16 | .94 | .06 | .06 | .941 (.057) | 1.78 (.20) |
| | | 3 | 1 | 1.000 | 0 | .00 | 1.00 | .06 | .000 (.000) | .00 (.00) |
| | | 4 | 1 | 1.000 | 1 | 1.00 | .00 | .00 | .059 (.057) | 2.00 (.00) |
| | Below average | 2 | 439 | 439.000 | 404 | .92 | .08 | .08 | .920 (.013) | 1.70 (.04) |
| | | 3 | 35 | 35.000 | 21 | .60 | .40 | .03 | .048 (.010) | .86 (.17) |
| | | 4 | 14 | 14.000 | 6 | .43 | .57 | .02 | .014 (.006) | .55 (.21) |
| | | 5 | 8 | 8.000 | 8 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | Successful | 2 | 867 | 867.000 | 599 | .69 | .31 | .31 | .691(.016) | 1.06 (.04) |
| | | 3 | 268 | 268.000 | 162 | .60 | .40 | .12 | .187 (.013) | .87 (.06) |
| | | 4 | 106 | 106.000 | 44 | .42 | .58 | .07 | .051 (.007) | .52 (.08) |
| | | 5 | 62 | 62.000 | 62 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | Excellent | 2 | 164 | 164.000 | 63 | .38 | .62 | .62 | .384 (.038) | .48 (.06) |
| | | 3 | 101 | 101.000 | 83 | .82 | .18 | .11 | .506 (.039) | 1.39 (.11) |
| | | 4 | 18 | 18.000 | 12 | .67 | .33 | .04 | .073 (.020) | 1.00 (.25) |
| | | 5 | 6 | 6.000 | 6 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | Outstanding | 2 | 9 | 9.000 | 2 | .22 | .78 | .78 | .222 (.139) | .25 (.18) |
| | | 3 | 7 | 7.000 | 3 | .43 | .57 | .44 | .333 (.157) | .55 (.30) |
| | | 4 | 4 | 4.000 | 3 | .75 | .25 | .11 | .333 (.157) | 1.20 (.55) |
| | | 5 | 1 | 1.000 | 1 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |

*Standard error in brackets.

*Note*. Gehan-Wilcoxon statistic ($n$ = 1 496) = 180.532, $p$ = 0.00. Comparisons are exact.

Of the 867 applicants with CVs rated in the successful category, 599 experienced the terminal event in the second selection phase. Therefore, 69% of this proportion of the sample were terminated at the end of the second selection phase with 31% of the proportion surviving. For applicants with this CV rating the estimate of the probability of experiencing the terminal event during the second selection phase was 0.691. Thereafter, the rate of terminations per phase steadily decreased, with 162 (60%) being terminated during phase three and 44 (42%) in phase four. Sixty-two applicants with a successful rating for their CV survived onto the programme.

For the applicants with an excellent rating for their CV, 164 entered phase two with 63 cases thereof experiencing a terminal event at phase two. The ratio of terminal events was 0.38, with 0.62 of the proportion surviving. The probability of experiencing the terminal event at this selection phase was low at 0.384. This trend, however, changed in the third phase where 82% of the applicants were terminated resulting in the probability of experiencing termination during this third phase rising to 0.506. Within the fourth selection phase, 18 applicants entered, with 12 terminal events thereafter. The cumulative proportion surviving at the end of the fourth selection phase was 0.67, with a 0.073 probability density. Six applicants with this rating, therefore, survived onto the apprenticeship programme.

There was a low rate of terminations during phases two and three for applicants with an outstanding rating for their CVs. A low 22% of applicants were terminated at the end of phase two, which increased to 43% in phase three. There was, however, a significant increase in the rate of terminations in phase four. The rate of survival was low at 25%, with a relatively low probability density of 0.333. One of these applicants survived onto the programme and was accepted onto the apprenticeship programme.

Given the statistical significance of the Gehan-Wilcoxon value at 180.532, with a *p*-value of 0.000 shown in Table 6.31, the survival curves are regarded as statistically different across the groups.The survival rates across the groups were not due to chance. Rather, applicants with higher ratings for their CVs had a better chance of surviving onto the next selection phase.

### 6.6.6. Hypothesis six: Practical experience

The analysis of the sixth hypothesis aimed to determine whether or not the rating obtained for the experience of the applicants had a significant effect on their selection onto the apprenticeship programme. Three rating categories were used, namely, none, some but not substantial or relevant and, thirdly, credible experience.

The probability of applicants with no experience entering phase two and surviving was low at .019 with a probability density of 0.808. Of the 250 applicants entering this phase, there was a high number (202) of terminal events. An even higher proportion (85%) were terminated at the third phase. The cumulative proportion of surviving at the end of the third phase was 0.03 with a probability density of 0.164. The probability rate of survival then decreased with only 43% of the applicants being terminated at phase four. Four applicants with no experience were selected onto the apprenticeship programme.

Applicants rated as having some but not substantial or relevant experience also had a high probability density (0.791) of termination at phase two. With 950 entering at phase two, there were 751 terminal events. The termination rate decreased across phase three and four, however, the cumulative probability of survival was low at 0.05 at phase four. Forty-three applicants with some experience were accepted onto the apprenticeship programme. This was the highest number of applicants across the three rating categories.

The trend of a higher termination rate at phase two changed for the applicants rated with credible background experience. For this category, a higher termination rate was experienced during phase three. There was, hence, less probability in terms of a terminal event during phase two with 296 entering the phase and only 44% being terminated. However, at phase three, the proportion surviving was only 0.39 with 61% of the applicants being terminated. There was a slight drop in the termination rate at phase four but the proportion surviving was nevertheless still low at 0.47. Thirty applicants with credible experience were selected onto the apprenticeship programme.

The comparison of the survival curves across the three groups, shown in Table 6.32, shows statistical significance. The Gehan-Wilcoxon value is 149.206 and the *p*-value is 0.000. Applicants with a better rating for their practical experience were able to survive for longer through the selection phases, in comparison to those who had no experience.

Table 6.32

*Life Table of Practical Experience*

| First-order Controls | | Interval Start Time | No. Entering Interval | No. Exposed to Risk | No. of Terminal Events | Proportion Terminating | Proportion Surviving | Cumulative Proportion Surviving at End of Interval | Probability Density* | Hazard Rate* |
|---|---|---|---|---|---|---|---|---|---|---|
| Practical experience | None | 2 | 250 | 250.000 | 202 | .81 | .19 | .19 | .808 (.025) | 1.36 (.07) |
| | | 3 | 48 | 48.000 | 41 | .85 | .15 | .03 | .164 (.023) | 1.49 (.16) |
| | | 4 | 7 | 7.000 | 3 | .43 | .57 | .02 | .012 (.007) | .55 (.30) |
| | | 5 | 4 | 4.000 | 4 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | Some but not substantial/relevant | 2 | 950 | 950.000 | 751 | .79 | .21 | .21 | .791 (.013) | 1.31 (.04) |
| | | 3 | 199 | 199.000 | 127 | .64 | .36 | .08 | .134 (.011) | .94 (.07) |
| | | 4 | 72 | 72.000 | 29 | .40 | .60 | .05 | .031 (.006) | .50 (.09) |
| | | 5 | 43 | 43.000 | 43 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | Credible experience | 2 | 296 | 296.000 | 131 | .44 | .56 | .56 | .443 (.029) | .57 (.05) |
| | | 3 | 165 | 165.000 | 101 | .61 | .39 | .22 | .341 (.028) | .88 (.08) |
| | | 4 | 64 | 64.000 | 34 | .53 | .47 | .10 | .115 (.019) | .72 (.12) |
| | | 5 | 30 | 30.000 | 30 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |

*Standard error in brackets.

*Note.* Gehan-Wilcoxon statistic ($n$ = 1 496) = 149.206, $p$ = 0.00. Comparisons are exact.

### 6.6.7. Hypothesis seven: Qualification

The seventh hypothesis tested whether the rating provided to applicants on the amount and quality of qualifications obtained had a significant effect on their selection onto the apprenticeship programme. There were five categories ranging from below average to exceptional development.

As portrayed in Table 6.33, there were 108 applicants rated as having a below average level of qualification. In the second phase there were 98 terminal events. The proportion of cases surviving from the start of phase two to the end of the phase was 0.09 with a high probability density of 0.907, compared to the other phases. In the third phase 50% of the applicants were terminated with a low probability density of 0.046. There was, however, a slight increase in the proportion being terminated in the fourth phase with only 40% surviving this selection phase. Two applicants with a below average rating for their qualification level were selected onto the apprenticeship programme.

As in the below average rating category, there was also a high proportion of terminations in the second phase for the average rated category. In this category, 79% of the applicants were terminated with a probability density of 0.794. The number of terminal events decreased at the third and fourth phases, with 48% and 67% surviving each phase respectively. Thirty-six applicants survived onto the programme.

The applicants that were currently studying for their Grade 12 or equivalent qualification at the time of applying had a high termination rate during phase two. Of the 536 that entered the selection process, 367 (68%) were terminated at phase two, 111 (66%) at phase four. Fifty-five percent of the 58 applicants entering phase four survived, resulting in 32 of these applicants being accepted onto the programme.

For those rated as having consistent development, the highest termination rate was experienced at the third selection phase. At this point, 80% of the applicants were terminated with a probability density of 0.312. In comparison, 182 (61%) of the 298 applicants were terminated at phase two and 17 (74%) of the 23 applicants at the fourth phase. This indicated a 0.611 probability density at the second phase and 0.057 at phase four. Six applicants with a consistent development rating were selected onto the apprenticeship programme.

Table 6.33

*Life Table of Qualification*

| First-order Controls | | Interval Start Time | No. Entering Interval | No. Exposed to Risk | No. of Terminal Events | Proportion Terminating | Proportion Surviving | Cumulative Proportion Surviving at End of Interval | Probability Density* | Hazard Rate* |
|---|---|---|---|---|---|---|---|---|---|---|
| Qualification | Below average | 2 | 108 | 108.000 | 98 | .91 | .09 | .09 | .907 (.028) | 1.66 (.09) |
| | | 3 | 10 | 10.000 | 5 | .50 | .50 | .05 | .046 (.020) | .67 (.28) |
| | | 4 | 5 | 5.000 | 3 | .60 | .40 | .02 | .028 (.016) | .86 (.45) |
| | | 5 | 2 | 1.000 | 0 | .00 | 1.00 | .02 | .000 (.000) | .00 (.00) |
| | Average | 2 | 544 | 544.000 | 432 | .79 | .21 | .21 | .794 (.017) | 1.32 (.05) |
| | | 3 | 112 | 112.000 | 58 | .52 | .48 | .10 | .107 (.013) | .70 (.09) |
| | | 4 | 54 | 54.000 | 18 | .33 | .67 | .07 | .033 (.008) | .40 (.09) |
| | | 5 | 36 | 18.000 | 0 | .00 | 1.00 | .07 | .000 (.000) | .00 (.00) |
| | Currently in matric | 2 | 536 | 536.000 | 367 | .68 | .32 | .32 | .685 (.020) | 1.04 (.05) |
| | | 3 | 169 | 169.000 | 111 | .66 | .34 | .11 | .207 (.018) | .98 (.08) |
| | | 4 | 58 | 58.000 | 26 | .45 | .55 | .06 | .049 (.009) | .58 (.11) |
| | | 5 | 32 | 16.000 | 0 | .00 | 1.00 | .06 | .000 (.000) | .00 (.00) |
| | Consistent development | 2 | 298 | 298.000 | 182 | .61 | .39 | .39 | .611 (.028) | .88 (.06) |
| | | 3 | 116 | 116.000 | 93 | .80 | .20 | .08 | .312 (.027) | 1.34 (.10) |
| | | 4 | 23 | 23.000 | 17 | .74 | .26 | .02 | .057 (.013) | 1.17 (.23) |
| | | 5 | 6 | 3.000 | 0 | .00 | 1.00 | .02 | .000 (.000) | .00 (.00) |
| | Exceptional development | 2 | 10 | 10.000 | 5 | .50 | .50 | .50 | .500 (.158) | .67 (.28) |
| | | 3 | 5 | 5.000 | 2 | .40 | .60 | .30 | .200 (.126) | .50 (.34) |
| | | 4 | 3 | 3.000 | 2 | .67 | .33 | .10 | .200 (.126) | 1.00 (.61) |
| | | 5 | 1 | .500 | 0 | .00 | 1.00 | .10 | .000 (.000) | .00 (.00) |

*Standard error in brackets.

*Note.* Gehan-Wilcoxon statistic ($n$ = 1 496) = 47.435, $p$ = 0.00. Comparisons are exact.

For applicants rated as having an exceptional level of qualification, a 0.500 probability of experiencing the terminal event during the second phase was experienced and the proportion of cases surviving from the start to the end of this phase was 50%. The proportion of terminal events decreased to 40% at phase three but increased to 67% at phase four. Of the 10 applicants with this rating, only one survived onto the apprenticeship programme.

The survival rate of the applicants, provided in Table 6.33, indicates that applicants with a better rating for their qualification level were able to survive for longer across the five selection phases. A statistically significant result was shown with the Gehan-Wilcoxon statistical value at 47.435, with a 0.000 *p*-value. The test statistic is significant as the *p*-value is less than 0.05.

### 6.6.8. Hypothesis eight: Leadership potential

The analysis for the eighth hypothesis aimed to determine whether or not the leadership potential rating obtained by the applicants had a significant effect on their selection onto the apprenticeship programme. Three rating categories were used, ranging from below average to above average.

The number of applicants entering phase two with a below average rating was 1 216, with 1 003 terminal events. The proportion of cases surviving this phase was 0.18 with an estimate of the probability of experiencing the terminal event during the phase at 0.825. In the third phase, 61% of the applicants were terminated with a probability density of 0.107. The lowest number of terminal events were experienced at the fourth phase with 60% of the applicants surviving with a probability density of 0.027. Fifty applicants with below average leadership potential were accepted onto the apprenticeship programme.

For those rated as having average leadership potential, the phase with the highest probability (0.498) of experiencing a terminal event was at the third phase. Of the 175 applicants entering this phase, 122 (70%) were terminated. In comparison, only 29% and 55% of the applicants entering phases two and four, respectively, were terminated. Twenty-four applicants with high average leadership potential survived and entered onto the apprenticeship programme.

Table 6.34

*Life Table of Leadership Potential*

| First-order Controls | | Interval Start Time | No. Entering Interval | No. Exposed to Risk | No. of Terminal Events | Proportion Terminating | Proportion Surviving | Cumulative Proportion Surviving at End of Interval | Probability Density* | Hazard Rate* |
|---|---|---|---|---|---|---|---|---|---|---|
| Leadership potential | Below average | 2 | 1216 | 1216.000 | 1003 | .82 | .18 | .18 | .825(.011) | 1.40 (.03) |
| | | 3 | 213 | 213.000 | 130 | .61 | .07 | .07 | .107 (.009) | .88 (.07) |
| | | 4 | 83 | 83.000 | 33 | .40 | .04 | .04 | .027 (.005) | .50 (.08) |
| | | 5 | 50 | 50.000 | 50 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | Average | 2 | 245 | 245.000 | 70 | .29 | .71 | .71 | .286 (.029) | .33 (.04) |
| | | 3 | 175 | 175.000 | 122 | .70 | .30 | .22 | .498 (.032) | 1.07 (.08) |
| | | 4 | 53 | 53.000 | 29 | .55 | .45 | .10 | .118 (.021) | .75 (.13) |
| | | 5 | 24 | 24.000 | 24 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |
| | Above average | 2 | 35 | 35.000 | 11 | .31 | .69 | .69 | .314 (.078) | .37 (.11) |
| | | 3 | 24 | 24.000 | 17 | .71 | .29 | .20 | .486 (.084) | 1.10 (.22) |
| | | 4 | 7 | 7.000 | 4 | .57 | .43 | .09 | .114 (.054) | .80 (.37) |
| | | 5 | 3 | 3.000 | 3 | 1.00 | .00 | .00 | .000 (.000) | .00 (.00) |

*Standard error in brackets.

*Note*. Gehan-Wilcoxon statistic ($n$ = 1 496) = 303.585, $p$ = 0.000. Comparisons are exact.

In the exceptional leadership potential category, the number of applicants entering phase two was 35, with 11 terminal events. The estimate of the probability of experiencing the terminal event during this phase was 0.314 with a proportion of cases surviving from the start of the phase to the end being 0.69. This trend changed in the third phase where 71% of the applicants were terminated. A lower percentage (43%), but still higher than in phase two, were terminated in phase four. In this fourth phase there were four terminations with a 0.57 proportion terminating. Three applicants rated as having exceptional leadership potential survived onto the apprenticeship programme.

The results depicted in Table 6.34 are statistically significant as the survival rates across the three groups were different. The Gehan-Wilcoxon value of 303.585 with a *p*-value of 0.000 indicates that the survival distribution was not due to chance but reflects a true difference in the data. The rating obtained by the applicants for their leadership potential had an impact on the probability of surviving across the selection phases. Those with more potential had a higher survival rate than those rated with less leadership potential.

### 6.6.9. Hypothesis nine: General aptitude

Hypothesis nine aimed to determine whether the general aptitude rating attained by the applicants had a significant effect or not on their selection onto the apprenticeship programme. Seven of the nine available rating categories were used.

Four applicants with a far below average rating remained in the selection process until the third selection phase when they were terminated. Of the 14 applicants with a below average rating, nine were terminated at phase three, with a high probability density of 0.0643. There was an 80% termination rate at the fourth phase with one applicant with this general aptitude rating remaining until the end of the selection process. For the applicants with a low average rating, 36 applicants survived until the third phase when there was a high termination rate of 94%. The probability density was high at 0.944. The two applicants that survived this phase where then terminated at the fourth phase.

Sixty-five applicants with an average rating for their general aptitude entered phase three at which stage 78% were terminated. This was a high probability density of 0.785. A further six applicants were terminated at the fourth phase with 57% of the proportion surviving into the fifth selection phase. These eight applicants were selected onto the apprenticeship programme.

Of the applicant grouping with a high average rating for their general aptitude, 110 entered the third selection phase. Eighty of these applicants were then terminated at this phase. This was a 73% termination rate with a high (0.727) probability density for the phase. Of the 30 applicants entering phase four 37% were terminated at the end of this phase. The remaining 19 applicants with a high average general aptitude survived the rest of the selection process and were selected onto the apprenticeship programme.

The applicants who achieved an above average rating for their general aptitude obtained 40% and 70% proportions surviving phase three and four respectively. A fairly high probability density of 0.598 was achieved for this rating category at the third selection phase. The highest number (33) of applicants from a scoring category that survived onto the apprenticeship programme were from this above average category.

For those with a superior rating, the probability of surviving was also higher than for those at the lower scoring categories. However, the proportion terminated doubled from the third to the fourth selection phase. Of the 66 applicants entering phase three, 32% were terminated at the end of this selection phase. At the end of the fourth selection phase, 64% of the 45 applicants were terminated. The remaining 16 applicants with superior general aptitude were accepted onto the apprenticeship programme.

The survival distribution amongst the groups, with the test statistic based on differences in group mean scores, in Table 6.35 was not due to chance. The Gehan-Wilcoxon value is 48.998 with a *p*-value of 0.000. This implies that a statistical significance exists between the six rating category groups for general aptitude, as their survival curves were unalike. Applicants with higher rating for their general aptitude were able to survive more selection phases than those with lower ratings for this form of aptitude.

Table 6.35

*Life Table of General Aptitude*

| First-order Controls | | Interval Start Time | No. Entering Interval | No. Exposed to Risk | No. of Terminal Events | Proportion Terminating | Proportion Surviving | Cumulative Proportion Surviving at End of Interval | Probability Density* | Hazard Rate* |
|---|---|---|---|---|---|---|---|---|---|---|
| General aptitude | Far below average | 3 | 4 | 4.000 | 4 | 1.00 | .00 | .00 | 1.000(.000) | 2.00(.00) |
| | Below average | 3 | 14 | 14.000 | 9 | .64 | .36 | .36 | .643(.128) | .95(.28) |
| | | 4 | 5 | 5.000 | 4 | .80 | .20 | .07 | .286(.121) | 1.33(.50) |
| | | 5 | 1 | 1.000 | 1 | 1.00 | .00 | .00 | .000(.000) | .000(.00) |
| | Low average | 3 | 36 | 36.000 | 34 | .94 | .06 | .04 | .944(.038) | 1.79(.14) |
| | | 4 | 2 | 2.000 | 2 | 1.00 | .00 | .00 | .056(.038) | 2.00(.00) |
| | Average | 3 | 65 | 65.000 | 51 | .78 | .22 | .22 | .785(.051) | 1.29(.14) |
| | | 4 | 14 | 14.000 | 6 | .43 | .57 | .12 | .092(.036) | .55(.21) |
| | | 5 | 8 | 8.000 | 8 | 1.00 | .00 | .00 | .000(.000) | .000(.00) |
| | High average | 3 | 110 | 110.00 | 80 | .73 | .27 | .27 | .727(.042) | 1.14(.10) |
| | | 4 | 30 | 30.000 | 11 | .37 | .63 | .17 | .100(.029) | .45(.13) |
| | | 5 | 19 | 19.000 | 19 | .00 | .00 | .00 | .000(.000) | .000(.00) |
| | Above average | 3 | 117 | 117.000 | 70 | .60 | .40 | .40 | .598(.045) | .85(.09) |
| | | 4 | 47 | 47.000 | 14 | .30 | .70 | .28 | .120(.030) | .35(.09) |
| | | 5 | 33 | 33.000 | 33 | 1.00 | .00 | .00 | .000(.000) | .000(.00) |
| | Superior | 3 | 66 | 66.000 | 21 | .32 | .68 | .68 | .318(.057) | .38(.08) |
| | | 4 | 45 | 45.000 | 29 | .64 | .36 | .24 | .439(.061) | .95(.16) |
| | | 5 | 16 | 16.000 | 16 | 1.00 | .00 | .00 | .000(.000) | .000(.00) |

*Standard error in brackets.

*Note*. Gehan-Wilcoxon statistic ($n$ = 412) = 48.998, $p$ = 0.000. Comparisons are exact.

### 6.6.10. Hypothesis ten: Technical aptitude

The tenth hypothesis sought to ascertain whether or not the technical aptitude ratings obtained by the applicants had a significant effect on their selection onto the apprenticeship programme. As indicated, eight of the nine rating categories were used. These ranged from significantly below average to a superior rating for technical aptitude.

Three applicants with significantly below average and four applicants with far below average technical aptitude survived until phase three where they were terminated. Similarly, 23 with below average technical aptitude survived until phase three where 91% were terminated. This resulted in a high probability density (0.913) of being terminated at this phase. The remaining two applicants were then terminated at phase four.

Fifty-nine applicants with low average technical aptitude survived until phase three. Of the 59 applicants entering the third phase, there was a high number (45) of terminal events. The cumulative proportion surviving at the end of the third phase was 0.24 with a high probability density of 0.763. The probability rate of survival then increased with only 43% of the applicants being terminated at phase four. Eight applicants with low average technical aptitude were selected onto the apprenticeship programme.

A similar pattern of survival was seen for the applicants with average and high average technical aptitude. Of those rated as having average technical aptitude, a large proportion (75%) were terminated at phase three, with a decrease to 41% at phase four. Sixteen of these applicants proceeded onto the programme. For those with high average technical aptitude, a 63% termination rate at phase three was followed by a lower 33% at phase four. The largest number (31) of applicants being selected onto the apprenticeship programme came from this technical aptitude scoring category.

Applicants rated as having above average technical aptitude had a fairly low probability density (0.409) of termination at phase three. With 88 entering this phase, there were 36 (41%) terminal events. The termination rate then increased to 62% at phase four. Twenty applicants with above average technical aptitude were accepted onto the apprenticeship programme. Two applicants, with superior technical aptitude, survived the entire selection process.

Table 6.36

*Life Table of Technical Aptitude*

| First-order Controls | | Interval Start Time | No. Entering Interval | No. Exposed to Risk | No. of Terminal Events | Proportion Terminating | Proportion Surviving | Cumulative Proportion Surviving at End of Interval | Probability Density* | Hazard Rate* |
|---|---|---|---|---|---|---|---|---|---|---|
| Technical aptitude | Significantly below average | 3 | 3 | 3.000 | 3 | 1.00 | .00 | .00 | 1.000(.000) | 2.00(.00) |
| | Far below average | 3 | 4 | 4.000 | 4 | 1.00 | .00 | .00 | 1.000(.000) | 2.00(.00) |
| | Below average | 3 | 23 | 23.000 | 21 | .91 | .09 | .09 | .913(.059) | 1.68(.20) |
| | | 4 | 2 | 2.000 | 2 | 1.00 | .00 | .00 | .087(.059) | 2.00(.00) |
| | Low average | 3 | 59 | 59.000 | 45 | .76 | .24 | .06 | .763(.055) | 1.23(.14) |
| | | 4 | 14 | 14.000 | 6 | .43 | .57 | .14 | .102(.039) | .55(.21) |
| | | 5 | 8 | 8.000 | 8 | 1.00 | .00 | .00 | .000(000) | .00(.00) |
| | Average | 3 | 107 | 107.000 | 80 | .75 | .25 | .25 | .748(.042) | 1.19(.11) |
| | | 4 | 27 | 27.000 | 11 | .41 | .59 | .15 | .103(.029) | .51(.15) |
| | | 5 | 16 | 16.000 | 16 | 1.00 | .00 | .00 | .000(.000) | .00(.00) |
| | High average | 3 | 126 | 126.000 | 80 | .63 | .37 | .37 | .635(.043) | .93(.09) |
| | | 4 | 46 | 46.000 | 15 | .33 | .67 | .25 | .119(.029) | .39(.10) |
| | | 5 | 31 | 31.000 | 31 | 1.00 | .00 | .00 | .000(.000) | .00(.00) |
| | Above average | 3 | 88 | 88.000 | 36 | .41 | .59 | .59 | .409(.052) | .51(.08) |
| | | 4 | 52 | 52.000 | 32 | .62 | .38 | .23 | .364(.051) | .89(.14) |
| | | 5 | 20 | 20.000 | 20 | 1.00 | .00 | .00 | .000(.000) | .00(.00) |
| | Superior | 3 | 2 | 2.000 | 0 | .00 | 1.00 | .00 | .000(.000) | .00(.00) |
| | | 4 | 2 | 2.000 | 0 | .00 | 1.00 | .00 | .000(.000) | .00(.00) |
| | | 5 | 2 | 2.000 | 2 | 1.00 | .00 | .00 | .000(.000) | .00(.00) |

*Standard error in brackets.

*Note.* Gehan-Wilcoxon statistic ($n$ = 412) = 40.351, $p$ = 0.000. Comparisons are exact.

Table 6.36 indicates that the Gehan-Wilcoxon value achieved for this construct is 40.351 and the *p*-value was 0.000. The differences in survival rate therefore reflect that a true disparity exists in the data. The survival rates across the groups indicate that applicants with higher technical aptitude had a better chance of surviving onto the next selection phase.

### 6.6.11. Hypothesis eleven: Teamwork competence

The eleventh hypothesis aimed to determine whether the teamwork competence rating assigned to the applicants had a significant effect or not on their selection onto the apprenticeship programme. Three of the four rating categories were used. These ranged from being a significant development area to an above average competency area.

As portrayed in Table 6.37, there were 168 applicants rated as having significant development areas within their teamwork competence. In the third phase there was a high (159) number of terminal events. The proportion of cases surviving from the start of phase three to the end of the phase was 0.05 with a high probability density of 0.946, compared to the other phases. In the fourth phase 89% of the applicants were terminated with a low probability density of 0.048. One applicant with this rating for the teamwork competence assessment was selected onto the apprenticeship programme.

There was a much lower rate of terminations within the development skill area rating category. Of the 181 applicants with this rating, 83 were terminated at phase three and 48 at phase four, resulting in 54% and 51%, respectively, surviving these two phases. Fifty applicants with this rating were selected onto the apprenticeship programme. This was by far the largest number of applicants accepted across the various rating categories.

For those rated as being competent in the teamwork competencies assessed, 49% were terminated at phase three, with another 35% being terminated at phase four. This resulted in the remaining 17 applicants being selected onto the apprenticeship programme. Twelve applicants with above average teamwork competencies survived the selection process until phase three. At this stage, a small proportion (2) were terminated with 83% surviving. A further one applicant was terminated at phase four with the survival percentage increasing to 90%. The remaining nine applicants were accepted onto the apprenticeship programme.

Table 6.37

*Life Table of Teamwork Competence*

| First-order Controls | | Interval Start Time | No. Entering Interval | No. Exposed to Risk | No. of Terminal Events | Proportion Terminating | Proportion Surviving | Cumulative Proportion Surviving at End of Interval | Probability Density* | Hazard Rate* |
|---|---|---|---|---|---|---|---|---|---|---|
| Teamwork competence | Significant development area | 3 | 168 | 168.000 | 159 | .95 | .05 | .05 | .946(.017) | 1.80(.06) |
| | | 4 | 9 | 9.000 | 8 | .89 | .11 | .01 | .048(.016) | 1.60(.34) |
| | | 5 | 1 | 1.000 | 1 | 1.00 | .00 | .00 | .000(.000) | .00(.00) |
| | Development area | 3 | 181 | 181.000 | 83 | .46 | .54 | .54 | .459(.037) | .59(.06) |
| | | 4 | 98 | 98.000 | 48 | .49 | .51 | .28 | .265(.033) | .65(.09) |
| | | 5 | 50 | 50.000 | 50 | 1.00 | .00 | .00 | .000(.000) | .00(.00) |
| | Competent | 3 | 51 | 51.000 | 25 | .49 | .51 | .51 | .490(.070) | .65(.12) |
| | | 4 | 26 | 26.000 | 9 | .35 | .65 | .33 | .176(.053) | .42(.14) |
| | | 5 | 17 | 17.000 | 17 | 1.00 | .00 | .00 | .000(.000) | .00(.00) |
| | Above average area | 3 | 12 | 12.000 | 2 | .17 | .83 | .83 | .167(.108) | .18(.13) |
| | | 4 | 10 | 10.000 | 1 | .10 | .90 | .75 | .083(.080) | .11(.11) |
| | | 5 | 9 | 9.000 | 9 | 1.00 | .00 | .00 | .000(.000) | .00(.00) |

*Standard error in brackets.

*Note.* Gehan-Wilcoxon statistic ($n$ = 412) = 116.316, $p$ = 0.000. Comparisons are exact.

The survival rate of the applicants, documented in Table 6.37, reveals that applicants with better competence in the teamwork competencies assessed were able to survive for longer across the five selection phases. A statistically significant result was shown with the Gehan-Wilcoxon statistical value at 116.316, with a 0.000 *p*-value. The test statistic is significant as the *p*-value is less than 0.05.

### 6.6.12. Hypothesis twelve: Standard interview

This hypothesis aimed to test whether the rating in the standard questions of the interview obtained by the applicants had a significant effect or not on their selection onto the apprenticeship programme. As was mentioned, three of the four rating categories were used.

The number of applicants entering phase two with a below average rating was 82, with 46 terminal events at phase four. This was 56% of the applicant pool, the highest percentage of terminations across the three rating categories. The proportion of cases surviving this phase was 0.44 with an estimate of the probability of experiencing the terminal event during the phase at 0.561. The surviving 36 applicants were selected onto the apprenticeship programme.

For the 59 rated as successful in this construct, 20 were terminated at phase four. This meant that a larger proportion (66%) survived this selection phase than those that scored below average. The remaining 39 applicants that had achieved a successful rating in the standard interview questions were selected onto the apprenticeship programme. Of these 39 applicants, two obtained an excellent rating, entered into the fourth selection phase, survived and were accepted onto the apprenticeship programme.

The survival distribution across the three groups was not due to chance. A true difference in the survival rate of the groups exists in the data. As reflected in Table 6.38, the Gehan-Wilcoxon value is 8.483 with a *p*-value of 0.014. The dissimilar survival curves for the groups indicates that better performance in the standard interview questions resulted in a better likelihood of survival into the fifth selection phase.

Table 6.38

*Life Table of Standard Interview*

| First-order Controls | | Interval Start Time | No. Entering Interval | No. Exposed to Risk | No. of Terminal Events | Proportion Terminating | Proportion Surviving | Cumulative Proportion Surviving at End of Interval | Probability Density* | Hazard Rate* |
|---|---|---|---|---|---|---|---|---|---|---|
| Standard interview | Below average | 4 | 82 | 82.000 | 46 | .56 | .44 | .44 | .561(.055) | .78(.11) |
| | | 5 | 36 | 36.000 | 36 | 1.00 | .00 | .00 | .000(.000) | .00(.00) |
| | Successful | 4 | 59 | 59.000 | 20 | .34 | .66 | .66 | .339(.062) | .41(.09) |
| | | 5 | 39 | 39.000 | 39 | 1.00 | .00 | .00 | .000(.000) | .00(.00) |
| | Excellent | 4 | 2 | 2.000 | 0 | 1.00 | 1.00 | .00 | .000(.000) | .00(.00) |
| | | 5 | 2 | 2.000 | 2 | 1.00 | .00 | .00 | .000(.000) | .00(.00) |

*Standard error in brackets.

*Note.* Gehan-Wilcoxon statistic ($n$ = 77) = 8.483, $p$ = 0.014. Comparisons are exact.

### 6.6.13. Hypothesis thirteen: General impression

The analysis from the thirteenth hypothesis aimed to determine whether the general impression rating from the interview provided to the applicants had a significant effect or not on their selection onto the apprenticeship programme. The survival analysis results for this hypothesis are provided in Table 6.39.

Twenty-five of the 46 applicants with a below average rating in the general impression construct were terminated after phase four. This meant that 54% of the applicants with this rating type were terminated. This was the largest percentage of terminal events across the three rating categories. It also meant that the cumulative proportion surviving after this interval was 0.46. The probability density (.543) was the highest for this rating category in comparison to the other two rating categories. However, these 21 surviving applicants were selected onto the apprenticeship programme.

A similar trend occurred for the applicants rated as successful in this construct. Thirty-eight of the 90, which was 42%, were terminated at phase four. This meant that a 0.58 proportion or 52 applicants, rated as successful in their general interview impression, survived and entered onto the apprenticeship programme. For the seven applicants with an excellent rating, three (43%) were terminated at phase four, with the remaining four being accepted onto the apprenticeship programme.

For this hypothesis, the Gehan-Wilcoxon value is 1.820 with a *p*-value of 0.402. The differences in survival rate, shown in Table 6.39, signify a true disparity that exists in the data. The survival curves were unalike across the three groups, with the curve for those who achieved a better general impression rating being significantly higher.

Table 6.39

*Life Table of General Impression*

| First-order Controls | | Interval Start Time | No. Entering Interval | No. Exposed to Risk | No. of Terminal Events | Proportion Terminating | Proportion Surviving | Cumulative Proportion Surviving at End of Interval | Probability Density* | Hazard Rate* |
|---|---|---|---|---|---|---|---|---|---|---|
| General impression | Below average | 4 | 46 | 46.000 | 25 | .54 | .46 | .46 | .543(.073) | .75(.14) |
| | | 5 | 21 | 21.000 | 21 | 1.00 | .00 | .00 | .000(.000) | .00(.00) |
| | Successful | 4 | 90 | 90.000 | 38 | .42 | .58 | .58 | .422(.052) | .54(.08) |
| | | 5 | 52 | 52.000 | 52 | 1.00 | .00 | .00 | .000(.000) | .00(.00) |
| | Excellent | 4 | 7 | 7.000 | 3 | .43 | .57 | .57 | .429(.187) | .55(.30) |
| | | 5 | 4 | 4.000 | 4 | 1.00 | .00 | .00 | .000(.000) | .00(.00) |

*Standard error in brackets.

*Note.* Gehan-Wilcoxon statistic ($n$ = 77) = 1.820, $p$ = 0.402. Comparisons are exact.

### 6.6.14. Overall results

The overall life table subdivides the period of observation into the five selection phases and estimates the probability of survival for each hazard. Phase one was the preliminary application review, phase two was the secondary CV review and psychological testing was done in the third selection phase. The applicants were interviewed in the fourth phase with trade testing being done in the final fifth phase.

From Table 6.40 it can be observed that a large proportion (56%) of the applicants were terminated at phase one. The probability density of being terminated at this phase was high at 0.561. However, the greatest number of terminal events (72%) occurred within the second phase. The probability density of being terminated at this phase is 0.318. After phase two, as the phases progress, the probability of cumulative survival increases. The proportion surviving at the end of each phase increased from 0.28 in phase two to 0.35 in phase three and 0.54 in phase four. This difference in the survival curves across the five selection phases is depicted in Figure 6.1. The probability of cumulative survival is indicated for each selection phase. The survival curve illustrates the probability of the applicants surviving a selection phase. The gradient of the line decreases as the selection process progresses.

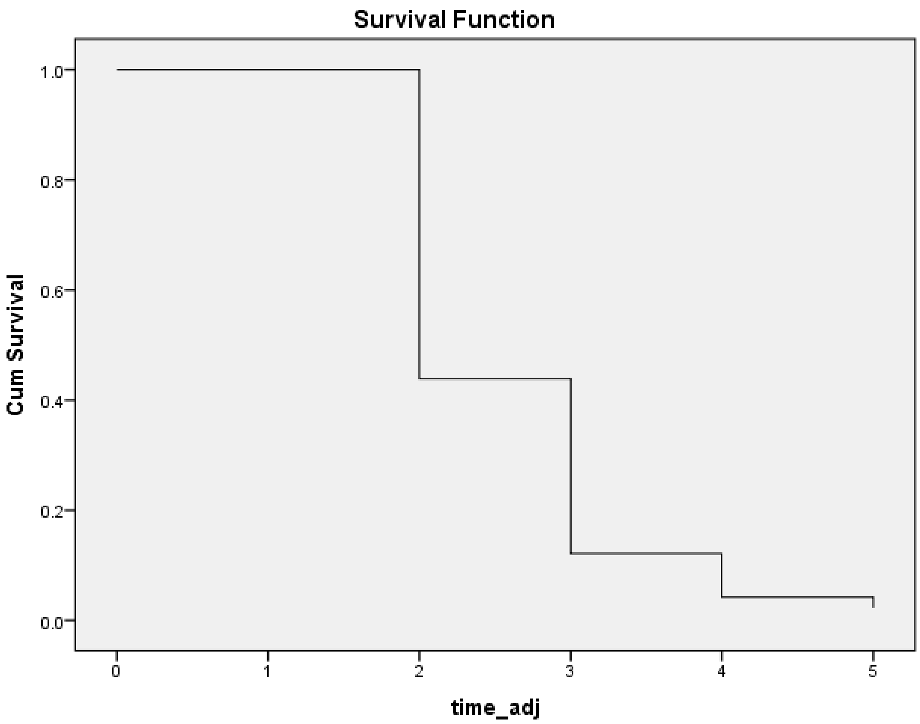


*Figure 6.1.* Survival chart.

Table 6.40

*Life Table of Overall Results*

| Interval Start Time | No. Entering Interval | No. Withdrawing during Interval | No. Exposed to Risk | No. of Terminal Events | Proportion Terminating | Proportion Surviving | Cumulative Proportion Surviving at End of Interval | Probability Density* | Hazard Rate* |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 412 | 0 | 3412.000 | 1916 | .56 | .44 | .44 | .561(.008) | .78(.02) |
| 2 | 1496 | 0 | 1496.000 | 1085 | .72 | .28 | .12 | .318(.008) | 1.14(.03) |
| 3 | 412 | 0 | 412.000 | 269 | .65 | .35 | .04 | .079(.005) | .97(.05) |
| 4 | 143 | 0 | 143.000 | 66 | .46 | .54 | .02 | .019(.002) | .60(.07) |
| 5 | 77 | 0 | 77.000 | 77 | 1.00 | .00 | .00 | .000(.000) | .00(.00) |

*Standard error in brackets.

## 6.7. Summary

Chapter Six documented the findings of this study. The demographic profile of the applicants was initially discussed, with the survival rate outcomes attained in the five selection phases presented in cross-tabulation format and analysed in section 6.3. The frequency distribution of fourteen constructs profiling the applications were provided, according to selection phase, and discussed in section 6.4. The median STs of 13 constructs, according to selection phase, were provided in a summary table and examined in section 6.5. In the final section the findings from the assessment of the 13 hypotheses were presented in life tables and clarified. The overall life table and survival chart were also presented and discussed in this section. In Chapter Seven these findings are discussed and contrasted in relation to relevant industry reports and other empirical literature.

# CHAPTER SEVEN
# DISCUSSION OF FINDINGS

## 7.1. Introduction

Step eight of the research process followed in this study is the interpretation of the results. Chapter Six presented and explained the findings of the descriptive and inferential statistics conducted. The purpose of Chapter Seven is to further discuss these findings, thus fulfilling the requirements of this eighth step in the research process. The initial section of this chapter debates the demographic profile of the applicants.

The collection of the demographic details on the applicants and the preliminary CV review was conducted in the first selection phase. Whilst the information gleaned from this phase is valuable, there are no hypotheses nor objectives directly related to this selection phase. The demographic information on the applicants pertains to the four aspects covered in section 6.2 and discussed in section 7.2. These are the race, gender, age and geographical location of the applicants. Thereafter, two descriptive sets of results from the first selection phase are discussed in section 7.3. The results on the preferred selection type were derived from section 6.4.1.1 and the phase one survival rate outcomes were sourced from section 6.3.1.

Table 7.1 provides a summary of the linkages between the objectives, hypotheses, selection phases and the findings achieved in this study. The four secondary objectives and the thirteen hypotheses of the study were investigated through phases two, three and four of the selection process. Table 7.1 indicates the sections within Chapter Six where the findings were presented and described, with the final column providing a link to the sections in Chapter Seven where there is further elaboration on these findings. Section 7.4 through to section 7.6 interpret the descriptive and inferential findings obtained for the second to fourth selection phases.

Table 7.1

*Linkages between Objectives, Hypotheses, Selection Phases and Findings*

| Primary Objective | Secondary Objectives | Hypotheses | Selection Phases | Presentation of Findings (Chapter Six) | Discussion of Findings (Chapter Seven) |
|---|---|---|---|---|---|
| To evaluate a profiling and selection process for apprentices in the South African automotive industry | Secondary Objective 1: Educational Profile | $H^1$ to $H^3$ | Phase 2 – Secondary CV Review | Sections 6.3.2, 6.4.2.1 to 6.4.2.3, 6.5.1, 6.6.1 to 6.6.3 | Section 7.4 |
| | Secondary Objective 2: Application Profile | $H^4$ to $H^8$ | | Sections 6.3.2, 6.4.2.4 to 6.4.2.8, 6.5.1, 6.6.4 to 6.6.8 | Section 7.4 |
| | Secondary Objective 3: Aptitude and Teamwork Profile | $H^9$ to $H^{11}$ | Phase 3 – Psychological Aassessment | Sections 6.3.3, 6.4.3, 6.5.2, 6.6.9 to 6.6.11 | Section 7.5 |
| | Secondary Objective 4: Interview Profile | $H^{12}$ to $H^{13}$ | Phase 4 – Panel Interview | Sections 6.3.4, 6.4.4, 6.5.3, 6.6.12 to 6.6.13 | Section 7.6 |
| | | | Phase 5 – Trade Test Results | Sections 6.3.5 and 6.6.14 | Sections 7.7 and 7.8 |

As reflected in Table 7.1, the second selection phase pertained to hypotheses one to eight. The results from hypotheses one to three were presented in sections 6.6.1 to 6.6.3 and relate to the first secondary objective. The outcomes from hypotheses four to eight, associated with the second secondary objective, were provided in sections 6.6.4 to 6.6.8. The nine findings obtained from these eight hypotheses are discussed in section 7.4. The findings of the first construct, secondary education type, is discussed in section 7.4.1, with the performance in mathematics and science being examined together within section 7.4.2. Sections 7.4.3 through to 7.4.7 analyse the findings achieved from the other five constructs, namely, the ratings provided on the motivational letter, CV, experience, qualification and leadership potential of the applicants. These descriptive findings were discussed in sections 6.4.2 and 6.5.1, with the inferential analysis presented in section 6.6. The descriptive statistics concerning the recommendation results from this selection phase were examined in section 6.3.2 and clarified in section 7.4.8.

There are three hypotheses, namely, hypotheses nine to 11, associated with the third secondary objective and the third selection phase. These hypotheses relate to the three forms of psychological assessment implemented in this phase which was operationalised in section 5.9.3.3. The descriptive statistics for these three constructs were documented in sections 6.4.3 and 6.5.2, with the inferential analysis of the three hypotheses portrayed in sections 6.6.9 to 6.6.11. Section 7.5 then gives an account of these descriptive and inferential results. The general aptitude results are analysed in section 7.5.1, the technical aptitude ratings in section 7.5.2 and teamwork competence results in section 7.5.3. Section 6.3.3 presented the overall recommendation outcomes achieved by the sample within this third selection phase. These results are then discussed within section 7.5.4.

Secondary objective four, as depicted in Table 7.1, is concerned with the results obtained from the fourth selection phase and hypotheses 12 and 13. Three constructs were extracted from this phase and were operationalised in section 5.9.3.4. The findings of the first construct, the ratings of the standard interview questions, are discussed in section 7.6.1, with the second construct, the general impression ratings, being analysed within section 7.6.2. These findings were initially presented in sections 6.4.4, 6.5.3 and 6.6.12 to 6.6.13. The recommendation results from this fourth selection phase were shown in section 6.3.4 and scrutinised in section 7.6.3.

From the fifth selection phase, the overall survival rate outcomes were clarified in section 6.3.5 and are discussed in section 7.7. Whilst not directly related to any of the study's hypotheses or secondary objectives, this finding has bearing on the primary objective of the study. The overall results attained within this study were presented in section 6.6.14 and are further analysed in section 7.8.

Besides providing a summary of the linkages between the objectives, hypotheses, selection phases and the findings, Table 7.1 also offers a map linking the findings in Chapter Six to the discussions in this chapter. Section 7.2 commences the chapter with an outline of the demographic profile of the applicants.

### 7.2. Demographic profile of applicants

Four central findings were extracted from the demographic information pertaining to the race, gender, age and geographical location of the applicants. The geographical profile of the sample is discussed first as this has bearing on the other demographic attributes.

The majority (81.4%) of the applicants that progressed to the second phase of the selection process were from the Buffalo City Metropole. This is primarily due to the Client implementing a strategy to provide employment and development opportunities to individuals that are located in the same town as the assembly plant. Individuals who reside in the Eastern Cape are given second priority. This strategy is not implemented indiscriminately. Applicants from the Buffalo City Metropole and Eastern Cape are still assessed and ranked through the four selection phases. Given this strategy, it is therefore very rare for applicants from outside the Eastern Cape to be successful in their application onto the apprenticeship programme. This is despite only 11.5% of the SA population residing in this province (Statistics SA, 2017). As discussed in section 3.4.1, only five percent of apprentices are recorded as registered within the Eastern Cape (merSETA, 2016).

Secondly, in terms of racial profile, over 90% of the applicants are Black African, with the second largest group (7.3%) being Coloured. According to Statistics SA (2017), approximately 81% of the national population is Black African, nine percent is Coloured, 2.5% Indian/Asian and eight percent White. The Eastern Cape racial profile is 83% Black African, 11.5% Coloured, 0.2% Indian/Asian and 5.4% are White. The racial profile of the sample was hence in line with that of the overall and provincial populations. As discussed in section 3.4.1, the majority of national apprenticeship registrations are Black African learners. The racial profile of the sample is therefore also comparable to those revealed by other national studies (Hauschildt, 2016; Janse van Rensburg et al., 2012; Wildschut et al., 2012). However, the racial profile is in contrast to that established by Van Rooyen et al. (2010) who found that most South African artisans are White.

Thirdly, with reference to gender, the majority (67%) of the sample are male. Statistics SA (2017) reported that just over 51% of the national population is female, with approximately 53% of the Eastern Cape population being female. The gender profile of the applicants within this study is therefore contrary to that of the actual population profile. This finding therefore lends credence to the statement that apprenticeships remain male-dominated as discussed in sections 3.4.1 and 3.6. Similar traditional profiles (i.e., more males than females) have been established in other studies ((Janse van Rensburg et al., 2012; merSETA, 2016; Van Rooyen et al., 2010; Wildschut et al., 2012). Nevertheless, the percentage of females in this study (i.e., approximately 30%) is less than that obtained in these other national studies (i.e., roughly 10 to 20%).

Fourthly, in terms of age, the majority (37%) of the sample was between 25 and 29 years of age at the time of their application onto the apprenticeship programme. Only 8.3% of the Eastern Cape and 9.7% of the total SA population falls within this age category (Statistics SA, 2017). The age profile of this sample is therefore not aligned to either the provincial or national age profile. However, it is comparable to that established in other national studies and the average age of apprentices in the national population as discussed in section 3.6. Whilst apprenticeships predominantly cater for minors and school-leavers, the average age of registered apprentices is about 26 years of age (Hauschildt, 2016; Vass & Raidani, 2016; Wildschut et al., 2012). This is also consistent with the age profile of local artisans established by Van Rooyen et al. (2010). In this study the majority were between 30 to 39 years of age, which equates to them being in the 25 to 29-year age category at the start of their apprenticeship training.

This concludes the discussion pertaining to the demographical profile of the applicants. Section 7.3 that follows analyses the descriptive statistical results achieved from the first selection phase.

## 7.3. Phase one: Preliminary curriculum vitae review

The two main findings gleaned from the first selection phase pertained to the preferred apprenticeship type and the survival outcomes of the phase. With regard to the preferred apprenticeship type, the majority (51.4%) of the applicants applied for the automotive electrical apprenticeship programme, in comparison to the millwright position. This is in contrast to other national datasets mentioned in section 3.4.1. Other South African studies have found that students registering for an apprenticeship prefer the millwright trade over the automotive electrical trade. While a larger differential percentage has been established (Janse van Rensburg et al., 2012), several studies have confirmed at least double the number of registrations for the millwright trade in comparison to that for an automotive electrical trade (merSETA, 2016; Mukora & Visser, 2008). As discussed in Appendix N, the curricula of these two trades is very different. In comparison to millwrights, who install and repair different types of machines, an automotive electrician works primarily with the electrical wiring of motor vehicles. The latter trade may be perceived by the public as being more relevant to an OEM. Nevertheless, these trades are two of the priority training areas identified from the *National Scarce Skills List* (Government Gazette, 2014a; Wildschut et al., 2013) discussed in section 3.5.2.

Furthermore, the majority (56.2%) of the candidates were terminated in the first selection phase. The purpose of this selection phase was establishing whether all the required documentation had been submitted and that minimum educational requirements had been met. The high termination rate at this phase suggests that the applicants needed to make reasonable effort to understand and comply with the submission requirements before applying for a vacant position.

## 7.4. Phase two: Secondary curriculum vitae review

Nine main findings were obtained from the constructs investigated within the second selection phase. A summary of the descriptive statistics achieved from these nine constructs is provided in Table 7.2 whilst Table 7.3 summarises the inferential statistics.

### 7.4.1. Secondary education type

Table 7.2 indicates that most (65.4%) of the applicants attended a non-technical secondary school. This is significantly less than the 92.7% that applied for an automotive operator position within the automotive industry (Puchert et al, 2017a, 2017b). The high percentage of non-technical applicants may lend weight to the discussion in section 3.7.2.1 that there is currently a lack of interest and understanding in technical training amongst the country's youth (Mummenthey et al., 2012; Pandor, 2018; Patel, 2008, 2012). However, it is important to draw attention to the unique definition of these two forms of secondary education within this thesis. In section 1.6 the operational definitions of the technical and non-technical forms of secondary education were made clear. As defined by the Client, a technical form of secondary education includes mathematics, science and two technical subjects. Accordingly, a National Certificate (Vocational) is not defined as a technical form of secondary education. By the Client's definition, depending on the subjects taken, a N3 Technical Certificate may or may not be deemed a technical form of secondary education. This may not be the common operationalisation of these types of secondary education.

Despite the higher number of non-technical applicants, the median STs for this secondary education construct showed that the applicants with a technical type secondary education survived longer than those with a non-technical type of secondary education. The life table for this construct also revealed that the applicants with a technical type secondary education survived more selection phases compared to those with a non-technical secondary education. As summarised in Table 7.3 a significant relationship was hence established between the type of secondary education and the applicants' selection onto the apprenticeship programme. The null hypothesis was rejected on the basis of there being a statistically significant ($p$ = 0.000) relationship between the variables.

Applicants with a technical secondary education had a lower termination rate in the apprenticeship selection process. This is contrary to the findings of Puchert et al. (2017a, 2017b) who established that applicants with a technical type of secondary education were less likely to be employed as an automotive operator. However, as discussed in the previous paragraph, the operationalisation of these two forms of secondary education (i.e., technical and non-technical) is specific to this study as they are based on the definition provided by the Client. The advantages the applicants with a technical type secondary education, as defined in this study, had over the non-technical applicants seems to be the attainment of the two technical subjects and the practical exposure gained during attending these subjects. This finding is in line with global and national trends to prefer a technical type qualification for the selection of apprentices and in the automotive industry in general (Nomvete et al., 2017; Schafmeister, 2013; Vass & Raidani, 2016), as discussed in section 4.6.

Table 7.2

*Summary of Phase Two Descriptive Analysis*

| No. | Construct | Main Findings |
|---|---|---|
| 1 | Secondary education type | 65.4% of the applicants attended a non-technical secondary school. |
| | | Candidates with a technical type secondary education survived longer than those with a non-technical type secondary education. |
| 2 | Mathematics performance | 35.8% of the applicants attained a score below 40% for mathematics. |
| | | The portion of the sample that performed better in mathematics survived more selection phases. |
| 3 | Science performance | 47.5% of the candidates scored less than 40% for science. |
| | | The applicants that performed better in science survived more selection phases. |
| 4 | Motivational letter | 46.7% of the sample's motivational letters were deemed below the successful rating category. |
| | | The survival rate of the applicants increased as the quality of the motivational letters improved. |
| 5 | Curriculum vitae | 30.5% of the CVs submitted were rated as below successful. |
| | | Candidates with better quality CVs survived longer than those with a poorer quality. |
| 6 | Practical experience | 80.2% of the sample had either none or some but not substantial nor relevant experience. |
| | | Less experience resulted in a lower survival rate. |
| 7 | Qualification | 43.6% of the candidates had not studied beyond Grade 12. |
| | | Studying post-Grade 12 resulted in a longer survival rate. |
| 8 | Leadership potential | 18.7% of the sample were rated as having average and above leadership potential. |
| | | The applicants that had average leadership potential survived more selection phases. |
| 9 | Recommendation status | 71.7% of the applicants were terminated at the second selection phase. |

### 7.4.2. Mathematics and science performance

Over a third (35.8%) of the applicants achieved a score below 40% for mathematics. Furthermore, almost half (47.5%) of the sample attained a score in the same performance category for science. A low level of mathematics skills was also found amongst technical students in Malaysia (Kazalin et al., 2009). In a similar study on the selection of automotive operators, discussed in section 3.7.1, only 10.7% of the applicants scored in the same performance category for mathematics and 25.6% for science. However, in this latter study the applicant pool also included individuals with an academic type of secondary education (Puchert et al., 2014). The very poor results obtained in this study may be an illustration of the dire quality of mathematics and science TVET education in SA confirmed in other national studies (Schwab & Sala-i-Martin, 2017; Vass & Raidani, 2016; Wedekind, 2015) and discussed in sections 3.5.1 and 4.5.2.1.

However, the applicants that performed better in mathematics and science survived more selection phases as seen in their higher median STs. The second and third central finding from the second selection phase, summarised in Table 7.2, is hence that improved marks in these two subjects resulted in optimal performance as measured by the selection success of the applicants. As discussed in section 1.3.1, enhanced STEM skills has been linked to optimal success in many areas, such as productivity, innovation, technology shifts and economic growth (Chalikias et al., 2014; Craig et al., 2011; Spaull, 2013). At the other end of this debate, section 3.7.1 summarises literature suggesting that poor results in these two subjects may be a contributing factor to the lack of technical skills in SA (Mummenthey et al., 2012; Vass & Raidani, 2016; Wedekind, 2015).

The analysis for the second hypothesis was based on whether the Grade 12 mathematics performance of the applicants had a significant effect or not on their selection onto the apprenticeship programme. Overall, the analysis reflected statistical significance with a *p*-value of 0.000 and a Gehan-Wilcoxon statistical value of 86.010. Since the significance value is less than 0.05, the survival curves are regarded as statistically different across the groups.Therefore, the null hypothesis is rejected as summarised in Table 7.3. The Grade 12 mathematics mark obtained by the applicants had a significant effect on their selection onto the apprenticeship programme, with those having higher marks having a better chance of progressing onto the next selection phase. Specifically, applicants with mathematics and science marks above 60%

survived and had a higher cumulative proportion surviving through the selection phases, in comparison to the other performance categories.

With regards to the third hypothesis, the analysis sought to establish whether the Grade 12 science performance of the applicants had a significant effect on their selection onto the apprenticeship programme. The overall comparison across the science performance categories represented a statistical significant result, with a 0.000 *p*-value and a 127.828 Gehan-Wilcoxon statistical value. It can therefore be concluded that the Grade 12 science marks achieved by the applicants had a significant effect on their selection onto the apprenticeship programme. As summarised in Table 7.3 the null hypothesis is rejected since the *p*-value is less than 0.05.

This is in line with the findings and recommendations made globally in terms of apprenticeship applicants, discussed in section 4.6.1. Whilst Besterfield-Sacre et al. (1997) indicate that a strong interest in these two subjects is likely to lead to success on an apprenticeship programme, good performance in mathematics and science is recommended by other researchers (COTVET, 2014; Martin, 2016; Torpey, 2013). Students that do not achieve good or very good school achievements are less likely to find an apprentice place and remedial education may even be required (Steedman, 2012). National research, mentioned in section 4.6.2, has recommended to the automotive industry the inclusion of the mathematics and/or science subjects in the secondary education achieved. This recommendation was, however, aimed at entry-level operator screening processes. Nevertheless, the use of these subjects as preliminary screening mechanisms will still assist the industry to ensure they have the STEM-related aptitudes and capacities required (Puchert et al., 2017a, 2017b).

### 7.4.3. Motivational letter

As summarised in Table 7.2, almost half (46.7%) of the motivational letters were rated as below average and well below average. However, applicants with motivational letters rated as outstanding had double the median ST of those whose letters were rated as well below average. The inferential analysis tested whether the quality of the motivational letter sumitted by the applicants had a significant effect on their selection onto the apprenticeship programme. For this fourth hypothesis the Gehan-Wilcoxon value is 156.149 with a *p*-value of 0.000. The test statistic is significant as the *p*-value is less than 0.05. It is therefore concluded that the rating of the motivational letters had a significant effect on the selection of the applicants onto the apprenticeship programme. This forms the basis for rejecting the null hypothesis as summarised in Table 7.3.

This is similar to the findings of other authors that a well-crafted covering letter could act as a catalyst for continued consideration in future selection stages as outlined in section 4.4.2.2. Ogden (2016) as well as Ross and Young (2005) found that most employers use covering letters to assess the match between the applicant and the requirements of the vacant position. The motivational letter rating was based on neatness, layout as well as spelling and grammar usage. However, the reason for and logic behind the application, the trade specified and any contradiction to school subjects were criteria given priority in the rating of these motivational letters. Through the motivational letter the Client aimed to establish the goodness-of-fit between the applicant and their specific artisanal needs. The applicants who were able to tailor the content of their covering letter to make this match clear were given better ratings. This ultimately resulted in them surviving through more selection phases. Whilst not in apprenticeship selection practices, Stewart and Knowles (2000) as well as Tomaska and Nosek (2018) established similar findings in generic selection practices.

Thus far in section 7.4 the findings from four of the constructs within the second selection phase have been discussed. These are the secondary education type, the mathematics and science performance of the applicants and the motivational letter rating. In the next section the fifth construct, the CV rating attained, is examined.

### 7.4.4. Curriculum vitae

Table 7.2 indicates that almost a third (30.5%) of the CVs submitted by the applicants were rated as below successful. Higher ratings in CV quality did, however, result in improved median STs of applicants across the selection phases. Hypothesis five tested whether or not the ratings the applicants obtained for their CV had a significant effect on their selection onto the apprenticeship programme. The differences in survival rates across the groups reflects a true variance in the data. As indicated in Table 7.3, the Gehan-Wilcoxon value is 180.532 ($p$ = .000). Since the significance value of the test is less than 0.05, it is concluded that the survival curves are different across the groups. A significant relationship was hence established between the rating obtained for CVs presented by the applicants and their selection onto the apprenticeship programme. The null hypothesis was rejected on the basis of there being a statistically significant ($p$ = .000) relationship between the variables.

Table 7.3

*Summary of Phase Two Inferential Analysis*

| No. | Hypotheses | Wilcoxon Statistic | *p*-value | Accept Hypothesis | Reject Hypothesis |
|---|---|---|---|---|---|
| $H_0^1$ | The type of secondary education does not have a significant effect on the applicants' selection onto the apprenticeship programme. | | | | ✔ |
| $H^1$ | The type of secondary education has a significant effect on the applicants' selection onto the apprenticeship programme. | 87.916 | 0.000 | ✔ | |
| $H_0^2$ | The Grade 12 mathematics mark does not have a significant effect on the applicants' selection onto the apprenticeship programme. | | | | ✔ |
| $H^2$ | The Grade 12 mathematics mark has a significant effect on the applicants' selection onto the apprenticeship programme. | 86.010 | 0.000 | ✔ | |
| $H_0^3$ | The Grade 12 science mark does not have a significant effect on the applicants' selection onto the apprenticeship programme. | | | | ✔ |
| $H^3$ | The Grade 12 science mark has a significant effect on the applicants' selection onto the apprenticeship programme. | 127.828 | 0.000 | ✔ | |
| $H_0^4$ | The motivational letter rating does not have a significant effect on the applicants' selection onto the apprenticeship programme. | | | | ✔ |
| $H^4$ | The motivational letter rating has a significant effect on the applicants' selection onto the apprenticeship programme. | 156.149 | 0.000 | ✔ | |
| $H_0^5$ | The curriculum vitae rating does not have a significant effect on the applicants' selection onto the apprenticeship programme. | | | | ✔ |
| $H^5$ | The curriculum vitae rating has a significant effect on the applicants' selection onto the apprenticeship programme. | 180.532 | 0.000 | ✔ | |
| $H_0^6$ | The practical experience rating does not have a significant effect on the applicants' selection onto the apprenticeship programme. | | | | ✔ |
| $H^6$ | The practical experience rating has a significant effect on the applicants' selection onto the apprenticeship programme. | 149.206 | 0.000 | ✔ | |
| $H_0^7$ | The qualification rating does not have a significant effect on the applicants' selection onto the apprenticeship programme. | | | | ✔ |
| $H^7$ | The qualification rating has a significant effect on the applicants' successful selection onto the apprenticeship programme. | 47.435 | 0.000 | ✔ | |
| $H_0^8$ | The leadership potential rating does not have a significant effect on the applicants' selection onto the apprenticeship programme. | | | | ✔ |
| $H^8$ | The leadership potential rating has a significant effect on the applicants' selection onto the apprenticeship programme. | 303.585 | 0.000 | ✔ | |

Only one of the five criteria used to rate the quality of the CVs pertained to the content thereof. The other four criteria were neatness, layout, spelling and grammar. The CVs were hence primarily rated on their aesthetics. Similar findings of a predictive relationship between the positive ratings by recruiters of CVs and their employability have been established in previous research. This research was discussed in detail within section 4.4.2.2. In a comprehensive study across various industries, Chen et al. (2011) found that recruiters used both the content and aesthetics of CVs to make hiring recommendations. Cole et al. (2007) and Tsai et al. (2011) also found that the content provided within CVs (i.e., work experience and educational background) resulted in better perceptions of fit to job and organisation, thus leading to improved selection opportunities. However, as with this study, the research conducted by Arnulf et al. (2010) found that CV layout predominantly had a significant impact on further selection prospects. Several authors state that the reason for this is that recruiters infer certain personality traits (e.g., extraversion and openness to experience) from the aesthetics and layout of the CV (Cole et al., 2003, 2009; Burns et al., 2014). In the appraisal of the CVs in this study, as suggested by the predominance given to the four criteria mentioned earlier, the assessors were looking for conscientiousness within the CVs presented by the applicants.

### 7.4.5. Practical experience

As indicated in Table 7.2, 16.7% of the sample had no experience, whilst 63.5% had some experience. The majority (80.2%) of the applicants therefore did not have credible experience. However, obtaining a higher rating for the experience criteria improved the median ST of applicants across the selection phases. The more experience the candidate had, the higher where the prospects of remaining in the selection process.

The inferential analysis on this construct tested whether the rating obtained by the applicants for their experience had a significant effect on their selection onto the apprenticeship programme. From this analysis it can be concluded that applicants rated with no experience had a higher probability of being terminated or not progressing onto the programme compared to those rated with some or credible background experience. The Gehan-Wilcoxon value is 149.206 ($p$ = .000). This implies a statistical significance when comparing the survival distribution amongst the groups, with the test statistic based on differences in group mean scores. Since the significance value of the test is less than 0.05, it is concluded that the survival curves are different across the groups. As indicated in Table 7.3, the null hypothesis is rejected as the rating of the experience gained by the applicants had a significant effect on their selection onto the apprenticeship programme.

This is contrary to the findings of Cole et al. (2007) discussed in section 4.4.2.2. These researchers established a positive correlation between academic qualifications, extracurricular activities and the judgments made by reviewers on the employability of applicants. Work experience was not as highly correlated as qualifications and extracurricular activities. Nevertheless, the finding of this study regarding experience is consistent with the findings of other researchers (Juhdi et al., 2010; Wilkin & Connelly, 2012).

The results from this construct are linked to those of Wildschut et al. (2012) and Janse van Rensburg et al. (2012) who confirmed that individuals are least likely to enter an apprenticeship in SA from an unemployed position. As discussed in section 4.6.2, job experience facilitated access to a career path that required the completion of an apprenticeship. Whilst this study found that a better experience rating improved the prospects of candidates remaining in the selection process, the highest number of successful applicants (i.e., were accepted onto the apprenticeship programme) came from the second best rating category. The Client has a specific preference for accepting a good mix of both experienced and unexperienced candidates. Candidates who are young school-leavers that aim to embark on an apprenticeship programme immediately after completing Grade 12 are also given preference. These applicants would typically be scored as having some but not substantial experience. These candidates are likely to have had technically-oriented extra-curricular activities recorded on their CVs so had gained some practical experience but would not have entered into employment yet.

### 7.4.6. Qualification

The seventh central finding from the second selection phase, depicted in Table 7.2, was that almost half (43.6%) of the applicants had not studied beyond Grade 12 or equivalent despite having at least some time to do so. This is contrary to a national study where 40% of those registered for an apprenticeship had either undergraduate degrees, diplomas or certificates (merSETA, 2016). Another national trajectory study, also discussed in section 3.4.1, similarly found that only 3.9% of the sample entered an apprenticeship directly after school, given that most first studied and/or gained employment elsewhere (Wildschut et al., 2012).

Obtaining higher ratings in level of qualification improved the median ST of applicants across the selection phases. Furthermore, as indicated in Table 7.3, the seventh null hypothesis of this study was rejected as it is concluded that the qualification rating obtained by the applicants had a significant effect on their selection onto the apprenticeship programme. The Gehan-Wilcoxon value realised for this hypothesis is 47.435 ($p$ = 0.000). This implies statistical significance as the $p$-value is less than 0.05.

This conclusion is consistent with the findings of other researchers that applicants with higher qualifications and self-directedness have higher employability rates than those with lower qualifications (Brewer, 2013; Raemdonck et al., 2012; Schmidt et al., 2016). This was collaborated through the research of Wildschut et al. (2012) which established that the majority of apprenticeship participants had studied post-secondary education before entering into the programme. However, Nunley et al. (2016) concluded from a résumé audit that employment prospects were not significantly affected by higher college qualifications or internship experience.

Seven of the nine constructs extracted from the second selection phase have been analysed thus far in this section. The second last construct, leadership potential, from this phase is examined in the section that follows.

### 7.4.7. Leadership potential

The eighth core finding from this selection phase was that the majority (81.3%) of the applicants were rated as not having leadership potential. This is consistent with the global literature emphasising the lack of employability skills outlined in section 3.7.3. This deficiency has been established in graduates in general (Burning Glass Technologies, 2013; Gallup Inc., 2014; NACE, 2016) and specifically within technical students and STEM graduates (Husain et al., 2010; Kramer et al., 2015; Rahman et al., 2011; Rasul et al., 2012, 2013).

Table 7.2 indicated that a central finding from this construct was that applicants rated as having average leadership potential survived slightly longer, as evidenced in the median ST, than those rated as having above average leadership potential. As discussed in section 3.4.4, the retention of artisans is a key factor for organisations. Van Rooyen et al. (2010) concluded that development opportunities and career progression are regarded as being as important as remuneration for artisans. In terms of leadership potential, the reviewers within this study may have judged the applicants with above average leadership potential as being higher risk candidates for exiting the artisanal profession and entering either self-employment or a managerial career, post the apprenticeship programme. Candidates rated as having average and above average leadership potential both had higher median STs that those with a below average rating and hence survived further into the selection process.

The inferential analysis of this construct tested whether the leadership potential rating attained by the applicants had a significant effect on their selection onto the apprenticeship programme. There were three rating categories, namely, below average, average and above average. As reflected in Table 7.3, the statistic value shows significance through a Gehan-Wilcoxon value of 303.585 ($p$ = 0.000). This suggests that the survival distribution among the groups is not due to chance but represents a true difference that exists in the data. Since the significance value of the test is less than 0.05, it is concluded that the survival curves are different across the groups. Therefore, the null hypothesis is rejected as the leadership potential ratings had a significant effect on the selection of the applicants onto the apprenticeship programme.

Other researchers have also established a link between the number, type and quality of extracurricular activities and positive outcomes in terms of skill acquisition, the likelihood of further consideration in selection process and being employed. Nemanick and Clark (2002) also concluded from a résumé evaluation that the number of leadership positions documented by applicants had a positive impact of the selection judgements made. Other researchers have indicated that recruiters infer effective interpersonal skills and leadership potential from extra-curricular activities, such as membership in professional or social societies or coaching of sports. These inferences were found to enhance employability prospects (Brown & Campion, 1994; Duggan, 2017; Rubin et al., 2002). A link between the perceptions made by recruiters on extracurricular activities and the employability ratings of graduates has also been established (Cole et al., 2007).

#### 7.4.8. Recommendation status

Most (71.7%) of the applicants were rejected after the second selection phase. This phase was concerned with scrutinising the quality of the submitted documentation as well as assessing the documentation on the eight screening criteria discussed in section 7.4. The low survival rate of this selection phase implies that applicants should concern themselves with the manner in which they compile their application documentation to ensure selection at this phase.

Section 7.4 has discussed the core findings from the second selection phase. The descriptive and inferential statistics from eight constructs were examined as well as the overall survival rate of the phase. The next section considers the results from the third selection phase.

### 7.5. Phase three: Psychological assessment

In this section the core findings from the three types of psychological assessments and the overall recommendation judgement are discussed. The central descriptive analysis findings from each assessment as well as the recommendation status are summarised in Table 7.4, with Table 7.5 offering the inferential analyses from this selection phase.

#### 7.5.1. General aptitude

As defined in section 1.6, the general aptitude rating was the average stanine score achieved from six DAT-K battery sub-tests. These were Vocabulary, Verbal Reasoning, Non-verbal Reasoning, Reading Comprehension, Comparison and Memory. The first main finding is that most (86.9%) of the sample performed at an average and above level in the general aptitude testing. This portion of the sample, therefore, would outperform at least 40 to 60% of the South African population. These results are vastly improved upon those obtained for two of the same general aptitude sub-tests (i.e., Non-verbal Reasoning and Comparison) in a selection process for automotive operators, which was outlined in section 3.7.1. A direct comparison between the general aptitude sub-test results attained in these two studies is not possible as the Puchert et al. (2014) study did not use averaged stanine results across the various sub-tests, but rather documented the results obtained per sub-test. Nevertheless, the difference (i.e., about 30%) between the cumulative percentage of candidates that scored in the low average and below categories are very different, specifically for the Non-verbal Reasoning and Comparison sub-tests. Whilst assessing different cognitive abilities, both of these sub-tests require the candidates to determine associations, patterns, similarities and differences between non-verbal items. The apprenticeship applicants may have developed stronger aptitudes in these areas given the technically-oriented training they have received in their secondary education.

The median ST of the candidates steadily improved across the ratings as their performance in the sub-tests improved. However, as mentioned in Table 7.4, the median ST for those rated within the below average category was higher than four of the other categories. This anomaly may have been due to the applicants scoring well in the other constructs measured in this phase. This may have affected their overall recommendation status. The Client's preference was for the teamwork competence and technical aptitudes to be given priority in the ranking order of these three constructs. However, only one of the 14 applicants that scored within this rating category survived through the selection process and was accepted onto the apprenticeship programme.

Hypothesis nine tested whether the rating provided to applicants on their general aptitude scores had a significant effect on their selection onto the apprenticeship programme. From the analysis it can be concluded that applicants rated with higher general aptitude had a higher probability of surviving and progressing onto the programme compared to those rated with lower general aptitude. The Gehan-Wilcoxon value is 48.998 ($p$ = .000). This implies a statistical significance when comparing the survival distribution amongst the groups, with the test statistic based on differences in group mean scores. Since the significance value of the test is less than 0.05, it is concluded that the survival curves are different across the groups. As indicated in Table 7.5, the null hypothesis is rejected as the general aptitude rating attained by the applicants had a significant effect on their selection onto the apprenticeship programme.

Table 7.4

*Summary of Phase Three Descriptive Analysis*

| No. | Construct | Main Findings |
|---|---|---|
| 1 | General aptitude | 86.9% of the applicants performed at an average and above level in the general aptitude testing. |
| | | Median ST steadily improved as the rating categories improved. |
| | | The median ST of the below average rating category was higher than the other four rating categories, except the above average and superior categories. |
| 2 | Technical aptitude | 78.4% of the sample scored at an average and above level in the technical aptitude testing. |
| | | The median ST of the applicants progressively improved as their technical aptitude rating increased. |
| 3 | Teamwork competence | 15.3% of the applicants performed at a competent and above level in the teamwork competence testing. |
| | | Median ST steadily improved as the rating categories improved. |
| | | The median ST of the development area rating category was higher than the other two rating categories, except the above average category. |
| 4 | Recommendation status | 63.4% of the applicants were terminated at this phase. |

Similar findings of a predictive relationship between general aptitude ratings and employability have been established in previous research. Kuncel et al. (2010), Kuncel and Hezlett (2010), Schmitt (2014) as well as Schmidt and Hunter (1998), whose research was documented in section 4.4.4.1, concluded cognitive ability to be the most consistent and strongest predictor of performance in academic and employment contexts. According to Schmidt et al. (2016), the use of GMA testing with either integrity testing or a structured interview yields the best predictive validity of job performance. Within the selection of automotive operators, Puchert et al. (2017a) found a significant relationship between results attained by applicants in three specific aptitudes, namely, Verbal reasoning, Non-verbal Reasoning and Visual Perceptual Speed and their employability prospects. These three sub-tests were also employed within this study.

### 7.5.2. Technical aptitude

Technical aptitude, operationalised in section 1.6, is comprised of six TRAT battery sub-tests. These were Dexterity, Coordination, Assembly, Calculations, Spatial Perception 2-D and 3-D. The stanine scores for each of these sub-tests were averaged to obtain the technical aptitude rating for this third selection phase.

Table 7.4 indicates that most (78.4%) of the applicants performed at an acceptable level (i.e., average and above) in the technical aptitude testing. Fewer candidates than for the general aptitude construct, therefore, would outperform at least 40 to 60% of the South African population. Of these 78.4%, 30.6% would outperform over 60% and 21.4% would outperform at least 77% of the national population. The significantly below average rating category was employed for the technical aptitude ratings of the sample. In comparison, to general aptitude where only 13.1% would be outperformed by at least 60% of the national population, 21.6% of the sample would be outperformed by this segment of the population in terms of their technical aptitude. Of the 30 candidates that scored between significantly below average and below average on these sub-tests, none were successful in their application and accepted on the apprenticeship programme. Twenty-one were terminated after the third selection phase and the remaining two after the fourth selection phase.

Table 7.5

*Summary of Phase Three Inferential Analysis*

| No. | Hypotheses | Wilcoxon Statistic | *p*-value | Accept Hypothesis | Reject Hypothesis |
|---|---|---|---|---|---|
| $H_0^9$ | The general aptitude rating does not have a significant effect on the applicants' selection onto the apprenticeship programme. | | | | ✔ |
| $H^9$ | The general aptitude rating has a significant effect on the applicants' selection onto the apprenticeship programme. | 48.998 | 0.000 | ✔ | |
| $H_0^{10}$ | The technical aptitude rating does not have a significant effect on the applicants' selection onto the apprenticeship programme. | | | | ✔ |
| $H^{10}$ | The technical aptitude rating has a significant effect on the applicants' selection onto the apprenticeship programme. | 40.351 | 0.000 | ✔ | |
| $H_0^{11}$ | The teamwork competence rating does not have a significant effect on the applicants' selection onto the apprenticeship programme. | | | | ✔ |
| $H^{11}$ | The teamwork competence rating has a significant effect on the applicants' selection onto the apprenticeship programme. | 116.316 | 0.000 | ✔ | |

In the previous section, a study done by Puchert et al. (2014) was discussed, which also assessed five of the same technical aptitude sub-tests as this study. These were the Dexterity, Coordination, Assembly, Spatial Perception 2-D and Spatial Perception 3-D sub-tests of the TRAT battery. Once again a direct comparison is not possible (e.g., the Calculations sub-test was not used in the automotive operator study) but it is noteworthy that there is a 10% difference between the averages obtained by the two samples in these technical aptitude sub-tests. That the apprenticeship sample had better ability in these aptitudes is to be expected given their educational background and future career aspirations.

Hypothesis ten determined whether or not the ratings the applicants obtained for their technical aptitude had a significant effect on their selection onto the apprenticeship programme. The technical aptitude of the applicants was rated according to eight categories, ranging from significantly below average to superior. The highest scoring category, namely, outstanding, was not operationalised. The differences in survival rate showed a true variance across the groups in the data. Table 7.4 indicates a key finding from this construct being the median ST of the applicants progressively improving as their technical aptitude rating increased. Furthermore, the Gehan-Wilcoxon value realised for the inferential analysis of this construct was 40.351 ($p$ = .000). Since the significance value of the test is less than 0.05, it is concluded that the survival curves are different across the groups. A significant relationship was hence established between the technical aptitude rating obtained by the applicants and their selection onto the apprenticeship programme. The null hypothesis was therefore rejected on the basis of there being a statistically significant ($p$ = .000) relationship between the variables.

This is consistent with the findings of other researchers that discovered a predictive relationship between technical aptitude ratings and employability. Bordelon and Kantor (1984) also used two Co-ordination technical aptitude tests and were able to accurately predict candidates that were successful as pilots, while Francis et al. (2001) and Gallagher et al. (2009) used technically-oriented aptitude tests to differentiate between applicants applying for surgical positions.

Thus far this section has analysed the results obtained for two of the three constructs assessed in the third selection phase. In the final section the teamwork competence attained by the sample is scrutinised.

### 7.5.3. Teamwork competence

The teamwork competence rating was based on the performance of the applicants on nine competencies. In section 5.8.2.4 it was clarified that the Client requested the assessment of these competencies as the lack thereof had been experienced in the intake of apprentices in previous years. The Client clarified that successful applicants needed to enter the apprenticeship programme with many of these competencies as the development thereof could not be incorporated into the curriculum of the programme. For this reason, the constructs within this third selection phase were prioritised with the teamwork competencies being the most important, as discussed in section 5.9.3.3. The need for these employability competencies, such as teamwork, interpersonal, thinking and problem solving skills, is a regular feature within vocational training and employment literature (Brewer, 2013; De Guzman & Ok Choi, 2013; Hauschildt, 2016; López-Cabrales et al., 2011).

However, the third central finding for the third selection phase depicted in Table 7.4, is that only a minority (15.3%) scored at a competent and above level in these competencies. This is similar to the findings of other researchers who concluded that vocational students may have obtained technical competencies but they lack teamwork, communication and problem solving skills required by industry. Several local studies have established that apprentices lack the problem solving and thinking skills needed by industry (Hauschildt, 2016; Jacobs, 2015; merSETA, 2016). Rahman et al. (2011) also established a lack of these two generic competencies amongst technical students in Malaysia. Thinking skills, resource management competence, as well as system and technology competence, were the least developed employability competencies, according to another study on employability skills amongst Malaysian technical-vocational students (Bakar & Hanafi, 2007). Information skills were the least developed of seven employability competencies assessed amongst final year technical students (Kazalin et al., 2009).

The median ST steadily increased as the teamwork competency level of the applicants improved. However, the median ST of the development area rating category was minimally higher than the competent rating category. Whilst this at face-value seems contradictory to the stance of the Client regarding these teamwork competencies described in the previous paragraph, only 28% of the candidates with teamwork competency at this rating level were accepted onto the apprenticeship programme. This is in comparison to 33% of those with a competent rating and 75% of the applicants that were rated as having above average teamwork competencies. Applicants with developmental needs within their teamwork capabilities may have been accepted onto the programme due to employment equity requirements and the necessity for adequate consideration of internal applicants.

Hypothesis 11 tested whether the rating provided to applicants on their teamwork competence had a significant effect on their selection onto the apprenticeship programme. There were four rating categories, namely; significant development area, development area, competent and above average area. The exceptional rating category was not employed in the ratings provided to the applicants. The Gehan-Wilcoxon value obtained for this hypotheses is 116.316 ($p = 0.000$). Since the significance value was less than 0.05, it was concluded that the association between the covariates and the ST was statistically significant. As indicated in Table 7.5, the null hypothesis is therefore rejected and it is concluded that the teamwork competence rating obtained by the applicants had a significant effect on their selection onto the apprenticeship programme.

#### 7.5.4. Recommendation status

As indicated in Table 7.4, a significant portion (63.4%) of the sample were terminated at the third selection phase. Obtaining higher ratings in the general aptitude, technical aptitude and teamwork assessments therefore improved the median ST of applicants across the selection phases. Section 7.5.4 concludes the analysis of the findings derived from the third selection phase. The next section progresses onto the fourth phase, which was the panel interview.

### 7.6. Phase four: Panel interviews

In this section the three main findings from the fourth selection phase are debated. Table 7.6 summarises the descriptive statistics from these three constructs and Table 7.7 provides a summary of the findings from the inferential statistics.

#### 7.6.1. Standard interview

The first core finding from this selection phase, as summarised in Table 7.6, was that less than half (42.7%) of the applicants scored at a successful and above level. The questions posed to the candidates clarified their competence in initiative, problem solving, planning and organising, quality orientation and teamwork. Overall, therefore, the applicants lacked the level of employability competencies as defined by several authors in section 4.2 (Askov & Gordon, 1999; Fugate et al., 2004; Rasul et al., 2013; Wesselink et al., 2009).

Table 7.6

*Summary of Phase Four Descriptive Analysis*

| No. | Construct | Main Findings |
|---|---|---|
| 1 | Standard interview | 57.3% of the applicants obtained a below average rating in the standard interview questions.<br>The median ST improved from the below average category to the successful category. |
| 2 | General impression | 67.8% of the sample scored a successful and above rating for the general impression of the interview.<br>The median ST improved from the below average category to the successful category. |
| 3 | Recommendation status | 55% survived the fourth selection phase. |

Table 7.6 specifies that the median ST for this construct improved from the below average category to the successful category. The same median ST was then attained for the excellent rating category. The skill level of the applicants in the competencies measured in this portion of the interview therefore had an impact on their survival through the last selection phase. However, once at a successful level, further competency did not strongly improve survival time. Given that the interview was the last selection intervention to appraise applicants the Client needed to accept those candidates with adequate employability competencies onto the programme in order to fill the vacant apprenticeship positions available within the organisation.

The inferential analysis on this construct tested whether the rating in the standard questions of the interview obtaind by the applicants had a significant effect on their selection onto the apprenticeship programme. As reflected in Table 7.7, the statistical value showed significance through a Gehan-Wilcoxon value of 8.483 ($p$ = 0.014). This suggests that the survival distribution among the groups is not due to chance but indicates that a true disparity exists in the data of the groups. Since the significance value of the test is less than 0.05, it is concluded that the survival curves are different across the groups. Therefore, the null hypothesis is rejected as the ratings in the standard interview questions had a significant effect on the selection of the applicants onto the apprenticeship programme.

It is therefore concluded that the employability competencies, as measured by the standard interview questions, can improve the acceptance of applicants onto an apprenticeship programme. This is similar to the findings of several other global researchers. Forsblom et al. (2016) established that premature terminations of apprentices could be significantly alleviated through the use of interviews in the selection process. The inclusion of face-to-face interviews resulted in the fairer selection of apprentices by a Swiss intermediary organisation (Imdorf & Leemann, 2012). Interviews were also used to successfully distinguish candidates for inclusion in an apprenticeship programme in China. Selecting apprentices in the same manner as other employees was found to strengthen the skills development programme (Tang, 2015).

### 7.6.2. General impression

Table 7.6 indicates that most (67.8%) of the applicants performed at a successful level and above in the general impression aspect of the interview. This is in contrast to the findings of global researchers who established a lack of personal professional competencies, such as communication and interpersonal skills, within STEM graduates (Kramer et al., 2015). However, Bakar & Hanafi (2007), Kazalin et al. (2009) and Rasul et al. (2013) concluded that Malaysian technical students had effective interpersonal and personal quality skills.

As with the standard interview median STs, the median ST for the general impression construct improved from the below average category to the successful category. The same median ST was then achieved for the excellent rating category. Whilst the personal professional competencies of the applicants had an impact on their survival through to the last selection phase, higher levels thereof did not strongly improve survival time. This is probably an indication of the need indicated by the Client to accept those applicants with adequate competencies onto the apprenticeship programme in order to fill their quota of vacant positions available.

Table 7.7

*Summary of Phase Four Inferential Analysis*

| No. | Hypotheses | Wilcoxon Statistic | *p*-value | Accept Hypothesis | Reject Hypothesis |
|---|---|---|---|---|---|
| $H_0^{12}$ | The standard interview rating does not have a significant effect on the applicants' selection onto the apprenticeship programme. | | | | ✔ |
| $H^{12}$ | The standard interview rating has a significant effect on the applicants' selection onto the apprenticeship programme. | 8.483 | 0.014 | ✔ | |
| $H_0^{13}$ | The general impression rating does not have a significant effect on the applicants' selection onto the apprenticeship programme. | | | | ✔ |
| $H^{13}$ | The general impression rating has a significant effect on the applicants' selection onto the apprenticeship programme. | 1.820 | 0.402 | ✔ | |

The inferential analysis on this construct sought to establish whether the rating for the general impression aspect of the interview had a significant effect on the selection of the applicants onto the apprenticeship programme. The overall comparison across the general impression rating categories represents a statistical significant result, with a 0.402 *p*-value and a 1.820 Gehan-Wilcoxon statistical value. It can therefore be concluded that the performance of the applicants in the general impression part of the interview had a significant effect on their selection onto the apprenticeship programme. As summarised in Table 7.7 the null hypothesis is rejected since the *p*-value is less than 0.05.

It is therefore concluded that better employability competencies, as measured by the general impression attributes, can improve the acceptance of applicants onto an apprenticeship programme. International researchers (Forsblom et al., 2016; Imdorf & Leemann, 2012; Tang, 2015) have indicated that the use of interviews are helpful in screening apprenticeship applicants, as outlined in section 7.6.1. However, there is no similar research in SA.

#### 7.6.3. Recommendation status

Table 7.6 highlights that the majority (55%) of the applicants survived the fourth selection phase. The applicants that performed better in the standard interview and general impression aspect of the interview survived more selection phases. This is consistent with other research concluding the success of the interview technique in assessing the latent competencies of applicants (Branine, 2008; Fernández-Aráoz, 2014; Huffcutt et al., 2001). Interview performance has been confirmed as a reliable indicator or predictor of on-the-job functioning (Schmidt et al., 2016; Schmidt & Zimmerman, 2004). Interviews are widely used as a selection technique within the manufacturing sector (Giffi et al., 2015) and within the selection of apprentices (e.g., Goastellec & Ruiz, 2015; Grosvenor, 2016; NAS, 2017; Torpey, 2013). However, there are only two global studies that provide conclusive evidence of the predictive value of interviews in apprentice selection. Both Forsblom et al. (2016) and Tang (2015) established that the use of job interviews reduced the number of premature terminations by apprentices within the companies surveyed.

This discussion on the survival rate outcomes obtained within the fourth selection concludes section 7.6. In the next section the outcomes from the trade test results are analysed.

## 7.7. Phase five: Trade test results

Most (98.7%) of the 77 applicants were successful in the fifth selection phase with most (49.4%) passing the trade test after the second attempt. This trade test pass rate (98.7%) far exceeds the national baseline pass rate of 45% (Government Gazette, 2015a) and the average attained within the manufacturing industry of 68% (merSETA, 2016). It also exceeds the 2020 improvement target of a 65% pass rate (Government Gazette, 2015a). The pass rate attained in this study is especially commendable given that 42.9% passed at first attempt and 49.4% following their second attempt. This lends support to the contention that a structured apprenticeship development system will improve the pass rate of apprentices at the first sitting (Mahembe, 2012). The positive impact of this selection intervention could only be established at the end of the apprenticeship programme. This highlights the importance of using data that follows workers for a lengthy time period after an intervention (Corseuil et al., 2012).

The demographic profile findings, the results from each of the five selection phases as well as the nineteen constructs extracted from these phases have been debated in sections 7.2 to 7.7. The next section examines the overall results stemming from this analysis, specifically pertaining to the evaluation of the selection process employed.

## 7.8. Overall results

The findings for hypotheses one through to 13 show that a higher level of each covariate was associated with longer ST. Lower levels of each covariate resulted in a higher probability density value and hence a higher probability of termination in any selection phase. The significance of the Gehan-Wilcoxon statistic attained for each hypothesis suggested that the survival distribution among the groups was not due to chance but rather represented a true difference that existed in the data. The null hypotheses for each of the 13 variables were therefore rejected.

In section 1.6 evaluation was defined as the establishment of the value and quality of something. The selection process evaluated in this study is concluded to be valuable. The termination rate of the applicants was steady across the four phases. More than half of the submitted applicants were terminated at phase one. The highest termination rate (71.7%) was at the second phase. At this phase the secondary screening of the CVs was done and the applicants' submitted documentation was screened on eight criteria. The null hypotheses for each of the eight constructs investigated within this phase were rejected indicating that the variable under investigation did have a significant effect on the selection success of the applicants onto the apprenticeship programme. The early detection in a selection process of applicants that have the required attributes needed, allows the organisation to focus on the best candidates to fill the vacancy (Grosvenor, 2017). This was facilitated in a creditable manner by the Client. With a significant portion of the applicant pool already being terminated, the Client was able to invest in the costlier and time consuming psychological assessments in the third phase and interviews in the fourth phase.

Only 2% of the applicants in the study were successful in their application and accepted onto the apprenticeship programme. This is less than the 3.7% success rate within German apprenticeship programmes (Jacoby, 2014). Given that this country’s vocational training system is regarded as the benchmark (Fazio et al., 2016; G20ewg, 2012; Kahlen, 2016; OECD, 2011; Smith & Kemmis, 2013), this statistic reveals that the selection process used by the Client is a rigorous one.

The selection process investigated in this study can also be concluded to be of a high quality. One of the evaluation methods discussed in section 5.10, proposed by Rossi et al. (2004), is the assessment of programme outcome or impact. Rusek and Rist (2004) suggest the use of baseline indicators as a representation of outcomes or impact. An example of a baseline indicator within the apprenticeship context is the use of pass rates. The merit of any apprenticeship programme can then potentially be judged based on a comparison of their respective pass rates. Section 7.7 successfully drew this comparison.

## 7.9. Summary

Chapter Six presented the findings from the descriptive and inferential statistical analyses of the study. Chapter Seven discussed these findings in relation to industry reports and other empirical studies. These two chapters therefore conclude step eight of the research process provided in Chapter Five. In Chapter Eight a summary of the literature review, objectives of the study and methodology employed is provided. A summary of the main findings of this study are provided along with the conclusions derived from the secondary and primary objectives. Recommendations are offered to the five sets of stakeholders as well as those pertaining to possible future research. The contribution and limitations are also outlined.

# CHAPTER EIGHT
# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## 8.1. Introduction

Chapters Six and Seven presented and discussed the empirical findings of the study. The descriptive and inferential statistics for the 13 hypotheses were analysed and interpreted. Chapter Eight fulfils the requirements of the ninth step of the research process followed in this study. The first section provides a summary of the linkages between the objectives, hypotheses, selection phases, findings, conclusions and recommendations realised in this study. Thereafter, an overview of the study is provided in section 8.2. Pertinent aspects from the literature review are offered, the objectives of the study are recapitulated and a summary of the research methodology is provided. The conclusions and recommendations stemming from the secondary and primary objectives are then provided in sections 8.3 through to 8.5. Subsequently, the contributions and limitations of the study are discussed with the final section proposing suggestions for future research.

Table 8.1 builds on Table 7.1 provided in Chapter Seven through the addition of the last column on the table. This column summarises how the conclusions and recommendations documented in this chapter are linked to the four secondary objectives as well as the primary objective, through the hypotheses and selection phases.

The second selection phase pertains to hypotheses one to eight. The conclusions derived from secondary objective one, discussed in section 8.3.1, relate to hypotheses one to three. As discussed in section 7.4, the type of secondary education as well as the Grade 12 mathematics and science performance level attained by the applicants had a significant effect on their selection onto the apprenticeship programme. Five recommendations are derived from these findings, as summarised in Table 8.1. These pertain to the use of standardised application documents, the use of on-line technology, advisable subject pass rates as well as the provision of career guidance and job application preparation workshops. These recommendations are clarified in sections 8.5.2.2 through to 8.5.2.4, which are three of the recommendations made to the HRM field. The recommendation pertaining to the provision of career guidance is discussed in section 8.5.3.3, which is within the section outlining the recommendations to the automotive industry. The fifth recommendation is suggested to educational providers in section 8.5.4.

Table 8.1

*Linkages between Objectives, Hypotheses, Selection Phases, Findings, Conclusions and Recommendations*

| Primary Objective | Secondary Objectives | Hypotheses | Selection Phases | Presentation of Findings (Chapter Six) | Discussion of Findings (Chapter Seven) | Conclusions and Recommendations (Chapter Eight) |
|---|---|---|---|---|---|---|
| To evaluate a profiling and selection process for apprentices in the South African automotive industry | Secondary Objective 1: Educational profile | $H^1$ to $H^3$ | Phase 2 – Secondary CV Review | Sections 6.3.2, 6.4.2.1 to 6.4.2.3, 6.5.1, 6.6.1 to 6.6.3 | Section 7.4 | Sections 8.3.1, 8.5.2.2, 8.5.2.3, 8.5.2.4, 8.5.3.3 and 8.5.4 |
| | Secondary Objective 2: Application Profile | $H^4$ to $H^8$ | | Sections 6.3.2, 6.4.2.4 to 6.4.2.8, 6.5.1, 6.6.4 to 6.6.8 | Section 7.4 | Sections 8.3.2, 8.5.2.2, 8.5.2.3, 8.5.3.3, 8.5.3.4 and 8.5.4 |
| | Secondary Objective 3: Aptitude and Teamwork Profile | $H^9$ to $H^{11}$ | Phase 3 – Psychological Assessment | Sections 6.3.3, 6.4.3, 6.5.2, 6.6.9 to 6.6.11 | Section 7.5 | Sections 8.3.3, 8.5.2.3, 8.5.3.3, 8.5.3.4 and 8.5.4 |
| | Secondary Objective 4: Interview Profile | $H^{12}$ to $H^{13}$ | Phase 4 – Panel Interview | Sections 6.3.4, 6.4.4, 6.5.3, 6.6.12 to 6.6.13 | Section 7.6 | Sections 8.3.4, 8.5.3.3, 8.5.3.4 and 8.5.4 |
| | | | Phase 5 – Trade test results | Sections 6.3.5 and 6.6.14 | Sections 7.7 and 7.8 | Sections 8.4, 8.5.1.1, 8.5.2.1, 8.5.3.1 and 8.5.3.2 |

Hypotheses four to eight, also linked to the second selection phase, relate to the second secondary objective. The results from these hypotheses were discussed in section 7.4. The null hypotheses pertaining to each of the five constructs investigated were rejected. The motivational letter, CV, experience, qualification and leadership potential ratings had a significant effect on the selection of the applicants onto the apprenticeship programme. From these findings four recommendations are made. The first is the use of standardised application documentation, secondly, the use of on-line technology, thirdly, the provision of career guidance workshops and fourthly, the delivery of job application preparation workshops. These are four of the same recommendations mentioned in the previous paragraph.

There are three hypotheses, namely, hypotheses nine to 11, associated with the third secondary objective and the third selection phase. Section 7.5 gives an account of these findings. The general aptitude, technical aptitude and teamwork competence ratings had a significant effect on the selection of the applicants onto the apprenticeship programme. The null hypotheses were therefore rejected. Three recommendations stemmed from these findings, namely, the implementation of career guidance, standardisation exercises and job application preparation workshops, outlined in sections 8.5.3.3, 8.5.3.4 and 8.5.4 respectively.

Secondary objective four is concerned with the results from the fourth selection phase and hypotheses 12 and 13. The results of these two hypotheses were discussed in section 7.6. The null hypotheses of both were rejected as the standard interview and general impression ratings had a significant effect on the selection of the applicants onto the apprenticeship programme. From these findings three recommendations are made. As with the third secondary objective, these were executing career guidance, standardisation exercises and job application preparation workshops.

From the fifth selection phase, it was clarified that the vast majority (98.7%) of the apprentices selected onto the apprenticeship programme passed the trade test. This finding was clarified in section 7.7. Whilst not directly related to any of the hypotheses or secondary objectives, this finding has bearing on the primary objective of the study. Furthermore, the overall results attained within this study were discussed in section 7.8. Four recommendations are derived from these findings. The first recommendation, made to the local government, pertains to the completion of the national selection tool, discussed in section 8.5.1. The second recommendation is made to the HRM field, in section 8.5.2.1, relating to the use of a multi-hurdle selection process. The third and fourth recommendations are discussed in sections 8.5.3.1 and 8.5.3.2 and are concerned with the replication of the selection process and the marketing of the apprentice position.

The eleventh, and final, recommendation derived from this study was made to the TRAT test developer. This recommendation, documented in section 8.5.5, does not pertain to either the primary or secondary objectives of the study. However, before discussing these conclusions and recommendations in detail, a brief overview of the study is necessary.

## 8.2. Overview of the study

In this overview, the key considerations from the literature are provided, followed by a reiteration of the objectives of the study. In the last section a précis of the research methodology is presented.

### 8.2.1. Literature overview

The automotive industry is the largest manufacturing sub-sector within SA (De Lange, 2017) and is regarded as a mature industry (Bandyopadhyay, 2010). The industry contributes approximately 7.4% to the national GDP, has over 110 000 direct employees and a high portion of its production is exported (AIEC, 2017; ASCCI, 2018; Vermeulen, 2018). The automotive industry is also highly competitive. World-class management techniques, such as just-in-time production, total quality management and continuous improvement, are prevalent across the industry (Naude, 2009; Shatouri et al., 2012).

The national automotive industry is under pressure given key international trends impacting the sector. Higher volumes of units per model are expected to be produced, specifically for export markets, whilst simultaneously cutting costs and improving quality (DTI, 2015; Naude, 2013; Van Zyl, 2015). Upgrading of the infrastructure and technology within the South African automotive industry has therefore been necessary (AEIC, 2017). However, local automotive production still needs to radically improve if the industry is to survive long-term. The challenge is for national automakers to firmly establish themselves within the global supply chain (ASCCI, 2018; Naude, 2013).

In order to enable this, the automotive industry requires an efficient source of technical competencies, specifically at the technician and artisan levels (Brown, 2013; Nzimande &

Patel, 2012; Reddy et al., 2016). However, the number of artisans being produced in the country is decreasing by approximately 0.7% per year (Vass & Raidani, 2016). Technicians and artisans are two of the scarce and critical skills both globally (ManpowerGroup, 2016) and nationally (Government Gazette, 2014a, 2014b, 2018). Specifically, toolmakers, electricians, millwrights, automotive electricians as well as fitters and turners, are regarded as critical skills shortage areas within the manufacturing sector (Mummenthey et al., 2012; Wildschut et al., 2013).

According to the human capital theory, the underpinning theoretical framework of the study, both general and firm-specific human capital can be used to improve the financial and operational performance of firms (Becker, 1962; Ployhart & Moliterno, 2011; Wright et al., 1994). However, the potential of high quality firm-specific human capital to become an organisation's competitive advantage can be operationalised through HR practices, such as selection and training (Wright et al., 1994). The human capital theory has thus informed this study with regard to the manner in which the artisan job family, a vital portion of the automotive industry's labour force, should be managed with regard to recruitment and selection.

While there is some, mostly outdated, international research on the broad practices employed in the selection of apprentices and artisans, there is limited similar national research (Forsblom et al., 2016; Horn, 2016; Imdorf & Leeman, 2012). This is despite the conclusion drawn that recruitment and selection is the second highest immediate need to improve the pass rate and quality of artisans in the country (Government Gazette, 2015a). Furthermore, there is minimal national and international research on the profile of a successful artisan applicant. There is, therefore, the need for specific research on the profiling and selection of apprentices in the automobile industry in SA.

### 8.2.2. Objectives of the study

The primary objective of this study was to evaluate a profiling and selection process for apprentices in the South African automotive industry. Following on from this, there were four secondary objectives and 13 hypotheses stemmed from these objectives.

The four secondary objectives of this study were:

a) To assess the contribution of the educational profile on apprenticeship programme selection
b) To appraise the value of the generic application profile on apprenticeship programme selection

c) To evaluate the influence of aptitude and teamwork profile on apprenticeship programme selection

d) To assess the impact of interview profile on apprenticeship programme selection.

Prior to discussing the findings from these objectives and their associated hypotheses, a précis of the research methodology followed in the study is provided in the next section.

### 8.2.3. Summary of the methodology

As was illustrated in Figure 5.1, the research methodology of the study followed a 10-step research process. The initial two steps of the process culminated in the refinement of the research problem and identification of an appropriate research paradigm. The philosophical positioning of a study can have a significant impact on a study in terms of choices and decisions made. Research paradigms frame the beliefs, inferences and practices of researchers and can inform the way they view the nature of knowledge (Johnson & Christensen, 2014). This study was positioned at the third stage on the continuum of core ontological assumptions between the two core poles of positivism and interpretivism presented in Figure 5.2. This positioning accepts reality as a contextual field of information (Collis & Hussey, 2014). In line with this philosophy and the objectives of the study, a quantitative research approach was adopted for this study, employing longitudinal data.

The research process included both primary and secondary data stages. These were steps six and seven of the research process. In the primary data stage, the author was contracted as a HR consultant to assist in the design and implementation of an annual selection process for apprentices in a South African automotive firm, called the Client. The primary data stage employed a non-probability convenience sampling technique of applicants for the automotive electrical and millwright apprenticeship trainee positions at the Client. The primary sampling frame was hence all the applicants applying for these two positions during the 2012 to 2014 intake years. Six structured instruments, documented in Table 5.3, were designed and/or chosen to be employed in the five selection phases of the study. Following a pilot study, conducted during the 2012 intake year, primary data collection commenced. The author and the senior instructors at the Client fulfilled the primary data collection during the three intake years. The data from phases one through four was processed in the year prior to the apprenticeship intake with the data from phase five being processed at apprenticeship programme completion, usually four years later.

The primary data, collected for a specific purpose by the Client, was readily available to the author to use for secondary research purposes. The same sampling plan used in the primary data stage was employed, with the secondary data stage of the study taking place during the first five months of 2018. From the large amount of information available, 19 constructs from the five selection phases were selected, extracted and prepared for secondary data analysis purposes. The operationalisation of these 19 constructs was discussed in section 5.9.3.

The data analysis strategy incorporated both descriptive and inferential statistics. Frequency distribution tables were used to indicate the demographic details of the applicants as well as indicate the distributions of the groups on nine particular aspects of their applications, across the five selection phases. Cross-tabulations were used to depict the transitions across these five selection phases and medians were used to summarise the STs of the applicants across the 13 variables of the study. The survival analysis procedure was used to analyse the progression of the applicants through the five phases and the 13 hazards of the selection process. The Gehan-Wilcoxon proportional hazards statistical tool facilitated an understanding of the applicant termination rate per selection phase and provided an indication of the survival probability per variable and phase under investigation. This facilitated the analysis of the 13 hypotheses described in Chapter Six and further interpreted in Chapter Seven. These latter two chapters fulfilled step eight of the research process documented in Chapter Five. From this analysis, the central findings of the study and the the conclusions of the study could be extrapolated.

## 8.3. Conclusions derived from the secondary objectives

This section is comprised of four sections with each section discussing the conclusions derived from one of the four secondary objectives.

### 8.3.1. Secondary objective one: Educational profile

The first secondary objective of the study aimed to assess the contribution of the educational profile of the applicants on apprenticeship programme selection. The findings from hypotheses one to three led to the generation of three conclusions considered in the sections that follow.

#### 8.3.1.1. Conclusion one: Type of secondary education

There were almost double the number of applicants with a non-technical type of secondary education in comparison to those with a technical type. However, the median ST of the applicants with a technical type secondary education was larger than that for the applicants with a non-technical type of secondary education. The cumulative proportion of applicants surviving each selection phase, except in the second phase, was higher for the applicants with a technical type secondary education. Furthermore, there were more applicants with a technical type secondary education that survived the entire selection process and became apprentices. Therefore, the first conclusion drawn from this study was that a technical type secondary education positively influenced the likelihood of applicants being selected onto the apprenticeship programme.

#### 8.3.1.2. Conclusion two: Mathematics performance

The largest frequency of applicants obtained a score between 40 to 59% for mathematics. In terms of the median ST across the selection phases, the higher the percentage obtained for this subject the longer the applicants survived the selection process. Applicants scoring in the two highest percentage categories for this subject had higher cumulative proportions surviving at the end of each selection phase. Therefore, it can be concluded that higher marks in the mathematics subject engenders a stronger possibility of being selected onto an apprenticeship programme.

#### 8.3.1.3. Conclusion three: Science performance

As with mathematics, the largest frequency of applicants scored between 40 to 59% for science and the median ST of applicants improved as their performance in the subject improved. Applicants scoring 60% and above had more than double the cumulative proportion surviving post the third selection phase, in comparison to the 40 to 59% category. This proportion again further doubled if the applicants scored 80% and above. Hence the third conclusion extracted from this study was that applicants with higher performance in science are more reliably able to be successful in selection as apprentices.

### 8.3.2. Secondary objective two: Application profile

The second secondary objective aimed to appraise the value of the application profile on apprenticeship programme selection. This objective related to the results of the fourth through to the eighth hypotheses. Five conclusions were drawn from these findings.

#### 8.3.2.1. Conclusion four: Motivational letter

The majority of the applicants submitted motivational letters that were assessed as being acceptable. The median ST of the applicants steadily increased as the rating of the quality of their motivational letters improved. The cumulative proportion of applicants surviving through the selection phases was the highest for the applicants with excellent and outstanding ratings. In comparison, those with motivational letters rated in the lower two categories had a larger number being terminated at each selection phase. The fourth conclusion derived from these findings was that higher ratings of motivational letters results in better survival opportunities across the selection phases.

#### 8.3.2.2. Conclusion five: Curriculum vitae

Applicants, on average, submitted better quality CVs than motivational letters. The median ST of the applicants through the selection phases increased according to the rating attained for the quality of their CV. More applicants with lower ratings were terminated in the early selection phases than those with higher ratings for their CVs. A higher cumulative proportion of applicants with better ratings survived into the third and fourth selection phases. It was therefore concluded that a good quality CV improved the likelihood of applicants' selection onto the apprenticeship programme.

#### 8.3.2.3. Conclusion six: Practical experience

The majority of the applicants had some practical experience although not regarded as substantial and/or relevant. Nevertheless, this rating improved their median survival rate in comparison to those rated with no experience. Those that were rated as having credible experience attained the longest median ST. The cumulative proportion of applicants surviving through the selection phases, therefore, was the highest for those with the latter rating. In comparison, those with no experience or with experience regarded as not substantial and/or relevant had a larger proportion being terminated at each selection phase. The conclusion derived from this was that the higher the rating of applicants' experience the better their chances of survival across the selection phases.

#### 8.3.2.4. Conclusion seven: Qualification

Only a small percentage of the applicant pool had studied after secondary education in a field consistent with the apprenticeship type selected in their application, despite having the time available to do so. However, the median ST of applicants steadily increased with an improved rating in their level of qualification. Applicants rated as having consistent qualifications in line with the selected apprenticeship type had the highest cumulative proportion of applicants surviving through the selection phases. Those currently in matric had the second highest cumulative proportion of applicants surviving through the selection phases. The deduction drawn for these results was that consistent development in the area of interest can result in effectual outcomes in the selection of applicants onto an apprenticeship programme.

#### 8.3.2.5. Conclusion seven: Leadership potential

Most of the applicants did not obtain a good rating with regard to their leadership potential. However, those that received an average rating in this criteria had the highest median ST. As a result, those rated with average leadership potential had the highest cumulative proportion of applicants surviving through the selection phases. This was higher than those rated as having above average potential. Whilst having a fairly large proportion surviving phase two, those with an above average leadership potential rating did not fare as well as the average rating category applicants in the third and fourth selection phases. Those with above average leadership potential did not survive as long as those with average potential. This could be due to the perception that those with above average potential may not remain within the apprenticeship programme and/or as an artisan but may be more interested in progressing into a managerial position or starting their own trade business in the future. It was, nevertheless, concluded that the leadership potential rating obtained by applicants is an important criterion to be considered in the selection of apprentices.

### 8.3.3. Secondary objective three: Aptitude and teamwork profile

The third secondary objective sought to evaluate the influence of aptitude and teamwork competence on apprenticeship programme selection. The findings from hypotheses nine through to 11 led to the generation of three conclusions that are clarified in the sections that follow.

#### 8.3.3.1. Conclusion nine: General aptitude

Most (86.9%) applicants obtained an average and above rating for their general aptitude. Of the 54 applicants that scored below this rating level only one was selected onto the apprenticeship programme. The median ST of the applicants through the selection phases steadily increased according to their aptitude rating attained. More applicants with lower ratings were terminated in the early selection phases than those with higher general aptitude ratings. A higher cumulative proportion of applicants with better ratings survived into the third and fourth selection phases. These findings show that a higher level of this covariate was associated with longer ST. It was therefore concluded that average and above average general aptitude improved the likelihood of selection onto the apprenticeship programme.

#### 8.3.3.2. Conclusion ten: Technical aptitude

The majority (78.4%) of the applicants had technical aptitude rated as average and above. Of those that obtained ratings below this level, only eight that scored low average were accepted onto the apprenticeship programme. The rating obtained in these aptitudes therefore improved the applicants' median survival rate through the selection phases. The median ST steadily improved as the technical aptitude rating increased. A larger proportion of applicants with higher technical aptitude ratings survived through the selection phases. The conclusion derived from this was that average and above ratings for the technical aptitudes resulted in a better chance of survival across the selection phases and hence acceptance onto the apprenticeship programme.

#### 8.3.3.3. Conclusion eleven: Teamwork competence

The largest frequency of applicants obtained ratings within the significant development area and development area categories. The development skill area had the highest median ST across the selection phases. However, the competence and above average skill area categories had higher median ST than the significant development area category. Therefore, it was concluded that better teamwork competencies enhanced the possibility of being selected onto the apprenticeship programme.

### 8.3.4. Secondary objective four: Interview profile

The fourth secondary objective aimed to assess the impact of interview competence on apprenticeship programme selection. Table 8.1 reflected that the results from the assessment of hypotheses 12 and 13 pertained to this secondary objective. The findings from these two hypotheses led to the generation of two conclusions.

#### 8.3.4.1. Conclusion twelve: Standard interview

The majority (57.3%) of the 143 applicants that were interviewed obtained below average ratings in the standard interview questions. Five of the seven questions posed to the applicants assessed the Initiative, Problem-solving, Motivational Fit, Teamwork and Planning and Organising dimensions. Therefore, this further collaborates the finding for hypothesis 11 and the eleventh conclusion drawn in this chapter. The applicants within the below average rating category had the lowest median ST and the highest proportion of terminal events. It was therefore concluded that better performance, as measured by the standard interview questions, improved the acceptance of applicants onto the apprenticeship programme.

#### 8.3.4.2. Conclusion thirteen: General impression

A third of the applicants were rated as below average in the general impression element of the interview. All five of the dimensions assessed in the general impression aspect of the interview were related to employability competencies. Furthermore, as with the ratings for the standard interview questions, applicants within the below average rating category had the lowest median ST and the highest proportion being terminated at phase four. More applicants from the successful and excellent rating categories were accepted onto the apprenticeship programme. From this it was concluded that enhanced general impression ratings improved the likelihood of being selected onto the apprenticeship programme.

## 8.4. Conclusions derived from the primary research objective

The primary objective of this study was to evaluate a profiling and selection process for apprentices in the South African automotive industry. This objective relates to the 13 hypotheses and the results obtained from each phase in the selection process. As discussed in the previous sections, the null hypotheses of these 13 hypotheses were rejected as the constructs investigated did have a significant effect on the selection of the applicants onto the apprenticeship programme. Candidates who were assessed as having a better rating on each of the 13 constructs survived longer in the selection process and were more likely to be successful in their application to be apprentices.

From these overall findings, the evaluation of the selection process was concluded to be rigorous, valuable and of high quality. The termination rate across the selection phases was steady and the process provided for early detection of the applicants who did not possess the required attributes. The ultimate goal of the apprenticeship programme is the demonstration of competence in the trade test. The pass rates achieved by the apprentices in this study far exceeded those attained in other national apprenticeship programmes.

## 8.5. Recommendations stemming from the objectives

In section 8.5, each sub-section provides recommendations for a particular stakeholder. The section commences with a recommendation offered to the national government. Thereafter, four recommendations pertaining to the broad field of HRM are provided, with section 8.5.3 outlining another four suggestions to the automobile industry. Section 8.5.4 provides a proposal to educational providers of apprenticeship programmes and section 8.5.5 makes a recommendation to one of the test developers.

### 8.5.1. Recommendation to the South African government

One recommendation suggested to the national government is with regards to their announcement of a pending national selection tool for apprentices. As illustrated in Table 8.2, this recommendation was derived from the primary objective of the study.

#### 8.5.1.1. Recommendation one: Confirm national selection tool

The literature review in section 3.3 highlighted that Germany focuses on the recruitment and selection phase of the apprenticeship life cycle (Fazio et al., 2016; Jacoby, 2014; Kahlen, 2016). The other three countries, as well as SA, reviewed in this study do not adopt this focus in their apprenticeship systems, despite their stating they were revitalising the apprenticeship systems in their countries. This difference in focus may be one of the key contributing factors for the outstanding success of the German apprenticeship system and a reason for its benchmark status (Grosvenor, 2016).

It is recommended that the national government follow-up on its suggestion that a recruitment and selection tool be designed to facilitate the effective entry of applicants onto apprenticeship programmes (Government Gazette, 2015a). A call was made to collaborate with employers and establish the strengths and weaknesses of current selection methods in order for the best practices to be incorporated by other employers in their selection policies.

Table 8.2

*Summary of the Recommendations*

| Stakeholder | Recommendations | Primary Objective: Evaluate Selection Process | Secondary Objectives | | | |
|---|---|---|---|---|---|---|
| | | | 1: Educational Profile | 2: Application Profile | 3: Aptitude and Teamwork Profile | 4: Interview Profile |
| Recommendation to the South African government | Confirm national selection tool | ✔ | | | | |
| Recommendations for the human resource management field | Use of a multiple-hurdle selection process | ✔ | | | | |
| | Use of standardised application documentation | | ✔ | ✔ | | |
| | Use of on-line technology | | ✔ | ✔ | ✔ | |
| | Subject pass rates | | ✔ | | | |
| Recommendations for the automotive industry | Replication of selection process | ✔ | | | | |
| | Marketing of the apprentice position | ✔ | | | | |
| | Career guidance | | ✔ | ✔ | ✔ | ✔ |
| | Standardisation exercises | | | ✔ | ✔ | ✔ |
| Recommendation for educational providers | Job application preparation workshops | | ✔ | ✔ | ✔ | ✔ |

It is hence recommended that the selection process evaluated in this study be adopted for replication by the government. The selection process could initially be piloted in another automotive plant to ensure the process is sufficiently streamlined and replicable beyond the Client. Once the initial replication issues have been resolved the selection process could be offered on a national basis. An implementation guideline booklet, similar to that produced by NAS (2017), could be composed and distributed to interested parties. Implementation workshops should also be facilitated at a provincial level, specifically in towns were the OEMs are located.

### 8.5.2. Recommendations for the human resource management field

Four recommendations are tendered to the HRM discipline with regards to apprenticeship selection practices. As portrayed in Table 8.2, the first recommendation is linked to the primary objective with the other three recommendations being linked to three of the four secondary objectives.

#### 8.5.2.1. Recommendation one: Use of a multiple-hurdle selection process

Figure 4.1 depicted a successive or multiple-hurdle selection approach. This general selection process had eight steps from initial recruitment to the short-listing of successful candidates. According to Van der Merwe (2002) this process is used by most organisations in SA. Multiple level selection processes can be used if the reliability of employing a singular approach is under question (Piro, 2011). A multi-stage selection process could alleviate the risk associated with misrepresentation and/or lying discovered on job applications or CVs (Trindale, 2015). The subjectivity associated with certain singular screening techniques and the associated incorrect identification of the best candidates (Kalugina & Shvydun, 2014; Watkins & Johnston, 2000) can hence be alleviated through the use of various selection phases. A composite battery of tools supplemented with non-cognitive measures such as interviews could also assist in reducing the potential legal risks associated with certain types of testing (McFarland et al., 2004; Schmidt et al., 2016).

The effectiveness and fairness of using multiple tools to make a selection decision can therefore enhance the predictive validity of the process (Van der Flier et al., 2003). A multiple rather than a singular phase selection process for entry-level operators has been previously recommended to the automotive industry (Gump, 2006; Puchert et al., 2017a, 2017b). In line with this previous research and the conclusions derived in this study, it is recommended that HR practitioners adopt a multiple-hurdle selection process on a consistent basis. This recommendation is therefore related to the primary objective. As discussed in section 7.7, the selection process investigated in this study was concluded to be valuable and of high quality. The 13 constructs were established to be predictive of high quality incumbents and the trade test pass rate far exceeded that of any other documented by an accredited test centre in SA.

#### 8.5.2.2. Recommendation two: Use of standardised application documentation

In this selection process, applicants were terminated at phase one due to non-compliance on a number of stipulations. This included not submitting all the required documentation (e.g., certified copies of actual qualifications and identity document) as well as the minimum educational requirements not being met. Other reasons for termination at this phase included: not specifying the apprenticeship type applied for in the motivational letter, not indicating the internal application number (e.g., TECH 2012), handwritten applications, not completed pure mathematics (i.e., applicant had done mathemtical literacy or not done this subject at all) and/or science at Grade 12 or equivalent.

Over half the initial sample of applications ($N$ = 3 412) in this study were not successful in phase one. This was due to one or more of the reasons mentioned in the previous paragraph. As clarified in section 1.4.3, apprentice applicants are unlike other staff as this pool of candidates is usually young and inexperienced (Grosvenor, 2017). To address this issue, and to reduce the likelihood of high calibre candidates being terminated due to carelessness on their part in compiling their application documentation, it is recommended that standardised applications forms should be used in the initial apprenticeship selection practices. This recommendation therefore stems from the first and second secondary objectives of the study.

The host organisation is encouraged to design template documents in order to facilitate the stated advantages (e.g., easy comparison and filtering) of this pre-screening device (Schmidt et al., 2016; Wickramasinghe, 2007). Through the use of these standardised forms the applicants would be prompted to provide certain information that was often omitted and resulted in them being terminated at this early stage in the selection process. The process would also be more streamlined, time and cost-effective as information needed for screening purposes would be readily available. This could also be extended to providing templates for applicants to use in terms of the layout of a good CV and motivational letter. Initial briefing or training workshops could be implemented to assist the applicants to understand the requirements and the manner in which the documentation should be completed. This recommendation relates to the first and second secondary objectives.

#### 8.5.2.3. Recommendation three: Use of on-line technology

Following on recommendation two, the third recommendation centres on making use of on-line technology to assist alleviate the manual screening of mass applicants at the early stages in the selection process. There are many on-line technology options available, with only a few being suggested here. The first proposal is that the standardised application documentation and templates, suggested in section 8.5.2.2, be made available on-line.

Another proposal is the development and implementation of realistic on-line job previews. As discussed in section 4.4.2.2, Lachu (2014) has suggested that these on-line job previews will enable apprenticeship applicants to obtain a realistic appraisal of the different apprenticeship types being offered by an organisation and facilitate the accurate identification of the correct type in their application. In the first phase of the selection process investigated in this study, applicants were often terminated due to their lack of identification of apprenticeship type in their application documentation. Furthermore, applicants often identified an apprenticeship type but failed to appropriately link their existing qualifications and/or experience to this apprenticeship type. This resulted in their obtaining a low rating for their motivational letter. This could be alleviated through the applicants previewing each apprenticeship type using this on-line tool, thereby more successfully understanding the requirements and better aligning their application with these. An on-line ‘pre-application’ assessment, such as developed by Siemens, could be useful in assisting apprenticeship applicants in their decision on the most suitable apprenticeship type to apply for (Grosvenor, 2017).

Novel on-line preliminary CV screening and tracking techniques has been proposed by several researchers (Amdouni & Ben Abdessalem Karaa, 2010; García-Sánchez et al., 2006;

Perinot, 2016) and were considered in sections 4.4.2.2 and 4.4.4. These on-line screening and tracking systems are worthy of consideration for apprenticeship selection practices. The option of the tool having some initial pre-selection criteria built into the system would be advantageous in filtering through the large volume of applications received for apprenticeship programmes. Besides being helpful in facilitating the refinement of the matching process between positions and applicants, these tools will also assist the applicants who have not been successful to have a positive impression of the selection process. The tracking and feedback mechanisms would allow even rejected applicants experiencing the application process as being fair, transparent and cutting edge. This is regarded as important for the branding and image of organisations (Anderson et al., 2010; Schmitt, 2014; Trindale, 2015).

Despite the disadvantages of on-line psychological testing provided in section 4.4.4, the general and technical aptitudes tested in the third phase of the selection process could also be done on-line. The use of gamification tools were also discussed in section 4.4.4. These forms of assessment have a strong appeal for millennials and can hence be a powerful tool to attract potential applicants into apprenticeship programmes (Hawkes et al., 2017). For the competencies assessed in the third tool of phase three, namely, the teamwork competencies, a gamification tool could also be designed.

#### 8.5.2.4. Recommendation four: Subject pass rates

The fourth and final recommendation to HR practitioners involved in the selection of apprentices is the setting of minimum pass rates for the mathematics and science subjects. In this study, regardless of the type of secondary education obtained, applicants that performed better in mathematics and science survived more selection phases. It is proposed that the minimum pass rate for acceptance onto an apprenticeship programme be 50% and above for both these subjects. Whist this is aligned to the national standpoint on the minimum entrance requirements for apprenticeship candidates (Government Gazette, 2015a), this is seldom upheld (Arfo, 2015). In this study too, eight apprentices had obtained between one to 19% for mathematics and 13 had attained between 20 to 39%. In science, eight apprentices had achieved between one to 19% and 18 had achieved scores between 20 to 39%. That is 27% and 34% of the total sample of applicants that were accepted onto the apprenticeship programme. However, improving these minimum entrance requirements would substantially stream-line the initial selection of these candidates and would be a more time and cost-effective manner of initially reducing the number of applicants progressing to the expensive phase three where psychological testing was done. In this study at least 56 applicants were tested in phase three that did not achieve 40% or more for mathematics and 78 that did not achieve 40% or more for science. These candidates were ultimately not successful in phase three and the cost of their assessment could have been alleviated earlier in the selection process through the use of their subject performance as a preliminary screening tool.

### 8.5.3. Recommendations for the automotive industry

The four recommendations provided in section 8.5.2 are also relevant for the automotive industry. In addition, however, four other recommendations are submitted to the sector. As illustrated in Table 8.2, the first two recommendations pertain to the primary objective of the study and the other two recommendations to the four secondary objectives of the study.

#### 8.5.3.1. Recommendation one: Replication of selection process

The trade test pass rate attained post the selection process followed in this study far exceeded that of current national trends (e.g., as discussed in the Government Gazette, 2015a; Mahembe, 2012; Mbatha et al., 2014). This means that the selection process was able to ascertain those that were most suited for the Client and this resulted in good pass rates. Other automotive plants are therefore encouraged to adopt a similar rigorous selection process for their apprentices. This would improve the likelihood of these organisations also achieving high trade test pass rates. This aligns with the recommendation for investment in improved selection and screening of apprentices made by others (Government Gazette, 2015b; merSETA, 2016).

#### 8.5.3.2. Recommendation two: Marketing of the apprentice position

The literature review of the global apprenticeship programmes in section 3.3 highlighted the increasing trend of the youth favouring university over vocational type qualifications (Fazio et al., 2016; Jacoby, 2014; Kahlen, 2016). An account of the challenges in realising the value and attraction of apprenticeship programmes to various stakeholders was provided in section 3.7. In order to deal with this dilemma, it is recommended that the national automotive industry use proactive steps to entice the youth into their apprenticeship programmes. Other sectors, such as the financial, healthcare and services sectors, are successfully targeting and promoting their apprenticeship programmes to this pool of applicants (Giffi et al., 2014, 2015; Kramer et al., 2015). The automotive industry should adopt a similar stance to these sectors and convey the positive attributes of their apprenticeship programmes to their target audience. Higher calibre candidates may also be attracted to apply for these programmes within the automotive industry if the profile and attractiveness of working in the industry was made clear (Giffi et al., 2014; Shankel, 2010). This recommendation is in line with that made by several global and national authors (Duarte, 2017; Kramer et al., 2015; Government Gazette, 2015a; OECD, 2011). This enhancement of a career within the manufacturing industry should be done in collaboration with educational providers (Shankel, 2010).

#### 8.5.3.3. Recommendation three: Career guidance

As discussed in sections 8.5.2.2 and 8.5.2.3, applicants did not accurately reflect on their career options, nor indicate the type of apprenticeship that best suited their subject choice and extra-curricular activities. This resulted in the candidates often not indicating a preferred apprenticeship type on their motivational letter, which would have resulted in them being terminated at phase one. If they did indicate a preference on their motivational letter and this was in contradiction to their subject choice and extra-curricular activities, this would have been discovered in the CV review within selection phase two. These candidates are likely to have received a very low rating for both their motivational letters and their CV. This may then have resulted in their termination at this second selection phase.

It is advised that career guidance practitioners be made available within the automotive industry to guide existing employees in terms of development opportunities. Applicants should be guided in terms of the appropriate type of apprenticeship to apply for in terms of their previous subject choice and experience. Where applicable, applicants could also be advised to pursue the shorter ARPL option rather than the longer route of attending an apprenticeship programme. The need for career guidance to job applicants is in line with recommendations made by other researchers (Brewer, 2013; Hessler & Ritchie, 2006; merSETA, 2016).

#### 8.5.3.4. Recommendation four: Standardisation exercises

The subjectivity of raters in their review of CVs is a common criticism of the selection tool (Breaugh, 2009; Kalugina & Shvydun, 2014; Watkins & Johnston, 2000). To address this aspect, it is recommended that the Client, and other automotive plants replicating this selection process, periodically use inter-rater standardisation exercises to ensure consistency in the rating of the CVs.

Section 4.4.4.2 highlighted that in AC-type exercises, consensus between the assessors is a key determinant of the tool's reliability (Ballantyne & Povah, 2004). Section 4.4.5 indicated that the disadvantages of interviews (e.g., faking and impression management) can be minimised through the use of panel interviews (Wickramasinghe, 2007). The implementation of inter-rater standardisation exercises for the phase three assessors and the phase four interviewers would also facilitate enhanced consistency in the ratings done by these reviewers. The guidelines and procedures presented by the Assessment Centre Guidelines for SA (Meiring & Buckett, 2016) could be useful for the automotive industry to follow in this regard. Refresher training for these assessors and/or reviewers could also be useful (Cole et al., 2009; Fritzsche & Brannick, 2002). This section concludes the four recommendations submitted to the automotive industry.

### 8.5.4. Recommendation for educational providers

One recommendation is offered to secondary educational providers to assist these institutions enhance the future selection possibilities of their students. This recommendation pertains to the four secondary objectives as depicted in Table 8.2.

#### 8.5.4.1. Recommendation one: Job application preparation workshops

In this study better ratings were obtained for the CVs than for the motivational letters submitted by the applicants. However, a significant portion of applicants were terminated in both the first and second phase due to their inappropriate completion of the application documentation. It is therefore recommended that educational institutions offer job application preparation workshops to their students, specifically in their final year of study. These workshops should provide guidance to the students on how to compile a good CV and motivational letter. This could be part of the English curriculum in terms of creative writing exercises. Furthermore, these workshops could equip the students with an understanding of what to expect from a selection process and an appreciation of basic work ethic principles, such as punctuality and professionalism.

This is in line with recent suggestions made to formal and informal education and training providers to enhance employability. These researchers suggested incorporating work readiness or core work skills workshops into the training to better facilitate the transition of students into the workplace (Brewer, 2013; Shankar et al., 2016). The provision of support to candidates during their application for new positions has also been highlighted by other researchers (Azar et al., 2013; Fox, 2018; Hessler & Ritchie, 2006). These preparation workshops should focus on assisting the potential applicants to address two fundamental flaws in their application as discovered in this study. These are, firstly, following the instructions provided within the advertisement and, secondly, enhancing their profile provided in their CV. These two issues are discussed in the following two paragraphs.

Potential applicants should be encouraged to focus on following the instructions included in job or position advertisements. In this study, a large portion of the applications were terminated at phase one due to the inappropriate and incomplete documentation submitted. High potential candidates could have been terminated at this early stage and not understand the reason for their application not being successful, especially if they had attained the minimum entrance requirements. Furthermore, applicants should be encouraged to pay attention to the layout, structure and quality of the CVs and motivational letters compiled and submitted in their application for positions. This is important given the empirical findings established in section 4.4.2.2 between CV content, perceptions thereof and the judgements made by reviewers related to hireability (Arnulf et al., 2010; Burns et al., 2014; Van Toorenburg et al., 2015). This would also assist in reducing the interpretation gap (DuRose & Stebleton, 2016; Fox, 2018) discussed in section 4.5.2.2.

Secondly, applicants should be encouraged to gain credible experience in their field of interest and application. This may entail volunteering and doing work for no pay until the opportunity arises to be selected onto an apprenticeship programme. Working in a related area (e.g., operator or assembler in the production environment) is regarded as better than having no experience at all and would improve ratings.

Applicants are also encouraged to continue studying in their area of interest and obtain post-secondary education level qualifications whilst waiting for the opportunity to be selected onto an apprenticeship programme. Applicants should also be advised to be active in their participation in extra-curricular activities while studying. This contributes to their rating in terms of leadership potential. One of the reasons provided for the current global STEM paradox is the lack of basic employability and soft skills within the graduate pool (Giffi et al., 2015; Kramer et al., 2015). Apprentice applicants need to take a proactive role in developing these skill sets in order to enhance their employability opportunities. This recommendation is in line with that tendered by other researchers that individuals use part-time employment and various extra-mural activities to develop the core work competencies and behaviours required by employers (Brewer, 2013; Evans & Richardson, 2017; Fox, 2018).

### 8.5.5. Recommendation to test developer

The eleventh recommendation gained from this study is presented to the TRAT test developers. This recommendation does not relate to either the primary or secondary objectives of the study.

#### 8.5.5.1. Recommendation one: Formal validation

The TRAT battery was produced in 1983 and has not been revised since this publication date. The culture friendliness of the test could therefore be questioned. The tool has also not been validated, as proposed would be done in the test manual. These two issues could draw concern to the reliability and validity of this instrument.

The instrument is registered and approved by the HPCSA and is also a popular test within SA. It is hence recommended that the test developer conduct a validation study to formally confirm the credibility and status of this battery. The results attained in this study could be used to assist in this regard.

## 8.6. Contributions of the study

The contribution of this research study is three-fold. Firstly, the study has confirmed the quality and value of this selection process for apprentices within the automotive industry. Secondly, the study offers vital information pertaining to the optimum profile of successful apprentice applicants. The third contribution relates to the use of the survival analysis statistical procedure in the HRM field. These contributions are discussed in detail within the next three sections.

### 8.6.1. Recommended selection process for automotive apprentices

It was established in Chapter Four that there is limited global and national research on the profile and selection process for apprentices. This study can therefore be regarded as a significant contribution to the HRM field as it is the first study, globally, to provide longitudinal data on the impact of a selection process for an apprenticeship programme.

Section 4.6.1 presented the empirical literature available in terms of global apprentice selection practices. Besides the specification of minimum scholastic achievement (e.g., Forsblom et al., 2016; Imdorf & Leemann, 2012), cognitive and other aptitudes tests are regularly used (e.g., Mueller & Wolter, 2014; Siegenthaler, 2011; Torpey, 2013) in the selection of apprenticeship applicants. Interviews are also a commonly used selection tool (e.g., Tang, 2015; Schmid & Storni, 2004; Stalder, 2000). Regardless of the specific tools used, rigorous and multi-phase selection processes are encouraged (Imdorf & Leemann, 2012; Lovender, 2015; Torpey, 2013).

Nationally, less empirical research is available on the selection practices employed and more research insight has been provided on the following of minimum educational requirements set per apprenticeship (Mummenthey et al., 2012). Several national bodies have highlighted the need for in-depth selection techniques (merSETA, 2016; Mummenthey et al., 2012) as well as the assessment of various aspects such as aptitude, ability, motivation, personality and learning ability (Mummenthey et al., 2012). A study on the optimum selection process for automotive operators has recommended a multiple rather than a singular phase selection process (Puchert et al., 2017a, 2017b).

This research study has provided evidence of the importance of a multiple-hurdle standardised selection process for apprentices within the automotive industry. The study has confirmed the significant impact of several criteria on the optimum selection of apprentices. Rather than any one aspect (e.g., scholastic achievement or aptitude) being a sole determinant of those most suitable to becoming an apprentice, this study has highlighted that several factors contribute to the identification of the best applicants for this position.

It has been recommended that the selection process investigated in this study be replicated across the automotive industry in the establishment of the best potential artisans. However, this selection process could also be employed cross-industry. This would fulfil the need recently identified by the local government for the development of a recruitment and selection tool to improve the throughput rate of apprentices (Government Gazette, 2015a).

### 8.6.2. Development of an automotive apprentice profile

Prior to this study, limited research had been done on the optimum profile of apprentices. Besides the age stipulations and minimum educational requirements, outlined in section 4.6, there is no empirical information regarding the criteria that could be useful in predetermining those applicants that could be successful in an apprenticeship programme. This study sought to bridge that gap in the literature.

This study has resulted in the identification of 13 broad criteria that have a significant impact on the selection of applicants onto an apprenticeship programme. The use of these criteria can now be used across the automobile industry and potentially other manufacturing concerns too. This is the first comprehensive profile of criteria that are predictive of successful selection onto an apprenticeship programme. This profile has shed light on the importance of further research on the selection of potential artisans. This research can therefore be regarded as a major contribution to the field of HRM, specifically in terms of recruitment and selection.

### 8.6.3. Use of survival analysis in the human resource management field

Section 5.9.4.4 outlined that the survival analysis statistical procedure has been regularly applied within the medical field (Ajagbe et al., 2014; Agarwal, 2012; Barraclough et al., 2009).

Survival analysis is also increasingly being used to predict the onset of areas outside the medical field (Chung et al., 1991; Shakar & Hűllermeier, 2014; Singh & Mukhopadhyay, 2011). This study has provided empirical research illustrating the effective use of the statistical tool within the HRM field. This is the first study in the discipline making use of this statistical procedure.

The survival analysis procedure has provided a novel and scientific manner to analyse the termination rate of the applicants across the selection process. This statistical method of analysis could be used to understand the survival rate of applicants across other selection processes. Survival analysis could also be used in other HR activities. The method is particularly useful in enhancing understanding of terminations across a time span. The method could therefore be used to appreciate when and why individuals terminate from development programmes as well as their exit from organisations.

The significance of the study has been summarised. Nevertheless, and not withstanding these three contributions, there are also limitations inherent in the research study. These are discussed in the next section.

### 8.7. Limitations of the study

There are three limitations pertaining specifically to the research methodology used in this study. The first limitation is concerned with the study's sample, the second limitation is concerned with one of the data collection instruments used and the final limitation relates to the data analysis approach employed.

This study stemmed from an annual recruitment process completed by a national automotive assembly plant. Whilst this enabled a large sample of applicants to be investigated it was a convenience sampling method which has its own disadvantages (Bryman, 2016). This sample was drawn from a limited geographical area as indicated as a selection priority of the Client. Furthermore, the selection process and several of the tools used in the selection process were designed by the Client and/or were used for the express purpose of fulfilling the mandate set by the Client. A potential shortcoming of this research is therefore that broad guidelines can only be submitted to the South African automotive industry. The application of these guidelines beyond this sector may be limited. However, the decisions taken in the design of any selection process are common to most organisations. Amongst others, that is, firstly, the reduction of unemployment within their immediate environment (i.e., as part of their social responsibility initiatives) and, secondly, the improvement of the calibre of applicants absorbed into the organisation.

The second limitation pertains to the TRAT battery. In section 8.5.5 it was recommended that the test developer formally validate this tool. The instrument is nevertheless registered and approved by the HPCSA and is a widely used test battery within SA.

The third limitation concerns the dilution of the scores obtained by the applicants within the selection process. In the second phase the applicants' performance in two subjects were classified into five categories. Two of these categories, namely 40 to 59% and 60 to 79%, were very broad. If there had been more categories, the performance of the applicants may have been more sensitively differentiated. Furthermore, within the third phase of the selection process three broad areas were assessed, namely, general aptitude, technical aptitude and teamwork competence. In the two aptitude assessment areas, standard psychometric testing protocol was utilised and the obtained raw scores were converted to stanine scores for reporting purposes. Furthermore, the average scores attained by applicants, across several sub-tests, was computed as an indication of their general aptitude and technical aptitude performance. The teamwork competence of the applicants, across several dimensions, was also diluted into an average score. The intensity and subtleties between the actual scores achieved in specific sub-tests and/or dimensions may have been weakened by this data analysis technique.

Another limitation, recognised during this study, is the limited amount of research literature available on the selection of apprentices and artisans. Whilst there is more global information than that available within SA, a substantial amount is not original, peer-reviewed research. It is with these limitations in mind that the recommendations for future research are propounded in the section that follows.

## 8.8. Recommendations for future research

Future research that could potentially stem from this study are within four main research areas. These are the replication of the study, the extension of the study to a broader sample, adding a qualitative dimension to the study and extending the study to investigate the output of the apprenticeship programme.

The suggestions are that the selection process employed in this study be replicated for an operator position. Given the similarity in the nature of work done and the need for this pool of talent, future research of this nature could provide fruitful benefits for the HRM field as well as the broader manufacturing sector.

Replications of this study could also be done with alternative forms of aptitude and/or teamwork competence batteries to ascertain the repetition of the obtained results. Future research should also investigate whether similar results were attained in the selection drives of the intake years post the study. This would provide an indication of the consistency in the results obtained in this study.

With regard to a broader sample, it is recommended that similar research be conducted in other automotive plants and/or in the broader manufacturing sector to ascertain the nature of the selection processes employed as well as the success of these. Future research may also consider replicating the same selection process on apprentices in other automotive firms in different provinces of SA and/or in alternative manufacturing industries such as the tyre industry or the chemical sector.

A qualitative study focussing on the experiences of applicants during the selection process for an apprenticeship programme would add value. This could be facilitated though focus groups. Even if the applicants were not successful, it is considered a vital component in the branding or image of world class organisations that applicants have a positive impression of the organisation and perceive that they have undergone a fair and transparent selection process. Future research could also include a qualitative review of the instructors' insights regarding the selection processes conducted for an apprenticeship programme. This may provide their recommendations for the improvement of the calibre of apprentices they need to train to become artisans.

It is recommended that future research investigate the group of apprentices selected onto the Client's apprenticeship programme to determine their specific profile in terms of the constructs investigated in this study. This could also be extrapolated to investigate if there is significance in these variables and the number of attempts taken to complete the trade test.

Finally, further longitudinal research could be conducted on this sample of apprentices that completed their apprenticeship within the Client. Information with regard to their performance on the apprenticeship programme (i.e., formative theoretical and practical assessments) could be analysed to further evaluate their suitability as apprentices. Furthermore, performance appraisal documents could be examined to establish whether the apprentices from this study are performing optimally as artisans on-the-job.

### 8.9. Concluding remarks

This eighth and final chapter of this dissertation has provided a summation of the study's main findings and described the fourteen conclusions established from these findings. These conclusions primarily focused on the contribution of the 13 constructs to the selection of applicants onto an apprenticeship programme. Drawing from these conclusions, one recommendation was offered to the national government, four recommendations were proposed to the HRM field and four to the automotive industry. Specifically, it was recommended that the selection phases employed in this study be retained and replicated by the automobile industry in their selection of apprenticeship applicants. Furthermore, one recommendation was submitted to educational providers to assist applicants improve their survival rate within selection processes. The final recommendation was made to the TRAT test developer regarding the formal validation of the tool.

The recruitment and selection of apprentices has become a major area of concern as "the correct recruitment and selection of apprentices affects the whole artisan development value chain" (Government Gazette, 2015a, p. 13). The recruitment and selection of apprentices is regarded as an area needing speedy attention in order to realise the national goals of improving trade test pass rates and producing higher quality artisans (merSETA, 2016; Pienaar et al., 2016). This study has hence made a significant contribution to both the HRM field and the automotive industry in addressing this area of trepidation. This study is the first national longitudinal study of a selection process for apprentices and is the first national study to make use of the survival analysis procedure within HRM.

This study is also powerful as it adds value to the automotive industry. Through this selection process the calibre of apprentices drawn into the industry can be enhanced thereby enabling the industry to be better equipped to deal with the productivity and technological challenges currently faced by the local industry. As one of the applicants from this study stated in their covering letter:

*"Being part of this apprenticeship programme will not only help me to contribute to our economy and the upliftment of the people within my community, but I will become part of a priviledged group of people making phenomenal cars"*

*(Anonymous, personal communication, April 12, 2013).*

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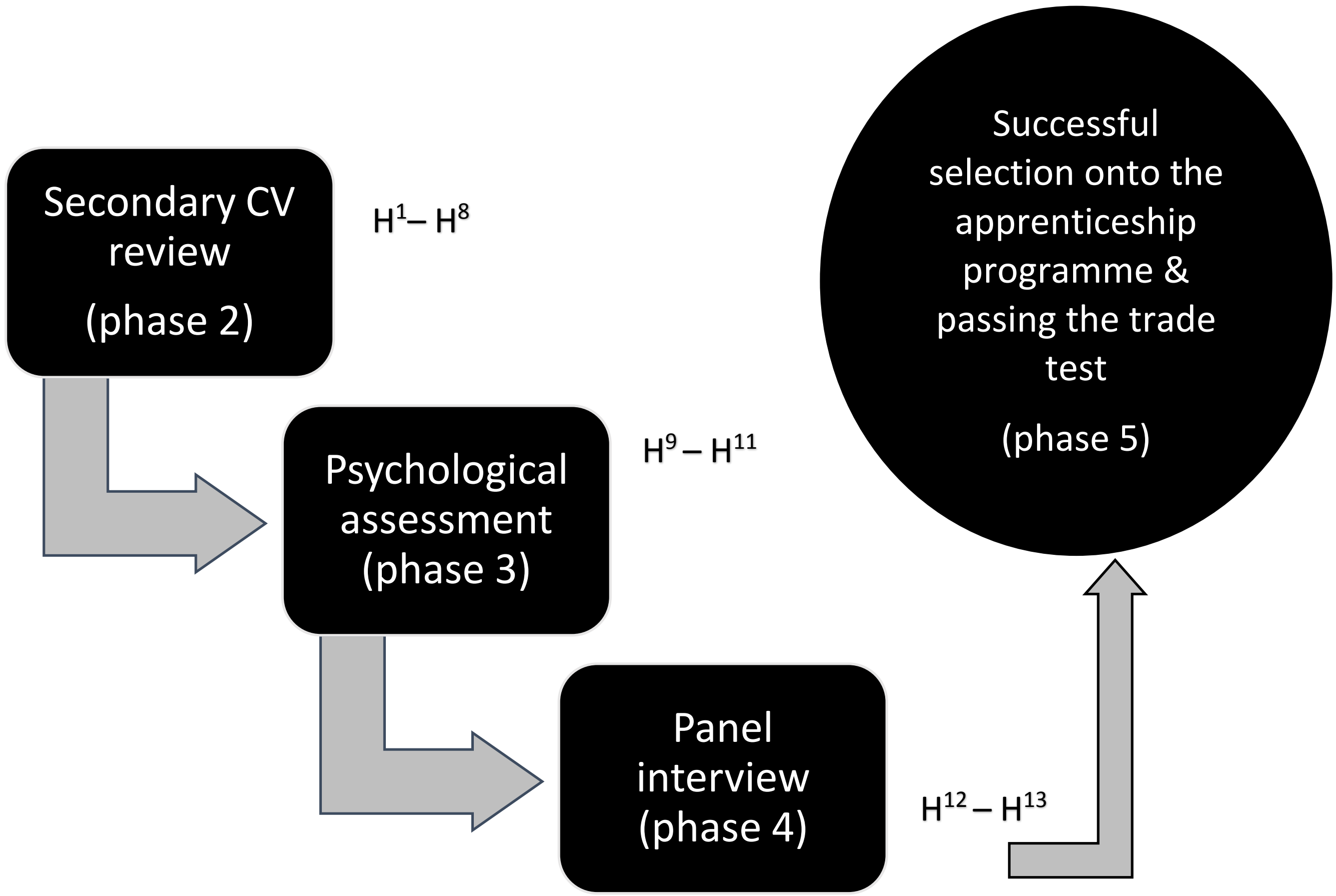
Appendix A

Conceptual Framework of Study



Appendix B

Apprenticeship Intake Selection Process

| | Phase | Purpose | Criteria and/or Rating process |
|---|---|---|---|
| 1 | Application and preliminary CV review | Ascertaining if all required documentation has been submitted and minimum educational requirements have been met | Yes (progress to phase two) or No. |
| 2 | Secondary CV review | Establishing the quality of documentation submitted as well as an assessment on other internal screening criteria | Rated on 12 criteria (scoring sheet provided as Appendix C), such as:<br>• Motivational letter<br>• Quality of CV<br>• Instruction medium<br><br>Rating from 1 (well below average) to 5 (outstanding) per criterion.<br><br>Overall, higher rated candidates progress to phase three. |
| 3 | Psychological assessment recommendation | Three categories of assessments are employed determining general and technical aptitude as well as teamwork competencies. | Assessments include:<br>• Six general aptitudes, namely, Vocabulary, Verbal Reasoning, Non-verbal Reasoning, Reading Comprehension, Comparison & Memory<br>• Six technical aptitudes, namely, Dexterity, Co-ordination, Assembly, Calculations, Spatial Perception 2-D & 3-D.<br>• Nine teamwork competencies, namely, Assertiveness, Conflict Management, Feedback, Influence, Initiative, Listening, Questioning, Problem-solving and Teamwork.<br><br>Four judgement categories:<br>1)Highly recommended<br>2)Recommended<br>3)Recommended with reservation<br>4)Not recommended |

Appendix B (continued)

Apprenticeship Intake Selection Process

| | Phase | Purpose | Criteria and/or Rating process |
|---|---|---|---|
| | Psychological assessment recommendation (continued) | | Categories 1 & 2 progress to phase four. |
| 4 | Panel Interview | Applicants are assessed on their responses and/or ratings on two broad categories of questions. | Planned Behavioural Questionnaire (interview sheet) is provided in Appendix D.<br><br>Categories of questions:<br>1) Seven standard questions, such as, Initiative, Problem-solving and Quality Orientation<br><br>2) Seven general interview impression criteria, such as: Presentability, Understanding, Communication and Punctuality<br><br>Rating from 1 (insufficient – does not meet expected standard) to 5 outstanding (far exceeds standard) per question.<br><br>Overall higher rated applicants progress to the medical & MIE checks. |
| | Applicant is notified and commences apprenticeship | | Provisional acceptance if applicant still needs to pass Grade 12. |
| 5 | National trade test score | National summative exit assessment from apprenticeship | Competent or Not yet competent<br>Must pass all modules |

Appendix C

Secondary Curriculum Vitae Review Screening Guidelines (A & B)

**Confidential - Secondary screening guidelines**

Enter score onto template:

Guide :

5: Outstanding- well above expected standard/ descriptor

4: Excellent – above expected standard/ descriptor

3: Successful- meets expected average standard/ descriptor

2: Below average – below expected average standard/ descriptor

1 Well below average – far below expected average standard/ descriptor

Note not all criteria use all 5 scores! – refer to template and/ or descriptors below

1. Quality of motivation letter ( neatness/ layout/ spelling grammar/ reason / logic/ contradiction with subject choices / trade)
2. Quality / Overall neatness of CV (layout/ content/ neatness/ spelling/ grammar)
3. Geographic area of applicant- current employed / studying or home in Buffalo City Metro area 5 points, in E cape 3 points, all other areas 1 point awarded. If candidate is studying outside BCM/ E-Cape base points / rating on home town if available.
4. Technical or non-Technical high school: 3 points for Technical /2 points for non-technical. NCV studies do not count as a technical high school and to get a 3 points technical high school candidates must be doing 2 technical subjects in addition to maths and science.(Some Technical High School students may go to a THS but not have maths / science and **TWO** technical subjects)
5. Suitability of school or NCV subjects where 5 points are given for fully suitable choices e.g. maths/ science / and two engineering related subjects one being electrical (or motor mechanics for auto electricians only) in nature, 4 points as above but with no electrical subjects, 3 points for having maths and science and non-mechanical or electrical subjects (e.g. civils/ woodwork etc.), 2 points for having maths and science and EGD or IT etc. only with NO trade subject, one point for maths and science only (!)
6. Highest matric level or nearest equivalent submitted maths mark – same as for 9 below.
7. Highest matric level or nearest equivalent submitted science mark – same as for 9 below.

Secondary screening B

8. Background (tech/practical experience/ work experience) .Discretionary guideline: If applicant has been to a technical high school/ NCV/ or has had alternate credible practical experience they can score a 3. If they have some practical experience but it is not substantial or relevant to trade applied for they get a 2, if they have no practical they get a 1.
9. Instruction medium – what is the highest English language score submitted (1 to 19% one point awarded(should not occur) , 20 to 39% two points awarded, 40 to 59% three points awarded, 60 to 79% four points awarded, 80 to 100% five points awarded.
10. Driver or learners licence (auto only) 4 points for drivers/ three points for learners/ 2 points for nothing
11. Level of qualification ,taking into account age/ vs. development/ qualification level as a guide. Current matric students cannot be expected to have a high qualification level so would get a 3, but a person of who has had opportunity to study e.g. post matric could be expected to grow with time. Consistent development in the same or related fields gets a 4 or 5 in exceptional cases. A person who has had time to study post matric but has not done so would get a one or a two depending on the time they have had to study.
12. Leadership/ training potential / – combination of age and leadership positions held e.g. sports captains, prefects/ group leaders , co-ordinators. Evidence of leadership in application documents and low age (below 30) gives a 4, one of these factors gives a three and none of this combination of factors gives a 2.

Appendix C (continued)

Secondary Curriculum Vitae Review Screening Guidelines (A & B)

Secondary screening A score sheet: Initials of screener..............................................................

| Criteria | | | | | |
|---|---|---|---|---|---|
| 1 Motivation letter | 1 | 2 | 3 | 4 | 5 |
| 2 Quality of CV | 1 | 2 | 3 | 4 | 5 |
| 3 Geographic area | 1 | n/a | 3 | n/a | 5 |
| 4 Tech High school | n/a | 2 | 3 | n/a | n/a |
| 5 School or NCV subjects | 1 | 2 | 3 | 4 | 5 |
| 6 Maths | 1 | 2 | 3 | 4 | 5 |
| 7 Science | 1 | 2 | 3 | 4 | 5 |
| Total secondary screening A | Actual mark /33 | % | | | |

Secondary screening B score sheet- Initials of screener..............................................................

| | | | | | |
|---|---|---|---|---|---|
| 8 Background Experience/practical | 1 | 2 | 3 | n/a | n/a |
| 9 Instruction medium | 1 | 2 | 3 | 4 | 5 |
| 10 Drivers (auto only) | n/a | 2 | 3 | 4 | n/a |
| 11 Level of qualification | 1 | 2 | 3 | 4 | 5 |
| 12 Leadership / Training potential | n/a | 2 | 3 | 4 | n/a |
| Total secondary screening B | Actual Mark /21(AE) 17(MW) | % | | | |

Combined score total out of for Millwrights ..............................................equals.....................................................%

Combined score total out of for Auto Electricians....................................equals.....................................................%

Other comments / notes of interest/ commendation / concern – any issues relevant to potential engagement for apprenticeship such as exceptionally high marks/qualifications , currently employed/ on learnerships / apprenticeships or similar etc. (what is not detected in previous questions but makes the candidate attractive or not) . Persons currently in full time apprenticeship or learnership should remain in that field , unless it is likely they can complete it before they can start their new apprenticeship.

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*Source:* Anonymous within the Client (2011).

Appendix D

Apprenticeship Interview Sheet

## Planned Behavioural Questionnaire

| |
|---|
| Interviewee:__________________________ Date:____________ |
| Interview Panellists: ........................................................................................................ |

Position: Millwright / Automotive Electrician/ Flexible/ other.............................. (Circle)

### 1. Initiative / Integrity / Energy:

Score =

1.1 Have you taken steps to improve your skills or performance? What did you do?

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............................................................................................................
............................................................................................................

1.2 Give an example when you were asked to do something that you did not think was right? What did you do?

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1.3 Tell me about a time when you had to work at a fast pace for a long period of time. What work did you do? What did you do to maintain the pace?

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Appendix D (continued)

Apprenticeship Interview Sheet

## 2. <u>Practical Learning / Technical Knowledge:</u>

Score =

2.1 What technical field/s have you studied? Tell me about one area of study. How difficult did you find it? To what extent did you master the subject?

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……………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………

2.2 Which course/ subjects in school was/ were the easiest for you, and which was the most difficult? Why?

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……………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………

2.3 Describe how you have gone about learning a new technical or other task.

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……………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………

## 3. <u>Analysis & Problem-Assessment / Judgement & Problem-Solving:</u>

Score =

3.1 What type of information did you use in choosing your trade? How did you utilise the information?

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……………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………

3.2 Describe a problem you have recently been asked to solve. What did you do? What alternatives did you consider?

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……………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………

3.3 Your change from ______________ to ______________ is a major career change. What influenced your decision to change jobs?

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……………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………

## 4. Quality Orientation / Planning & Organising

Score =

4.1 Describe the things you do to control error in your work. Tell me about the last time those methods helped you?

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............................................................................................................................................
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4.2 Can you give me an example of a time when you found quality defects in work outputs? What did you do about it?

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4.3 Have you ever changed any processes or methods of setting work priorities in your job at ? Give me an example.

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............................................................................................................................................
............................................................................................................................................

## 5. Teamwork:

Score =

5.1 Have you ever helped a peer / team member improve their performance at work? Tell me about one of those times.

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............................................................................................................................................
............................................................................................................................................

5.2 Have you ever helped a peer / team member learn something new? Give me an example. How did you go about it?

............................................................................................................................................
............................................................................................................................................
............................................................................................................................................

5.3 Can you describe a situation when you needed to co-operate with others to solve a problem? What were the results?

............................................................................................................................................
............................................................................................................................................
............................................................................................................................................

## 6. **Motivational Fit:**

Score =

6.1 Achievements,

Tell me about a time when you had a lot of challenge in your work. How satisfied were you with that and why?

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..........................................................................................................................................
..........................................................................................................................................

6.2 Continuous Learning,

Tell me about a time when you had to learn things continuously in your work. How satisfied were you with that and why?

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6.3 Independence,

Tell me about a time when you had a lot of opportunity to work independently from your leader / supervisor. How satisfied were you with that and why?

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..........................................................................................................................................
..........................................................................................................................................

Appendix D (continued)

Apprenticeship Interview Sheet

| Score = |
|---|

## 7. Buy-time Questions:

7.1 Why should you be considered for this position? (This is an opportunity to evaluate the applicant's skill to "sell" themselves)

................................................................................................................................................
................................................................................................................................................
................................................................................................................................................

7.2 In what technical areas do you consider yourself proficient? And what areas do you feel you need more development?

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................................................................................................................................................
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7.3 Considering the responsibilities of this position, where do you see the greatest opportunity for development?

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................................................................................................................................................
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7.4 What strengths do you have that we haven't talked about?

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................................................................................................................................................
................................................................................................................................................

Appendix D (continued)

Apprenticeship Interview Sheet

**8. Post interview impressions: Interview panel's considered decisions.**

| | Measurement variable | | | | |
|---|---|---|---|---|---|
| | | | | | |
| 8.1 | Presentability / body language | 0 | 3 | 6 | 9 |
| | | | | | |
| 8.2 | Communication : Verbal / speech | 0 | 3 | 6 | 9 |
| | | | | | |
| 8.3 | Understanding / response to questions | 0 | 3 | 6 | 9 |
| | | | | | |
| 8.4 | Organisational culture and task fit | 0 | 3 | 6 | 9 |
| | | | | | |
| 8.5 | Punctuality and documentation | 0 | 3 | 6 | 9 |
| | | | | | |

Appendix D (continued)

Apprenticeship Interview Sheet

Sub Total Q8 | / 45

Percentage answer for Q8 | ÷ 45 x 100 = %

Total for 8 based on standardised score key : ( 0;3;6;9)

Interview scoring information and final results :

Standardised Score Key: (0;3;6;9)

| | |
|---|---|
| **0** | Requirements not met |
| **3** | Can be Developed to Meet Requirements |
| **6** | Meets Requirements |
| **9** | Exceeds Requirements |

| Percentage Score | Final Translation | Definition |
|---|---|---|
| 0- 25% | 0 | Requirements not met |
| 25- 50 % | 3 | Can be Developed to Meet Requirements |
| 50- 75% | 6 | Meets Requirements |
| 75- 100% | 9 | Exceeds Requirements |

Overall score points out of max 72 | / 72

Translated % score based on above | ÷ 72 x 100 = %

Final interview grand total based on standardised score key :

*Source:* Anonymous within the Client (2011).

Appendix E

Key Differences between the DAT-K Sub-tests

| DAT-K Sub-Tests | Purpose or Intention of Sub-test | Number of Items per Sub-test | Time (in mins) for Test Completion |
|---|---|---|---|
| Vocabulary | Verbal comprehension factor | 30 | 20 |
| Verbal Reasoning | Aspect of general reasoning | 25 | 25 |
| Non-Verbal Reasoning: Figures | Aspect of general reasoning | 25 | 25 |
| Reading Comprehension | Reading comprehension | 25 | 33 |
| Comparison | Visual perceptual speed | 25 | 4 |
| Memory | Memory factor (part a) | n/a | 6 |
| | Memory factor (part b) | 25 | 10 |

*Note.* Adapted from *Manual for the Differential Aptitude Tests Form K* (p. 4-11), by N. Coetzee & H. N. Vosloo, 2000, Pretoria, South Africa: Human Sciences Research Council. Copyrighted 2000 by Human Sciences Research Council.

Appendix F

Key Differences between the TRAT Sub-tests

| TRAT Sub-Tests | Purpose or Intention of Sub-test | Number of Items per Sub-test | Time (in mins) for Test Completion |
|---|---|---|---|
| Dexterity | Two-hand eye co-ordination (facet of psychomotor coordination) | 72 | 2 |
| Coordination | Hand eye co-ordination (facet of psychomotor coordination) | 127 | 2 |
| Assembly | Ability to mentally assemble representations | 25 | 25 |
| Calculations | Ability to solve mathematical problems | 30 | 19 |
| Spatial Perception 2-D | Two-dimensional spatial perceptual ability | 25 | 17 |
| Spatial Perception 3-D | Three-dimensional spatial perceptual ability (part a) | 13 | 7 |
| | Three-dimensional spatial perceptual ability (part a) | 12 | 9 |

*Note.* Adapted from *Manual for the Trade Aptitude Test Battery* (p. 516-44), by J. J. Taljaard, 1983, Pretoria, South Africa: Human Sciences Research Council. Copyrighted 1983 by Human Sciences Research Council.

Appendix G

Description of Teamwork Competencies

| Competency | Description of Competency |
|---|---|
| Assertiveness | Able to put forward own opinions/ideas in an assertive fashion |
| Conflict Management | Sincerely attempts to deal with conflict<br>Conveys information in a professional manner<br>Does two of the following:<br>• Listens intently to others' opinions<br>• Agrees that the situation is unacceptable<br>• Offers solution(s) to the problem<br>• Obtains acceptance for the course of action from others<br>• Expresses a need for compromise (win-win). |
| Feedback | Regular feedback is provided to others in the exercise<br>Provides feedback on aspects doing well on and those areas the team needs to improve upon. |
| Influence/persuasion | Is able to convince others to accept their point of view and plan of action<br>Assertive behaviour – direct but not at expense of the other person<br>Uses at least one influencing style or technique effectively. |
| Initiative | On a regular basis provides options/solutions to be considered – the quality thereof is not a vital consideration in this dimension. |
| Listening | Is able to appropriately hear, observe and interpret the information provided<br>Effective non-verbal behaviour<br>Demonstrates one of the following:<br>• Nods head to show non-verbal listening<br>• Make affirming noises "Mmhh", "Yes"<br>• Attentive. |
| Questioning | Regularly asks for others' ideas and opinions |

Appendix G (continued)

Description of Teamwork Competencies

| Competency | Description of Competency |
| --- | --- |
| Problem-solving | Probes effectively for information |
| | Presents various solutions to the problem |
| | Illustrates clearly desire/willingness to solve the problem. |
| Teamwork | Effective teamwork shown by at least two of the following: |
| | • Listening to others |
| | • Encouraging/motivating others |
| | • Explaining solution to others – getting observers involved. |

Appendix H

Applicant Consent Form

**Ethics Research Confidentiality and Informed Consent Form**

**Juliet Ingrid Puchert** (an academic writing her Doctor of Philosophy (Industrial Psychology) through NMU) is asking people from your group for access to specific information pertaining to your apprenticeship journey within the company. It is hoped this information will benefit the company, and possibly other companies and organisations in the future.

Juliet Ingrid Puchert is conducting research regarding **THE EVALUATION OF A PROFILING AND SELECTION MODEL FOR APPRENTICES IN THE SOUTH AFRICAN AUTOMOTIVE INDUSTRY**. She is interested in finding out more about the optimum demographic, educational and skills profile of successful apprentices in the automotive industry as well as establish the impact of the selection steps on the success of apprentice applicants within the automotive industry. She is carrying out this research to help inform human resource selection practices in general and specifically within the South African automotive industry. As a result of this study, she aims to make recommendations to the automobile industry in order to improve their selection process for apprentices.

Please understand that you are not being forced to take part in this study and the choice whether to participate or not is yours alone. However, Juliet Ingrid Puchert would really appreciate it if you do provide her with access to your information pertaining to your apprenticeship journey with her. If you choose not take part in completed these tests, you will not be affected in any way. If you initially agree to participate, you may deny access at any time and your information will be removed from the study. If you do this there will be no penalties and you will NOT be prejudiced in ANY way. Confidentiality will be observed professionally.

For the purposes of this doctoral study, you are requested to provide Juliet Ingrid Puchert access to the following information:

1) The results achieved in the five steps of the company's selection process. This includes:
    a) your CV and attachments as well as motivational letter
    b) Internal screening documents pertaining to the CV review
    c) Psychological assessment information (i.e., general aptitude, technical aptitude and teamwork assessment scores)
    d) Internal screening documents pertaining to the panel interview
    e) Internal screening documents pertaining to the final selection decision
2) Your apprenticeship programme results (e.g., module results and performance reviews)
3) Trade Test results (i.e., internal and external body reports).

As part of the study you may also be requested to participate in an interview with Juliet Ingrid Puchert.

During the data collection phase of this study Juliet Ingrid Puchert will make use of one data-capturer, Mrs Loretta van Heerden, to assist her in this process. Mrs van Heerden will sign a non-disclosure agreement documenting her commitment to maintaining the confidentiality of your information. Data capturing will initially entail the recording of your names and ID number on an Excel spreadsheet alongside the information indicated in numbers (1) to (3) above. However, once all of your information across the various steps and phases of the apprenticeship programme have been accurately captured and integrated, these personal details will be deleted. Your information will then only be reflected as an identifier (e.g., a unique numbered code such as candidate #1, 2 or 3). Therefore, in terms of the research component, no one will be able to link you to the information or results you give. Only the researcher will have access to the unlinked information. The information will remain confidential and there will be no "come-backs" from the information you give. Furthermore, the information you provide Juliet Ingrid Puchert access to will not be removed off the company's premises. All data-capturing will be done on-site on a secure laptop solely used for that purpose. Only once your personal information (i.e., a unique identifier has been assigned to your information) is deleted will this information be removed off-site.

If possible, Juliet Ingrid Puchert would like to come back to the company once she has completed her study to inform you and the company of what the results were. It is hoped that there may then be a discussion on these findings and proposals around the research and what this means for apprenticeship selection and training in the industry and possible country in general.

Should you be willing to participate in this study, kindly complete the informed consent form provided overleaf.

Kind regards,

JULIET INGRID PUCHERT
Cell #: 083 4568208
Home #: 043 – 726 9565
e-mail: jpuchert@ufh.ac.za

**INFORMED CONSENT**

I hereby agree to participate in research regarding **THE EVALUATION OF A PROFILING AND SELECTION MODEL FOR APPRENTICES IN THE SOUTH AFRICAN AUTOMOTIVE INDUSTRY.** I understand that I am participating freely and without being forced in any way to do so. I also understand that I can stop participating at any point should I not want to continue and that this decision will not in any way affect me negatively.

I understand that this is a research project whose purpose is not necessarily to benefit me personally.

I have received the details of a person to contact should I need to speak about any issues which may arise from agreeing to participate in this study.

I understand that this consent form will ultimately not be linked to the information given access to, and that my information will remain confidential.

I understand that if at all possible, feedback will be given to me and the company on the results of the completed research.

I understand that I may withdraw from the study at any time without any penalty.

……………………………..
**Name of participant**

……………………………..
**Signature of participant** **Date**:…………………..

Appendix I

Permission Letter from the Client

**Puchert, Juliet**

| | |
|---|---|
| **From:** | [redacted] |
| **Sent:** | 21 May 2015 11:34 AM |
| **To:** | Puchert, Juliet |
| **Cc:** | [redacted] |
| **Subject:** | RE: Research |
| **Follow Up Flag:** | Follow up |
| **Flag Status:** | Completed |

Hi Juliet

At last I received a response! You have been given the go-ahead on the understanding that [redacted] is not referred to in the text of the thesis.

Sorry for the excessive delay – at least good news at the end of it.

Regards

[redacted]

Manager Training and Development
Human Resources
Manufacturing Assembly Plant

---

**From:** Puchert, Juliet
**Sent:** Wednesday, March 25, 2015 12:15 PM
**To:** [redacted]
**Subject:** Research

Hi [redacted]

Trust you are well.

I met with [redacted] at the end of last year regarding my Doctoral studies this year – and that I would like to research the selection process you use for the artisans at the Technical Training Centre.

The outcome of the research would be an investigation into the reliability and validity of the selection process – resulting in the generation of a model on this. Plus an investigation as to what is the optimum profile (education, qualifications, skills, aptitudes etc.) for automotive artisans in SA. Hopefully this will be of specific use for [redacted]

In order to do the research I would need access to information before & after my assessment step in the process. For example, the CVs of the candidates, interview rating forms, formative assessment results & final trade test results. I discussed this with [redacted] and he indicated that most of this information is in hard copy and with the instructors. But he indicated that I should refer the matter to you. Could I meet with you sometime to discuss this further? Sorry I know you are very busy – so whenever suits you.

I look forward to hearing from you.

Thanks!

University of Fort Hare

**Ms Juliet Puchert**
**Lecturer: Department of Business Management**
**University of Fort Hare**

**Balcony, first floor**
**East London**

t: +27 (0) 43 704 7030
e: jpuchert@ufh.ac.za
w: www.ufh.ac.za

Appendix J

Ethical Clearance Letter

Nelson Mandela Metropolitan University

*for tomorrow*

**Ref: H-16-BES-IOP-024 [Approved]**

**Chairperson: Faculty RTI Committee**
**Faculty of Business and Economics Sciences**
Tel. +27 (0)41 504 2906

10 November 2016

Prof R van Niekerk
Industrial and Organisational Psychology
South Campus
NMMU

Dear Prof van Niekerk

**PROJECT PROPOSAL: THE DEVELOPMENT OF A PROFILING AND SELECTION MODEL FOR ARTISANS IN THE SOUTH AFRICAN AUTOMOTIVE INDUSTRY (PHD)**

PRP: Prof R van Niekerk
PI: Ms JI Puchert

Your above-entitled application for ethics approval served at Fac RTI.

We take pleasure in informing you that the application was approved by the Committee. However, please note that the approval is on condition that permission to conduct the study is also obtained from the other relevant individuals, parties, organisations and/or role players to which the study pertains.

The ethics clearance reference number is **H-16-BES-IOP-024**, and is valid for three years. Please inform the Faculty RTI Committee, via the faculty representative, if any changes (particularly in the methodology) occur during this time.

Please inform your co-investigators of the outcome.

Yours sincerely

**Prof C Rootman**
**Faculty of Business and Economic Sciences**

*Submitted electronically without signature*

Appendix K

Turnitin Similarity Index Report

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## Turnitin Originality Report

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Appendix L

Differences between Apprenticeships and Other Forms of Training

| | Characteristic/Type of Training | Pre-apprenticeship or Traineeship | Internship | Informal Apprenticeship | Workplace Learning | Apprenticeship |
|---|---|---|---|---|---|---|
| 1 | Wage | Maybe | Maybe | Maybe | √ | √ |
| 2 | Contract of agreement (bilateral or tripartite) | X | Maybe | Maybe | √ | √ |
| 3 | Legal framework | X | X | X | X | √ |
| 4 | Workplace based | X | √ | X | √ | √ |
| 5 | Structured learning plan | √ | Maybe | X | Maybe | √ |
| 6 | On-the-job training | Maybe | Maybe | √ | √ | √ |
| 7 | Off-the-job training | X | X | X | X | √ |
| 8 | Formal assessment | X | X | X | X | √ |
| 9 | Industry-recognised certification | Maybe | X | X | X | √ |
| 10 | Curriculum established with private sector at industry level | Maybe | Maybe | √ | √ | √ |
| 11 | Duration | Minimum 3 months | 2 – 6 months | Variable | Minimum 3 months | At least 1 year |

Appendix L (continued)

Differences between Apprenticeships and Other Forms of Training

| | Characteristic/Type of Training | Pre-apprenticeship or Traineeship | Internship | Informal Apprenticeship | Workplace Learning | Apprenticeship |
|---|---|---|---|---|---|---|
| 12 | Target population | Young (or adult) job seekers, requiring remedial education or soft skills in preparation for apprenticeship work | Students or out-of-school youth seeking first time employment | Youth employed in informal sector or those within formal sector without structured apprenticeship programme | Employed or unemployed youth and adults who want on-the-job training | Students or out-of-school youth and adults who require soft and basic skills |

*Note.* Adapted from *Apprenticeships for the XXI century: A model for Latin America and the Caribbean?* by M. Fazio, R. Fernández-Coto and L. Ripani, L, 2016, http://www.skillsforemployment.org/ and *Overview of apprenticeship systems and issues: ILO contribution to the G20 task force on employment* by H. Steedman, 2012, http://www.ilo.org/wcmsp5/groups/public/---ed_emp/---ifp_skills/documents/genericdocument/wcms_190188.pdf

Appendix M

Summary of Key Characteristics of Apprenticeships by Country

| | Germany | United States of America | China | India | South Africa |
|---|---|---|---|---|---|
| Purpose | Meet industry skill demands | Meet skill requirements in high-growth industries | Workplace readiness | Part of a broader policy on widening skills | Meet industry skill requirements and enhance employment opportunities |
| Target group | Youth & adults (15 – 25+) | Youth & adults (15 – 25+) | Youth & adults (15 – 25+) | Youth & adults (14 – 25+) | Youth & adults (15 – 25+) |
| Employment Contract | Yes | Yes | No | Yes (to obtain NAPS benefits) | Type-specific |
| Wage | Type & region specific | • Programme dependent<br>• $15/hour average starting wage<br>• Incremental wage increases | Not stipulated (trainees may even pay for the service) | • Paid a stipend,<br>• Increases as progresses<br>• Paid by employers | Yes (trade specific) |
| Method | Dual legislated | Technical instruction and on-the-job training | Mostly theoretical | Basic theoretical training, mostly practical in the workplace | Technical instruction and on-the-job training |
| Duration | 2, 3 or 3.5 years (3 years on average) | 1-6 years | One year on average | Time-based, specified at 6 months, 1 year, 18 months, 2 years, 3 years or 4 years | 12 months to 4 years (3 years on average) |
| Outcome | • Trade test leads to certificate<br>• Centralised system | Industry-issued nationally recognised certificate | N/A | • Trade Test<br>• Nationally & internationally recognised certificate | • Trade Test<br>• Nationally recognised certificate |

Appendix M (continued)

Summary of Key Characteristics of Apprenticeships by Country

| | Germany | United States of America | China | India | South Africa |
|---|---|---|---|---|---|
| Incentives to employers: | | | | | |
| 1. Tax breaks | No | Yes | No | No | Yes |
| 2. Waiving or reduction of contributions | No | Yes | No | No | Yes |
| 3. Other | • Registration of apprenticeship programme; grants;<br>• Off-the-job training costs covered in community colleges | Contribute to national goals of apprenticeship placements | • No dismissal costs for firm;<br>• Fines for noncompliance with Apprenticeship Law | • Partial refund of stipend<br>• Partial refund of basic training costs | N/A |
| Incentives to apprentices | Not required – over supply of interested youth | College credits to progress in higher education | Workplace exposure | N/A | Workplace experience & skill acquisition |

*Note.* Adapted from *Apprenticeships for the XXI century: A model for Latin America and the Caribbean?* by M. Fazio, R. Fernández-Coto and L. Ripani, L, 2016, http://www.skillsforemployment.org/ and *Towards a model apprenticeship framework: A comparative analysis of national apprenticeship systems* by E. Smith and R. B. Kemmis, 2013, http://hdl.voced.edu.au/10707/292934.

## Appendix N

## Detailed Discussion of Research Instruments

This appendix documents details on the six research instruments used in the primary data stage of the study. These are the CV Secondary Screening Guidelines, the three psychological assessment tools, the Planned Behavioural Questionnaire and, finally, the national trade test.

*Phase 2: Secondary Curriculum Vitae Review*

The CV Secondary Screening Guidelines document (Appendix C) was developed internally within the Client in 2011. The training centre's manager initially designed the tool based on what he regarded as valuable criteria for the selection of apprentices within their organisation. The tool was then distributed to the author and the other senior instructors within the training centre for commentary and tweaked accordingly. The CV review tool was designed with the intent of a senior instructor and/or the author assessing an applicant on part A and deciding on whether the applicant should be considered for part B in another sitting, by another senior instructor and/or the author.

The rationale for using this CV review tool was to improve objectivity in the screening of applicants. At this point in the selection process there would still be a large pool of applicants to select from. The CV review tool assisted to reduce this pool to those who met the internal requirements of the company, as measured by the 12 criteria (Anonymous within the Client, personal communication, February 5, 2018). This instrument was used during the second phase of the selection process.

There are seven aspects assessed in part A and five within part B of the Secondary CV Review Screening Guidelines. Explicit recommendations regarding mark ranges per aspect is provided. A mark is awarded for each criteria assessed based on a five-point Likert scale ranging from well below average to outstanding. The scores obtained for part A and B are totalled and a percentage score is to be allocated. Based on this total score the applicant is either recommended or not to proceed to phase three of the selection process.

*Phase 3: Psychological Assessment Recommendation*

The third phase of the selection process employed three forms of assessment. There were: general aptitude testing, technical aptitude testing and teamwork competency assessment. The three instruments employed to conduct each of these three forms of testing are now summarised.

*a) The Differential Aptitude Test battery*

The intent of the DAT battery is to offer insight on the "differential aptitudes of Grade 10, 11 and 12 learners as well as of adults who wish to undergo post-school training or who wish to enter a particular occupation" (Coetzee & Vosloo, 2000, p. 2). The HSRC authorised the development of this psychological tool for the purpose of counselling and assisting in the production of an optimal match between individuals and work positions or post-school training (Coetzee & Vosloo, 2000).

The first purpose of the third phase of the selection process was to hone the applicant pool to those candidates that were deemed suitable in terms of potential for further training. To fulfil this need, the DAT battery was selected as an instrument. Given the expectation that the applicant pool may not have experienced advantageous education and training, the standard version, termed DAT-K, was deemed appropriate. Of the four versions of the battery available, the DAT-K version is suitable for candidates who have completed Grades 10 to 12 but may not have benefitted from favourable growth experiences (Coetzee & Vosloo, 2000).

The second purpose of the third phase of the selection process was to identify if the applicants had certain specific aptitudes identified in the job analysis. Six sub-tests from the DAT-K battery were therefore intentionally selected for use in this phase of the selection process. These are: Vocabulary, Verbal reasoning, Non-verbal reasoning, Reading Comprehension, Comparison and Memory. Appendix E summarised the assessment intention, the number of items per sub-test as well as the allocated timing of each of these sub-tests. These aspects are clarified in detail in the subsequent paragraphs.

- The Vocabulary sub-test

The aim of this test is to measure the Verbal Comprehension index, which is understood as the knowledge of words and their meaning. It also includes the ability to apply this knowledge in spoken and written formats. The ability of candidates to recognize a word and then to select a synonym for that word is regarded as a valid indication of their knowledge of words' meanings and hence a valid gauge for the verbal comprehension factor. The sub-test involves 30 multiple-choice type questions to be completed within 20 minutes (Coetzee & Vosloo, 2000).

- The Verbal Reasoning sub-test

The objective of this sub-test is to assess an attribute of General Reasoning on the basis of verbal material. The tool assumes that the skill of identifying relationships, conducting word similarities, deciphering general problems utilising logical thought, as well as an individual's vocabulary experience, are valid criteria of this aspect of general reasoning. There are 25 multiple-choice type questions in this sub-test with a 25-minute time limit (Coetzee & Vosloo, 2000).

- The Non-verbal Reasoning sub-test

Another aspect of General Reasoning is sought to be determined in this sub-test through the basis of non-verbal items. The instrument comprises of two types of questions. In the first set of questions, the relationship between two figures must be correctly identified and the same relational principle is then to be applied to a second pair of figures. The second type of questions consists of a series of modified figures. The underlying principle for the changes in the figures needs to be identified and applied to complete the series. The ability to adequately identify and apply the underlying principles informing these two forms of modification is regarded as a valid sign of non-verbal reasoning ability. Within 25 minutes, 25 multiple-choice type questions need to be attempted in this sub-test (Coetzee & Vosloo, 2000).

- The Reading Comprehension sub-test

The intention of this sub-test is to measure the ability to comprehend what is being read. It is assumed that a candidate's ability to choose the correct answers to questions on written passages is a valid gauge of reading comprehension. The sub-test consists of 25 multiple-choice type questions with a 33-minute test completion time (Coetzee & Vosloo, 2000).

- The Comparison sub-test

This sub-test investigates Visual Perceptual Speed, which is defined as the ability to quickly and precisely discern similarities and dissimilarities between visual configurations. The sub-test rests on the assumption that the ability to identify a group of characters (e.g., numerical, alphabetical or diagrammatical) that is not consistent with the other groups offered is a valid indication of Visual Perceptual Speed. There are 25 multiple-choice type questions to be completed within a four-minute time limit (Coetzee & Vosloo, 2000).

- The Memory sub-test

This sub-test aims to assess an aspect of the Memory factor by using meaningful material. It is based on the assumption that being able to memorize written paragraphs containing meaningful material and then to correctly answer questions on this summarised content, is a valid measure of an aspect of memory. There are two parts to this sub-test. In the first part, the candidate is given six minutes to read and memorise the two-page passage. In the second part, approximately 90 minutes later, 10 minutes is provided to answer 25 multiple-choice questions on the passage (without referring back to the passage) (Coetzee & Vosloo, 2000).

*b) The Trade Aptitude Test battery*

The objective of the TRAT battery is to provide assistance in the selection of prospective students for admission into technical institutes and colleges. The test battery is also specifically designed to identify candidates' potential to progress and successfully complete training in specific technical fields. The HSRC authorised the development of this psychological tool for use amongst Grade eight and above students who needed help in distinguishing their best match to the various specialised fields of artisan training available (Taljaard, 1983).

As with the first aptitude battery chosen for use in the third phase, the intent behind the second assessment instrument selected was to reduce the number of candidates in the applicant pool and to identify those with the requisite aptitudes to be effective in the apprenticeship training programme. To achieve this, six sub-tests from the TRAT battery were identified by the author as suitable for this phase of the selection process. These were: Dexterity, Coordination, Assembly, Calculations, Spatial Perception 2-D and 3-D. The key differences with regard to purpose, items per instrument and timing of these TRAT sub-measures are indicated in Appendix F. The specifics of these six TRAT tools are examined in detail in the ensuing paragraphs.

- The Dexterity sub-test

This sub-test measures two-hand eye co-ordination, a facet of psychomotor co-ordination. It is based on the assumption that the ability to simultaneously, rapidly and accurately draw circles between pairs of concentric circles, by using a pencil in each hand, is a valid gauge of two-hand eye co-ordination. The sub-test consists of 72 items (i.e., 36 pairs of circles) with a two-minute test completion time (Taljaard, 1983).

- The Co-ordination sub-test

The intent of this sub-test is to assess hand-eye co-ordination, a facet of psychomotor ability. The assumption underpinning this sub-test is that the ability to draw an unbroken line, quickly and precisely, between circular areas by going above one and below the other, without touching the areas or picking up one's pencil, is regarded as a valid measure of hand-eye co-ordination. Within two minutes, a line needs to be drawn between 72 circles with 127 marks available (Taljaard, 1983).

- The Assembly sub-test

This sub-test determines the ability to mentally assemble illustrations of mechanical parts, on the basis of fixed regulations, to form a provided mechanical object. In this sub-test 25 multiple-choice type questions are required to be finished within 25 minutes (Taljaard, 1983).

- The Calculations sub-test

The aim of this sub-test is to obtain an indication of ability to apply basic mathematical principles and carry out mathematical operations (i.e., adding, subtracting, dividing and multiplying). The mathematical operations within this sub-test must be done mentally, without any computations being written down. There are 30 multiple-choice type questions with a 19-minute time limit (Taljaard, 1983).

- The Spatial Perception 2-D sub-test

The sub-test assumes that the degree to which a candidate sees two-dimensional geometrical shapes and is able to mentally rotate them on a flat surface, is regarded to be a valid measurement of two-dimensional spatial perceptual ability. Twenty-five multiple-choice type questions are required to be accomplished within 17 minutes (Taljaard, 1983).

- The Spatial Perception 3-D sub-test

This tool assumes that the degree to which candidates are able to mentally visualise, turn and merge three-dimensional figures, in order to make them look like a given figure, and to mentally shape a three-dimensional structure from a two-dimensional plan, is a valid indication of their three-dimensional spatial perceptual ability. There are two parts to this sub-test: part (a) consists of 13 multiple-choice type questions to be attempted in seven minutes and part (b) has 12 multiple-choice type questions to be completed in nine minutes (Taljaard, 1983).

*Scoring mechanisms of the aptitude tests*

The scoring of the DAT-K sub-tests should be done manually with a scoring mask, as per the test manual. The same is true for the TRAT sub-tests, except for the Dexterity and Coordination sub-tests. These two sub-tests are to be visually scored in accordance with the test manual requirements. For the general aptitude ability score (i.e., used for hypothesis 11), the stanine scores obtained for the six DAT-K sub-tests were averaged. The same was true for the technical aptitude ability score obtained for testing hypothesis 12.

*c) Teamwork competency assessment*

The author developed various competency-based exercises for use in this third aspect of the testing phase. These exercises were designed to assess the nine competencies described in Appendix G. These exercises included, amongst others: building a house with spaghetti and marshmallows, making the tallest tower possible with pieces of cardboard, pins and masking tape or building a bridge between two tables with straws, pins, string and masking tape. The various exercises were to be used on a random and rotational basis to ensure there was no predictability across each day of the assessments. Applicants should be divided into groups with a maximum of five participants. Due consideration should be given to age, gender and race variables in the composition of these groups.

Assessors are to be trained in the facilitation and scoring of the exercises. A standardised instruction pack should be provided to the assessors which indicates the apparatus and instructions to be provided per exercise. Part of the assessors' training should include the provision of clear instructions on what and how the applicants would be observed. It is vital that the applicants understand that it is a practical assessment of their teamwork abilities, not their technical abilities.

Assessors should be provided with a standardised scoring sheet to record their judgments and comments on the behaviours observed. The applicants should be scored using a five-point Likert scale ranging from significantly below average to significantly above average. This scoring system is in line with the levels of competence proposed by several other researchers (Bryman & Bell, 2015a; Foxcroft & Roodt, 2013). To ensure reliability is maintained in the assessment, the assessors should also participate in standardisation practices. This entails two assessors observing and assessing the same group to ensure they derive the same scoring results for the applicants.

*Phase 4: Panel Interview*

The Planned Behavioural Questionnaire (Appendix D) (i.e., apprenticeship interview document) was initially designed by the Client's training centre manager in 2011. Following a desk-top review of the 'top' interview questions, he used his knowledge and understanding of what the organisation needs, in terms of apprentice attributes, to develop the questions within this Interview Sheet. The other senior instructors at the training centre and the author were then requested to add their comments and suggestions before the interview questions were finalised (Anonymous within the Client, personal communication, February 5, 2018). The interview document provides guidelines on the standard structured questions to be asked. There are seven categories of standard questions, with three to four question options per category provided.

The second part of the interview document pertains to the post-interview impression of the applicant. The applicant is assessed on five aspects, namely, presentation and body language; verbal communication ability; understanding and response to questions; organisational culture and task fit, and finally, punctuality and documentation.

This structured Planned Behavioural Questionnaire employs a four-point Likert scoring scale, ranging from 'requirements not met' to 'exceeds requirements'. The interview document was designed to be employed by two senior instructors simultaneously interviewing one applicant. The instructors are required to independently score the applicant on the interview sheet and then, following debate on their performance, agree on the final scores to be allocated to the applicant on a third document.

*Phase 5: Trade Test*

As indicated in Table N1, each trade's occupational qualification specifies a combination of knowledge, practical skills and work experience modules. These are provided in the Curriculum Document of each trade. For the automotive electrician and millwright trades, the number of modules and credit value for each of these module categories is tabulated in Table N1. The total credit value for each qualification is also indicated.

Table N1

*Occupational Qualification Combination Rules*

| Trade | Knowledge Modules | | Practical Skills Modules | | Work Experience Modules | | Total Credit Value |
|---|---|---|---|---|---|---|---|
| | Number of Modules | Credit Value | Number of Modules | Credit Value | Number of Modules | Credit Value | |
| Automotive Electrician | 12 | 72 | 8 | 72 | 3 | 216 | 360 |
| Millwright | 11 | 163 | 17 | 208 | 5 | 326 | 697 |

*Note.* Adapted from *Curriculum Document: Automotive Electrician* (n.d.) (p. 4-5) and *Curriculum Document: Millwright* (n.d.) (p. 8-9). Gauteng, South Africa: merSETA.

Each trade therefore has specific entrance, curriculum and assessment requirements. These assessment requirements are prescribed in an External Assessment Specifications document which forms part of the qualification design (Government Gazette, 2015b). Apprentices are only eligible to sit for the trade test once they can produce a completed, signed Statement of Work Experience as well as proof of having successfully completed the relevant knowledge and practical skills modules indicated in Table N1. The trade test then assesses critical aspects from these knowledge and practical skills modules. The details of the assessment outcomes for each of the trades assessed in this research study are provided in Table N2.

Table N2

*Description of Assessment Strategy of Trade Tests*

| Trade Area | Assessment Focus Area | Percentage |
|---|---|---|
| Automotive Electrician | Diagnose and conduct fault finding exercises on automotive electrical wiring, components and/or systems | 40% |
| | Remove, fix and maintain automotive electrical wiring, components and/or systems | 40% |
| | Install automotive equipment, components and/or systems | 20% |
| Millwright | Install, amend and maintain industrial machinery | 30% |
| | Analyse, locate and repair faults in industrial machinery | 40% |
| | Fit, test and order industrial machinery | 30% |

*Note.* Adapted from the *External Assessment Specifications: Automotive Electrician*, pp. 3-5, n.d., http://www.merseta.org.za/AutomotiveElectricianFullCurriculumandEASfor/tabid/245/ and *External Assessment Specifications: Millwright*, pp. 3-4, n.d., http://www.merseta.org.za/Millwrightcurriculumforpubliccomment.aspx

A 100% pass mark is required for the practical component and an 80% pass mark for the theoretical aspect. If less than a 50% overall mark is obtained the trainee needs to complete the entire trade test again. However, if the overall mark obtained is over 50%, but certain modules were not passed, then these modules need only be redone (Anonymous within the Client, personal communication, February 7, 2018).

According to the External Assessment Specifications documents, trade tests for automotive electricians and millwright apprentices must be assessed by a qualified and registered assessor with the NAMB. The assessor must have the requisite trade qualification and a specified minimum years of post-qualification experience in that trade in order to become registered with this body. For certain trades (e.g., millwright and motor mechanic), instructors also require a minimum number of years of practical experience training apprentices before they can become registered assessors with NAMB.

Appendix O

Primary Data Collection and Processing

The information provided in this appendix was gained from interviews with the Client's training centre manager (Anonymous within the Client, personal communication, April 2, 2015, February 7, 2018).

*Phase 1: Application Review and Curriculum Vitae Review*

This phase was conducted in May annually by the in-house administrators. The purpose of this phase was two-fold. Firstly, to check that the correct documents had been submitted by the applicants and, secondly, that the minimum educational qualifications had been obtained. Through this process, two piles were created and the results captured on a Microsoft Excel spreadsheet (i.e., progress or reject). The information pertaining to all the applicants (i.e., whether successful in this phase or rejected) were captured, including the reason(s) for their rejection from this phase. Besides not having attained the minimum educational requirements, other reasons for rejecting the application included: not specifying the apprenticeship type applying for, not including their CV, identity documents or qualifications, and/or not including a covering letter.

*Phase 2: Secondary Curriculum Vitae Review*

In June annually, the author and the senior instructors at the Client's training centre were responsible for this aspect of the selection process. The application documents of applicants who had successfully progressed from phase one were manually reviewed. The procedure and scoring rubric in the Secondary CV Review Screening Guidelines (Appendix C) were followed. One assessor would review a candidate's application and complete part A of the scoring rubric. Another assessor would then rate that application on part B of the scoring rubric. It took approximately 15 minutes to complete this phase per applicant.

The applications, with the completed scoring matrices, were then collated into five piles according to the total percentage score obtained in this secondary CV review by the centre's administrators. These five piles were: 0% to 20%; 21% to 40%; 41% to 60%; 61% to 80% and above 81%. These five piles were created per apprenticeship type applied for (i.e., five piles for the Automotive Electrical position and another five piles for those that applied for the millwright position). The highest scoring applicants (i.e., those scoring 81% and above) per apprenticeship type were then considered as eligible to proceed to phase three of the selection process. However, depending on the centre's requirements, the number already considered eligible, as well as the discrepancy between this demand and supply, the applications in the 61% to 80% pile were also considered for phase three. The applications in this latter pile were then more finely sorted. A senior instructor, per apprenticeship type, worked in a focus group of other instructors within that trade to make the final selection decisions for this phase. The completion of this phase then also ultimately resulted in two piles of applications being formed (i.e., progress or reject). The scores attained by each applicant for the 12 criteria, as well as the overall decision made, were captured on the same Microsoft Excel spreadsheet used in phase one. The information pertaining to all the applicants (i.e., whether successful in this phase or rejected) were captured, including the reason(s) for their rejection from this phase.

*Phase 3: Psychological Assessment Recommendation*

This phase was overseen by the author's external consultancy firm. A minimum of two trained assessors conducted this phase, overseen by a registered Psychometrist (Independent/Private Practice). The testing in this phase was executed in accordance with the guidelines stipulated in the selected psychological test manuals. An explanation of the manner in which research ethics were accommodated in this assessment process is provided in section 5.13. Assessments were executed in groups of up to 50 applicants per day. This testing was done during the July school holidays to enable the applicants currently in matric to attend.

The results for this phase were captured onto a Microsoft Excel spreadsheet. The stanine score obtained for each of the 12 aptitude sub-tests tests were recorded and further rated according to the following criteria: (a) stanine scores between one and three are regarded as below the requirement level; (b) stanine scores between four and five meet the requirements; (c) stanine scores between seven and nine are regarded as exceeding the requirements for the apprenticeship programme. The ratings for each of the nine teamwork exercise competencies were also recorded on this spreadsheet. The criteria here were: (a) competency ratings between one and two are development areas; (b) ratings of three were deemed competent in the dimension assessed; (c) ratings of four and five are regarded as exceptional and above average demonstration of the competency being assessed. Notes on the behaviour of the applicants in the teamwork exercises were also documented. Based on this information, clinical judgement was used by the author to make an overall recommendation rating per applicant, which was also recorded on this spreadsheet. Four rating categories were employed, namely, highly recommended, recommended, recommended with reservation and not recommended. The criteria for each of these ratings are documented in Table O1.

Table O1

*Psychological Assessment Recommendation Categories*

| Rating | Description |
|---|---|
| Highly Recommended | Minimum stanine four score across all aptitudes and minimum three rating on all teamwork competencies |
| Recommended | Two options:<br>1) Minimum three rating on all teamwork dimensions with one or two aptitude scores below average (i.e., stanine score three or less), or<br>2) Minor development areas (i.e., two or 2.5 score) on teamwork competencies with all aptitudes above a stanine three score |
| Recommended with Reservation | Two options:<br>1) Minimum three rating on all teamwork dimensions with a maximum of three aptitude scores below average (i.e., stanine score three or less), or<br>2) Minor development areas (i.e., two or 2.5 score) on teamwork competencies with one or two aptitudes below a stanine three score |
| Not Recommended | Two options:<br>1) Below a stanine four score on four or more aptitudes, and/or<br>2) Significant development areas in the teamwork dimensions (i.e., overall one to two rating) |

Applicants who had obtained a highly recommended or recommended rating in this phase were considered for phase four. Depending on the number of applicants in these two categories as well as employment equity requirements and the need for due consideration of internal applicants, more candidates were drawn from the recommended with reservation category. This was done through a focus group session with the Client's senior instructors and the author debating the calibre of applicants within this recommended with reservation category, per apprenticeship type. Having outlined the primary data collection of phase three, the next section describes that completed for the fourth phase of the selection process.

*Phase 4: Panel Interview*

These interviews were conducted annually during August and September, according to the instructions indicated in the Planned Behavioural Questionnaire (Appendix D), by the training centre's senior instructors and/or the author. Three applicants were interviewed per pair of interviewers per day, usually two in the morning and one in the afternoon session. The duration of an interview was approximately one hour per applicant. The scores were indicated, by hand, on the various interview sheets.

The top scorers in the interviews, with consideration to employment equity issues, were then considered successful in the fifth phase of the selection process. The senior instructors, in a focus group, then debated the calibre and qualities of the successful applicants and made a joint decision on the final group of successful apprenticeship applicants. This group then proceeded to the final stage of the organisational selection process, which included medical testing and qualification verification. These applicants were subsequently provisionally accepted (i.e., if they still needed to pass a qualification) and/or notified of their successful application onto the apprenticeship programme.

*Phase 5: Trade test*

As the Client is a registered national trade test centre, this final testing was done in-house. Depending on the apprenticeship type, this summative testing was facilitated over two to three consecutive working days. To build the confidence of the applicants, the practical component was usually conducted first, followed by the written theoretical component of the assessment. For the millwright apprenticeship two apprentices were tested per day, with three being tested per day for the automotive electrician trade. First attempt assessments were done in November annually. If deemed competent in this summative assessment, the results were forwarded to the NAMB for certification as a graduate apprentice. If the apprentice was deemed not yet competent, re-assessment was scheduled within one to two months. During this time, the apprentice is required to do self-study revision (Anonymous within the Client, personal communication, February 7, 2018). An apprentice may, however, only sit the trade test a maximum of three times during the apprenticeship period (Government Gazette, 2015b).

Appendix P

Detailed Secondary Data Sample Realisation Rate

| Intake Year | Selection Phase | No. of Applicants Entering the Selection Phase | No. of Applicants Surviving the Phase |
|---|---|---|---|
| | 1 | 1 036 | 484 |
| | 2 | 484 | 100 |
| 2012 | 3 | 100 | 40 |
| | 4 | 40 | 30 |
| | 5 | 28 | 28 |
| | 1 | 1 250 | 493 |
| | 2 | 493 | 119 |
| 2013 | 3 | 119 | 27 |
| | 4 | 27 | 22 |
| | 5 | 22 | 21 |
| | 1 | 1 126 | 519 |
| | 2 | 519 | 205 |
| 2014 | 3 | 205 | 76 |
| | 4 | 76 | 28 |
| | 5 | 27 | 27 |

Appendix Q

Reliability and Validity of the DAT-K Sub-tests

| DAT-K Sub-Tests | Reliability Coefficient (Kuder-Richardson formula 14) | Pearson product moment correlation coefficient with school subjects | |
|---|---|---|---|
| | | English | Mathematics |
| Vocabulary | 0.75 | 0.69*** | 0.45*** |
| Verbal Reasoning | 0.75 | 0.66 *** | 0.39*** |
| Non-Verbal Reasoning: Figures | 0.85 | 0.43*** | 0.51*** |
| Reading Comprehension | 0.80 | 0.65*** | 0.37*** |
| Comparison | * | 0.25** | 0.28*** |
| Memory | 0.84 | 0.51*** | 0.25** |

*Note.* Adapted from *Manual for the Differential Aptitude Tests Form K* (p. 35-38), by N. Coetzee & H. N. Vosloo, 2000, Pretoria, South Africa: Human Sciences Research Council. Copyrighted 2000 by Human Sciences Research Council.

* Speed test and the K-R formula is therefore not applicable.

** Correlations with $p$-value ≤ 0.05

*** Correlations with $p$-value ≤ 0.01

Appendix R

Reliability of the TRAT Sub-tests

| TRAT Sub-Tests | Purpose or Intention of Sub-test | Reliability Coefficient (Kuder-Richardson formula 21) |
|---|---|---|
| Dexterity | Two-hand eye co-ordination (facet of psychomotor coordination) | * |
| Coordination | Hand eye co-ordination (facet of psychomotor coordination) | * |
| Assembly | Ability to mentally assemble representations | 0.81 |
| Calculations | Ability to solve mathematical problems | 0.84 |
| Spatial Perception 2-D | Two-dimensional spatial perceptual ability | 0.92 |
| Spatial Perception 3-D | Three-dimensional spatial perceptual ability | 0.72 |

*Note.* Adapted from *Manual for the Trade Aptitude Test Battery (TRAT*) (p. 69), by J. J. Taljaard, 1983, Pretoria: Human Sciences Research Council. Copyrighted 1983 by Human Sciences Research Council.
* Speed tests and the K-R formula is therefore not applicable.