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The return on investment on firm based apprenticeships in South Africa

A research report submitted by

Denver Pillay

Student number: 1076974

Wits Business School

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ABSTRACT

The study sought to determine the return on investment of apprentice training in South Africa. This study was conducted within the confines of a case study on a South African manufacturing company, Aveng Rail. The study was conducted using mixed methodology and measured both tangible and intangible value in terms of return on investment. A quantitative analysis was conducted using a previously established mathematical model to measure return on investment based on the benefit to cost ratio of training. This entailed measuring the total cost of the apprenticeship over a three-year period and comparing it to the financial benefit of apprenticeships over the same period. The data sample included 185 tasks on which 15 apprentices worked over their apprenticeship period. The costs measured included: apprentices' salaries, infrastructure, tuition and opportunity costs of management. The benefits measured included lower input costs in production and improved efficiency of artisans.

Intangible benefits were measured using a qualitative analysis by means of interviews with managers involved in training apprentices. Interviews discussed the benefit and value that managers saw and experienced in training. A total of 12 managers were interviewed.

The findings of this study suggest that Aveng benefits from training apprentices. The quantitative analysis showed an average return on investment of apprentices training between 21 and 36%. The managers interviewed also saw value in terms of improved efficiencies, developing a pool of resources for the industry, and the benefit of training individuals according to the specific needs of their companies.

DECLARATION

I, Denver Pillay, declare that this research report is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Denver Pillay

Signed at ……

On the …….. day of …… 2017

DEDICATION

To my wife Helga:
Thank you for standing by me through this journey.

To my boys Noah and Anders:
Thanks for understanding when dad wasn't available.

To my Parents Dennis and Joyce Pillay:
Your encouragement and prayers have seen me through.

ACKNOWLEDGEMENTS

I would like to thank the following people for their assistance and support:

- Conrad Viedge for supervising me through this research report.
- Anthony Stacey for his endless commitment and dedication to seeing students through (thanks for the boot camp).
- My family for the sacrifices you have made.
- And ultimately to my Lord and Savior Jesus Christ, the Author and Finisher of my Faith.

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LIST OF ACRONYMS:

ACS: Automated and Control systems

AIT: Agency for International Training

ATS: Apprentice Training Scheme

CII: Construction Industry Institute

DFC: Dynamic Fluid Control

DHET: Department of Higher Education and Training

FET: Further Education and Training

ILO: International Labour Organisation

MGI: McKinsey Global Institute

ROI: Return On Investment

RPL: Recognition of Prior Learning

SDL: Skills Development Levy

SETA: Sector Education and Training

SIVET: Swiss Indian Vocational Education and Training

SME: Small to Medium Enterprises

VET: Vocational Education and Training

1 CHAPTER 1: INTRODUCTION

1.1 Purpose of the study

The purpose of this study was to determine the return on investment (ROI) of firm-based apprenticeships in the manufacturing sector.

1.2 Context of the study

According to the International Labour Organisation (ILO), youth unemployment refers to: available individuals whose ages are between 15 and 24 years without work but are actively looking for employment (World Bank Group, 2016). Data published by the ILO indicates that South Africa has the 4th highest percentage of youth unemployment in the world, recorded at 52%. Countries including Spain, Bosnia and Greece have 57.9%, 57,5% and 53,9% youth unemployment respectively (World Bank Group, 2016). Statistics South Africa corroborated the ILO's finding that youth unemployment in South Africa was 52%. Statistics South Africa further indicated that the country's total unemployment was approximately 24.5% (Statistics South Africa, 2016).

Burger, Berg and Fintel (2015) attributed the high youth unemployment in South Africa to the country's education policy. The South African National Policy pertaining to the promotion requirements of learners prevents a learner from being held back in a senior grade more than once; this was done to prevent a learner from occupying the senior phase (grades 7 to 9) for more than four years. Subsequently, the minimum pass for a Senior Certificate was reduced to a minimum of 40% for 3 subjects, including one official language, 30% for 3 subjects, and only 6 of the 7 subjects were required for a pass (Department of Basic Education, 2011). The policy's leniency and restriction on over-aged learners resulted in far more youth seeking jobs as opposed to staying longer in the Basic Education system (Burger, Berg, & Fintel, 2015). The unemployment problem was further compounded with both learners

successfully completing grade 12 entering the labour market, and unsuccessful learners also entering the market. The youth require skills in order to be absorbed into the labour market and business may be in a position to empower the youth with these skills. The South African labour market has expanded to 4.1 million available job seekers since 2000, however the economy was only able to absorb 2.8 million of these job seekers (Acha Leke, 2015).

A report titled "*South Africa's Big Five Bold Priorities for Inclusive Growth*" by the McKinsey Global Institute (MGI) in 2015 referred to South Africa's top five priorities to stimulate economic growth. This included: Advanced Manufacturing, Infrastructure Productivity, Natural Gas, Service Exportability and Raw and Processed Agricultural Exports. Pursuing this growth strategy could result in approximately 3.4 million jobs being created by 2030 (Acha Leke, 2015). Both the private and the public sector need to engage each other in order to implement this growth strategy. South Africa needs to remodel its human capital development policies and drive technical training and skills development in as many business institutions as possible in order to achieve this target.

Vocational Education and Training (VET) can be either school based or firm based. It is commonly practiced throughout the world. Countries including the United States of America, Italy, Sweden and France have established community colleges that provide full-time school-based vocational education for both adults and youth (Dustmann & Schönberga, 2012). South Africa has more than 50 such colleges around the country.

Countries, including Germany, Austria and Switzerland, have adopted a dual based VET system. The dual system allows for teenagers to join a firm at the age of 16 after completing grade 10. The teenager signs an apprenticeship contract with the firm and is thereafter regarded as both an employee and as a student. The teenager is referred to as an apprentice. The apprentice gains work experience and attends formal college once or twice a week based on the apprenticeship contract signed (Harhoff & Kane, 1993). Apprenticeship contracts can run from a period of 2 years up to a period of 5 years. Countries

like Switzerland and Germany do not have as many school dropouts as South Africa. The Swiss indicated that after the age of 16, most teenagers in Switzerland are tired of school and are seeking alternatives. Almost two thirds of all Swiss teenagers choose to follow firm-based apprenticeship programmes after grade 10 (Egg & Renold, 2015). The programme caters for both academically inclined and non-academically inclined students. Consequently Germany and Switzerland have recorded youth unemployment rates of 7.6% and 8.7% respectively in 2016 (World Bank Group, 2016).

The Swiss VET system comprises three stakeholders, namely: local government, professional bodies, and business. Local government provide funding for the school-based segment of the training. Professional bodies provide a curriculum of practical training and experience that businesses are required to provide to apprentices. Businesses provide practical and working experience to the apprentices. All three stakeholders hold each other accountable and have developed a model of excellence, ensuring world class on-the-job training (Egg & Renold, 2015).

Swiss companies were required to invest in technology and infrastructure in order to meet the stringent training requirements as dictated by the professional bodies. Whilst this appeared as sunken costs to companies, a study conducted by Strupler and Wolter (2012) showed that Swiss companies benefited in revenue of approximately 500 million Swiss Francs in 2009 due to the productivity of apprentices (refer to figure 1). One of the reasons for this benefit included the low input costs of apprentice salaries during the training phase.

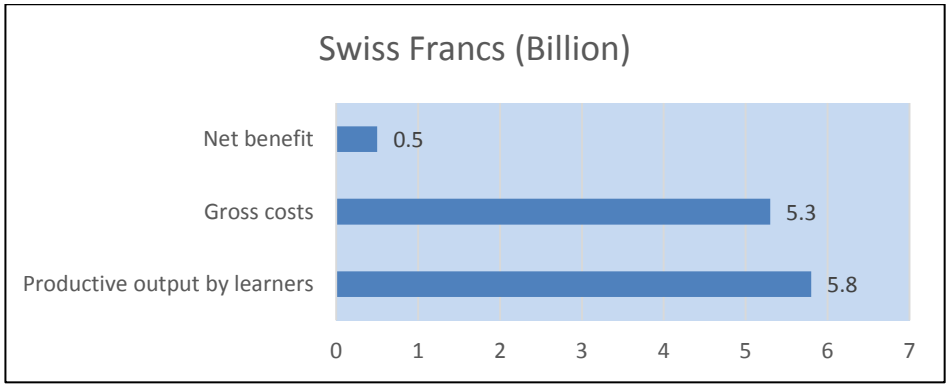

Figure 1: Benefit/Cost ratio for Swiss companies involved in VET programmes (Source: Strupler & Wolter, 2012 found in SERI, 2014c)

South Africa's labour policy allows for teenagers from the age of 15 to join apprenticeship programmes, hence young school leavers can effectively enter the labour market and subsequently be protected by national law. In 2014, the South African Department of Higher Education (DHET) partnered with the German government's Agency for International Technical Cooperation (AITC) and the Swiss government. The partnership gave birth to the A21 curriculum (Apprentices of the 21st century). The South African government undertook to fully fund the salaries, education and administration of all apprentices under the A21 dispensation (Education, 2016). This created an incentive for business to take on apprentices. However, businesses still need to be convinced that the incentive is worth considering as training is fairly prescriptive and requires hours of dedicated resources and increased infrastructure costs to accommodate apprentices.

1.3 Problem statement

1.3.1 Main problem

The main problem that this research sought to address was that training of apprentices was undertaken as an "act of faith" and organisations did not know what value they received from apprentice training. This was particularly true of firm-based apprenticeships.

1.3.2 Sub-problems

The first sub-problem was to determine the financial return on investment of training apprentices in South Africa.

The second sub-problem was to determine the value of apprenticeship training from a manager's perspective.

1.4 Significance of the study

Whilst government publicised that it fully funds apprenticeship programmes, businesses still needed to update infrastructure and commit resources in order for apprentices to be trained. The South African Skills Development Levy (SDL) Act of 1999 dictates that all registered South African companies shall pay 1% of their total wage bill to the SDL fund (Republic of South Africa, 1999). In essence, companies subsidise a large portion of the training indirectly. This study provides insight into the cost of training apprentices and whether businesses benefit from the process whilst providing firm-based training. Benefits include financial and human capital benefits for companies, apprentices and the government.

1.5 Delimitations of the study

Vocational Education and Training (VET) and Apprenticeships occur in almost every industry; this study only focuses on engineering based apprenticeships, further delimitations include:

- Mechanical fitting and turning, earth moving mechanics, tool making and electrical fitting.
- The topic focuses on the return on investment for training individuals. The input costs include that of training, company contributions to the Skills Development Levy, skills salaries and

infrastructure establishment as per requirements from professional bodies.

- The returns calculated was based on actual outputs of production during the process of training.

1.6 Definition of terms

Business: A business is an organisation or economic system where goods or services are traded for money (Collins, 2012).

Youth Unemployment: Refers to the share of the labour force who are between 15 and 24 years, without work, but available and seeking for employment (World Bank Group, 2016).

Vocational Education and Training: Refers to education that prepares a trainee for a job or career in trades and crafts (Seta, 2016).

Apprenticeship: Refers to work training that involves following and studying a master of the trade on-the-job instead of a formal school ("Apprenticeship," 2005).

Professional Body: Refers to an association of organised professionals who stipulate the requirements for completing qualifications and subsequently award these qualifications ("Professional Bodies," 2015).

Short-term Gain: These are financial gains that a firm experiences during the apprentice training programme (Muehlemann & Wolter, 2014).

Long-term Gain: These are both financial and non-financial gains that a company experiences post apprentice training (Muehlemann & Wolter, 2014).

Return on investment for training: This entails comparing the results of production improvements with the actual cost of the training programme (Phillips, 1996).

Journeyman: A journeyman is a person used to train apprentices during their on-the-job training phase of apprenticeship. The journeyman also serves as a supervisor to apprentices and has the relevant skill, qualification and ability to train and supervise (Canadian Apprenticeship Forum, 2009).

2 CHAPTER 2: LITERATURE REVIEW

This chapter begins with an introduction to the origins of apprenticeships and how the apprentice programme has evolved over the last 300 years. The chapter then looks at several countries that practice firm-based apprenticeships by reviewing literature from these countries and delving into their successes, failures and the lessons learned from apprenticeship training. The methods of apprenticeships, including firm-based apprenticeships, are also discussed.

2.1 Introduction

Apprenticeships date back as far as medieval times in England and Europe and was formalised in the 14th century. Apprenticeship periods ranged from 5 to 9 years. During this period, the apprentice's Master provided theoretical and practical instruction. The parents or guardians of the apprentice entered into a contract with the Master for the apprenticeship and paid a premium for the training and instruction received (Aldrich, 1999). The Master subsequently provided boarding, lodge, clothing, instruction and work experience.

The industrial revolution saw increased access to apprenticeships as firms grew and the need for skilled labour increased. The types of apprenticeships also grew from stone masonry to metal working and electrical trades. Several firms saw economic benefit in training apprentices as wages were fairly low and apprentices became increasingly productive during their apprentice tenure (Gospel, 1994). Today, apprenticeships are still successfully conducted in several countries throughout the world including: Germany, Sweden, Switzerland, England, Canada, Austria, the United States of America, India, Ghana and South Africa, to name a few. Methods of training include: Firm based Training, College Training and Dual-based training.

2.2 Background discussion.

There is limited research in South Africa regarding the rationale behind hiring apprentices. It is hoped that the return on investment (ROI) method may serve as an indicator to employers regarding the many benefits of hiring apprentices. According to Phillips (2007), the ROI in training is not limited to quantitative financial gain, but also to qualitative gains, including, but not limited to: the learning application, satisfaction, business impact and other intangible benefits (Phillips, 2007). ROI training analysis lends itself to applications in various industries, including the sales, services and the manufacturing industry.

The general method for calculating ROI is to divide the earnings received by the amount invested, hence the ROI is a type of benefit to cost analysis that is conducted by investors (Stone, 2005). The ROI and benefit to cost analysis is further explained in figure 1:

Table 1: ROI and Benefit to Cost Ratio Explained (Stone, 2005)

Metric	Definition	Formula
Cost	Total amount of money spent on training apprentices.	=sum of all input costs
Benefit	Total amount of money gained from training apprentices.	=sum of all benefits
Benefit to Cost ratio	The ratio of benefit to cost.	$= \frac{\text{Benefits}}{\text{Costs}}$
ROI	Ratio of adjusted benefits to costs.	$= \frac{\text{Benefits} - \text{Costs}}{\text{Costs}} [\times 100\%]$

The benefit to cost ratio of training is primarily used by Phillips (2007) to determine the ROI in training. According to Phillips (1996), both hard and soft data can be used to determine ROI. Hard data is measured in terms of actual costs, outputs, time and quality. Soft data is measured in terms of value, character, work climate, attitude and initiative. All articles referenced in this literature review use a benefit to cost analysis to determine the ROI of training

as explained above. According to Phillips (2012), one of the most important aspects in determining the ROI is to accurately account for all the costs and benefits involved in apprentice training.

Whilst this paper speaks to the ROI of apprentice training in South Africa, its foundation is based on the need for skilled tradesmen (Artisans) in South Africa. In keeping with the context of this paper, skills are defined as both the required qualification and experience to fulfil a function (Daniels, 2007). Whilst there are no specific government publications on the exact shortage of skills in South Africa, Breier and Erasmus (2015) cite severe skills shortages as the key factor in preventing or retarding economic growth in South Africa. It is imperative to have sufficient artisans in South Africa to enable service delivery, infrastructure development, wealth creation, alleviation of poverty and ultimately economic growth (Van Rooyen, Du Toit, Botha, & Rothmann, 2010). According to Jordaan and Barry (2009), South Africa is required to train and test at least 12500 artisans annually, however only 3000 are qualified annually. The effects of skills shortages are seen in many industries, including the power industry, where a lack of appropriately qualified technical personnel is hampering the desired level of service delivery in the country (Phillips, 2014).

Consequently, Breier and Erasmus (2015) attribute the lack of qualified artisans to a decline in apprenticeships and learnerships by means of Further Education Colleges (FET). There is also a misalignment with the qualifications from colleges and what industry requires (Breier & Erasmus, 2015). Another major contributor to the current artisan deficit is the closing down of two major artisan training centres run by Eskom and Telkom (Mateus, Allen-Ile, & Iwu, 2014).

Whilst this problem has reached critical levels in South Africa, it has also become an international problem where countries, including Australia, New Zealand and several European countries, face skills shortages (Mateus et al., 2014). The lack of suitably qualified artisans may have a negative long-term effect on business. This begs the question as to why does business not provide apprenticeships and develop skills that are suited to their requirements in light of the skills development levy paid. A follow-up to this question would be, what

are the financial implications of firm-based apprenticeship training. What is the cost to train apprentices and can firms recoup these costs? As previously stated, there is an unfortunate lack of published literature on the return on investment of apprenticeship training in South Africa.

There are however, several international publications citing the financial gains and losses of firm-based apprenticeships. Published countries include: Germany, Sweden, Switzerland, England, Canada, Austria, India and the USA. Furthermore, financial return on investment can be realised on both a short-term and a long-term basis. The short-term gains suggest that firms are able to show financial gain during the apprentice training period and the long-term gains include financial gains post apprenticeship. According to Dustmann and Schönberga (2012) and Wolter (2012), the long-term gains are a generic benefit to most companies as they include:

- The use of the training platform as a screening mechanism to recruit the best suited incumbent post training.
- Training of apprentices according to the skills they require.
- The costs of recruiting suitable incumbents are reduced to almost zero.
- The cost to retrain new recruits is nullified.

The short-term gains are not generic and differ per country; this is largely based on regulation within the vocational education and training system. Apprenticeship training from a business's viewpoint may either indicate a net benefit or net cost during the apprenticeship period. This is, by and large, dependant on labour regulations, competition, affordability of businesses and social partner agreements. In saying this, if there is a possibility that a business can generate substantial returns from training apprentices then the business may make the necessary investments to administer apprenticeships. Unfortunately, generating a net profit from training may also end up being a prerequisite for firms to train apprentices (Muehlemann & Wolter, 2014). The following paragraphs discuss the short-term and long-term gains for training apprentices in the various published countries.

2.2.1 Returns on Apprentice Training in Canada: (Canadian Apprenticeship Forum, 2009).

A national study reviewing the return on investment of apprenticeship training was conducted by the Canadian Apprentice Forum (CAF) from 2006 to 2008 and published in 2009 (Canadian Apprenticeship Forum, 2009). The sample size of the study was 1000 employers across 16 trades. The study stemmed from previous employer perception that apprenticeships were too expensive to undertake and served as a barrier to companies wanting to train apprentices. The study considered the cost of training apprentices against the benefit of training and included:

The cost associated with training, namely:

- Wages and benefits: This comprised the hourly wage of the apprentice, including benefits and compensations.
- The opportunity costs: A journeyman was allocated to instruct and supervise the apprentice during the apprenticeship period. There was also the cost of wastage and material required for basic skills training. Other opportunity costs included the usage of equipment and machinery.
- Administration costs: This included the cost of human resources to manage the extra staff, the cost of tuition fees at local colleges, the cost of traveling and stationery.

The benefits associated with the training namely:

- Charge-out Rates: Costs were recovered in charge-out rates.
- Productivity: Apprentices became productive as they gained experience.
- Dependency on Journeyman: The apprentice grew less dependent on the journeyman as he/she gained experience.

The overall result of the study indicated that the majority of the training administered was beneficial to the employer when considering the cost of training compared to returns. Only 2 of the 16 apprentice trades were not beneficial to the employer. This included hairstylist apprentices and electrical

power line apprentices. Hairstylist apprentices generate fairly low levels of revenue during their apprenticeship and the apprenticeship period of two years is relatively short and insufficient for companies to recuperate the cost of training before the end of the training period. Electrical power line apprenticeships are regarded as high risk and require extensive safety training and the continuous use of a journeyman. Wages for this apprenticeship are higher than other apprenticeships, hence a negative return during the training period. The general study shows that an average cost to benefit ratio of 1.47 and an ROI of 47% for apprentice training in Canada. Table 2 provides the return ratios and ROI for the 16 trades as researched in the study.

Table 2: Apprentice Benefit-to-Cost Ratio Per Trade: (Canadian Apprenticeship Forum, 2009).

Apprentice Benefit to Cost Ratio Per Trade:			
Trades	Duration in years	Benefit to cost ratio	ROI
Automotive Service Technician	4	1.69	69%
Boiler Maker	4	1.92	92%
Bricklayer	4	1.33	33%
Cabinetmaker	4	1.37	37%
Construction Electrician	4	1.49	49%
Construction Millwright and Industrial Mechanic	4	1.59	59%
Cook	4	1.32	32%
Electrical Power Line and Cable Worker	4	0.95	-5%
Hairstylist	2	0.55	-45%
Heavy duty Equipment Mechanic	4	1.97	97%
Machinist	4	1.87	87%
Motor Vehicle Body Repairer	4	1.72	72%
Plumber	4	1.39	39%
Refrigeration and Air Conditioning Mechanic	4	1.44	44%
Sheet Metal Worker	4	1.25	25%
Parts Person	4	1.68	68%
Average	4	1.47	47%

The actual Canadian dollar-value of the benefits-to-cost has been removed from the original table as the focus was not on the actual dollar value of the study but rather the Return on Investment (ROI). The study also considered the size of the employer regarding the staff complement. It showed that some employers with a staff complement of less than 10 people were not able to recover the cost of training during the apprenticeship period (Canadian Apprenticeship Forum, 2009). The trades cited were: Automotive service technicians and Air-conditioning and refrigeration mechanics (refer to figure 2.2)

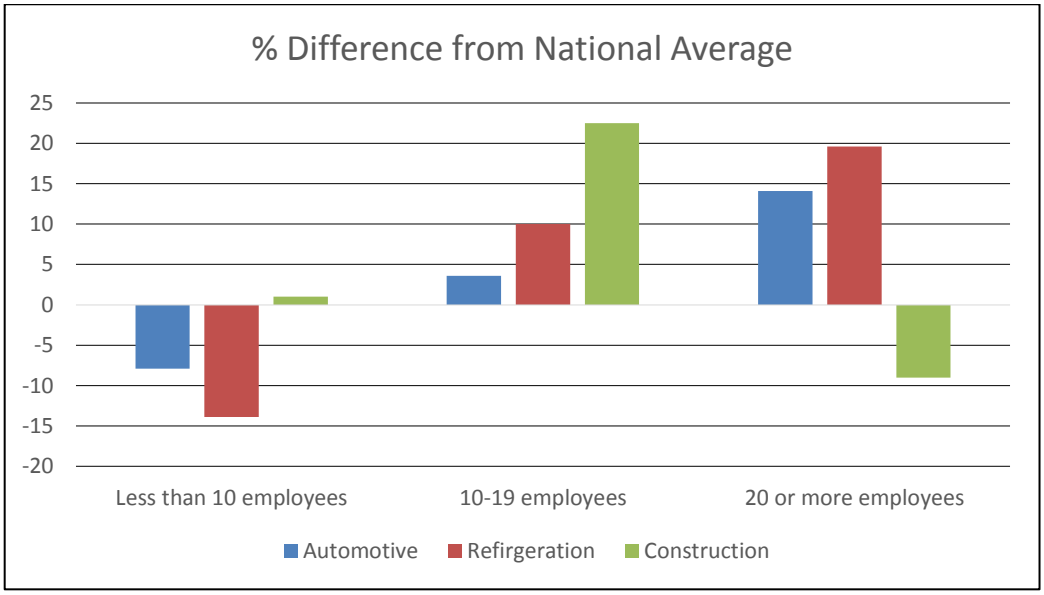

Figure 2: Percentage difference from National Average based on employer size (Canadian Apprenticeship Forum, 2009)

In summary, the net benefit of training apprentices increases annually per apprentice as he/she gains in experience and increases both productivity and quality. Thus, the revenue generated by apprentices increases through the apprenticeship period, resulting in a positive return on invested capital.

2.2.2 Returns on Apprentice Training In Switzerland:

Many Swiss companies cite overall financial gain from training apprentices, the results from country-wide surveys indicate an average of 10% return of training costs and also speaks to further long-term returns (Muehlemann, 2010). The dual apprenticeship programme employed in Switzerland requires apprentices to attend formal education at least once a week and gain practical experience at their allocated companies during the rest of the week (Meyer, 2006). Formal education in this context refers to attend VET colleges.

According to Wolter (2012), firms are required to place apprentices on productive tasks as soon as possible in order to realise any financial gain during training. Furthermore, the apprentice's wages also have to be considerably low to offset the cost of training. Swiss apprentices' wages are

not regulated by law and are determined by the company administering the apprenticeship (Wolter, Mühlemann, & Schweri, 2006). The question Wolter (2012) asks is what are the benefits to apprentices if firms exploit them as cheap labour to reduce the overall cost of production. Wolter (2012) cites that exploitation may result in learners choosing to go the school route (full-time vocational college) and not the apprenticeship route.

In order to create a mutually beneficial atmosphere, tasks allocated to Swiss apprentices were aligned with the qualification the apprentice studied for and served as an excellent source of learning. Furthermore, low-paying apprenticeship were still seen as feasible ways for young people to be educated as long as learning was regulated and the qualification was achieved at the end of the apprenticeship. Thus, the risk of exploitation was reduced (Muehlemann & Wolter, 2014). The costs associated with training apprentices were almost the same as that of the Canadian apprenticeship training programmes (Muehlemann & Wolter, 2014), these costs included:

- Wages of apprentices: Wages was paid by the firm even when apprentices were attending college, compensations was also made for food and travel and basic living expenses.
- Cost of Supervision: Supervisors and journeymen were required to be competent and knowledgeable to train, these were losses as far as opportunity costs are concerned.
- Cost of infrastructure: This included the machines and facilities that were required to impart knowledge.
- Cost of College: This included tuition fees that firms paid to colleges on behalf of the apprentices.

Table 3 indicates the returns of 26 trade occupations that administer apprenticeship training in Switzerland, seven of these trades returned a negative profit during the apprenticeship period. The average Benefit-to-Cost ratio was 1.13 and the ROI was 13% (Muehlemann, 2010). As cited in table 3, trades that yielded negative gains were predominantly four year apprenticeships, this observation differs with the Canadian Apprenticeship

Forum which cites that apprenticeship training over short periods are more likely to yield negative returns (Canadian Apprenticeship Forum, 2009).

Table 3: Benefit-to-Cost Ratio of Apprenticeship Training by Occupation (Muehlemann, 2010)

Benefit to Cost Ratio of Apprenticeship Training by Occupation			
Training Occupation	Duration in Years	Benefit to Cost Ratio	ROI
Cashier	2	1.37	37%
Other 2-year Programmes	2	1.05	5%
Administrative Assistant	3	1.07	7%
Sales Clerk	3	1.09	9%
Cook	3	1.01	1%
Hairdresser	3	1.11	11%
Auto Mechanic	3	1.03	3%
Bricklayer	3	1.15	15%
Painter	3	1.11	11%
Carpenter	3	1.42	42%
Health Specialist	3	0.74	74%
Pharmaceutical assistant	3	1.27	27%
Logistics Assistant	3	1.43	43%
Plumber	3	1.39	39%
Medical Assistant	3	1.26	26%
Dental Assistant	3	1.51	51%
Electrician	4	1.47	47%
Polymechanics Technician	4	0.82	-12%
IT Specialist	4	0.75	-25%
Joiner	4	1.36	36%
Auto Mechanic	4	0.95	-5%
Draftsperson	4	0.96	-4%
Automatician	4	0.91	-9%
Electronics Technician	4	0.78	-22%
Average	3.31	1.13	13%

2.2.3 Training in Germany:

A large portion of vocational educational training is apprenticeship based in Germany (Kupfer, 2010). Whilst the German apprentice training system shared a lot in common in structure with the Swiss apprenticeship training structure, there were also notable differences regarding the costs and benefits of apprentice training between the countries (Nilsson, 2010). Germany had a regulated market when considering apprenticeships in comparison to Switzerland. Hence the cost of employing apprentices in Germany were higher than those in Switzerland.

Swiss apprentices were also placed on productive tasks much sooner than German apprentices, resulting in higher production from Swiss apprentices (Dionisius et al., 2009). However, not all apprentice training in Germany was conducted at net cost; a survey conducted in 2007 showed a significant reduction in the cost of training by utilising apprentices on production at a much earlier stage in the apprenticeship. According to the survey, the net cost of training was reduced by approximately 36% (Schönfeld (2010) as cited in (Muehlemann & Wolter, 2014). This has resulted in almost 30% of German firms recognising a benefit to training (Muehlemann & Wolter, 2014). The percentage of firms with net costs was relatively high for Germany. Germany had however, seen an 18 % reduction in net costs from the year 2000 to the year 2007. Switzerland was far ahead of Germany with only 29 % of firms experiencing a net cost when training (Muehlemann & Wolter, 2014). Further details regarding specific trades that recognise positive returns or negative net cost are fairly limited.

2.2.4 Returns on Apprentice Training in the United States of America

A survey to determine the benefit-to-cost ratio of craft training in the American Construction Industry Institute (CII) was carried out in 2007. The survey aimed at determining the perception of training firms and construction managers on the effectiveness of firm based training from a productivity and wellbeing perspective. This included employee safety and absenteeism (Goodrum, Wang,

Haas, Glover, & Vaziri, 2007). The survey was sent to 150 members of the CII. The survey included determining the value that apprentice training would have on capital and maintenance projects. The survey found that only 13% of construction companies measured the costs to benefits of training apprentices, the remaining 87% of respondents mentioned that they did not know what to measure (Goodrum et al., 2007). Whilst Wolter (2012) does not indicate a time frame as to how long it takes for the average apprentice to become productive under the Swiss apprenticeship programme, Wang, Goodrum, Haas, Glover, and Vazari (2010) cite that it takes on average 35 weeks of training before production benefits are realised (refer to table 3 for a summary of the training benefits achieved).

Table 4:Summary of training benefits identified through the CII survey (Wang et al., 2010)

Benefits	Capital Project			Maintenance Project		
	95% Confidence Interval			95% Confidence Interval		
	Average	Lower Bound	Upper Bound	Average	Lower Bound	Upper Bound
Productivity improvement	11%	6.80%	14%	10%	7.70%	12%
Turnover Decrease	14%	10%	18%	14%	8%	19%
Absenteeism Decrease	15%	10%	19%	15%	8.30%	21%
Injury Decrease	26%	18%	33%	27%	18%	37%
Rework Decrease	23%	17%	29%	26%	18%	35%

Over and above the productivity improvements of 11% and 7.7% in the capital and maintenance projects, other measured improvements included a substantial decrease in injury, reworks and turnover. Being similar to the surveys carried out in the previously mentioned countries, no part of this survey provides a view from the apprentices' perspective.

2.2.5 Returns on Apprentice Training In India (Rothboeck, 2014)

A study was conducted in 2014 regarding the return on investment on apprenticeship training in India. The study measured the benefits to costs of

training by conducting case studies on five small to medium enterprises (SMEs). The ROI aspect of the study was to be used as a marketing tool by government to revive interest in apprentice training and to increase the social status of apprenticeship training (Rothboeck, 2014). The apprentice trades studied included: cooks, clerks, sales executives and various types of mechanics. The industries concerned included: the hospitality industry, food sales, food processing and the engineering manufacturing industry. The study was published in the International Labour Organisation's (ILO's) Asia-Pacific working paper series in 2014 (Rothboeck, 2014). The study noted that the Indian apprenticeship system was well established and supported by legislation, but was highly under-utilised, under-resourced, and posed several challenges regarding the quality of the qualification.

The study established that most enterprises had a tendency to employ apprentices as cheap labour for production, resulting in minimal training and minimal retention after the apprenticeship contract (Rothboeck, 2014). This is similar to the substitution theory of apprenticeship where apprentices have a high turn-over rate and are used because they are paid a stipend below the minimum regulated wage (Backes-Gellner, Wolter, Mohrenweiser, & Backes-Gellner, 2010). This was substantiated by a survey conducted by the ILO, World Bank and the Institute of Applied Medicines and Research in 2013 (International Labour Office for South Asia, 2013). According to the survey, Indian apprentices did not see apprenticeships as a very attractive training option with limited job guarantees, limited career development, low wages, and poor training facilities (International Labour Office for South Asia, 2013).

This led to reforms in apprenticeship and engagements between various stakeholders including the Indian Ministry of Labour, business and various social partners (Rothboeck, 2014). The apprentice act, and apprentice rules in India were amended resulting in a restructured apprentice system. Reforms included:

- Apprentice protection by means of a revised code of practice and guidelines for employers and apprentices.

- Significantly increased stipend for apprentices.
- Adequate funding for the administration of the apprentice scheme.

Apart from determining the ROI calculation of apprentice training, the study also included a qualitative assessment by means of semi-structured interviews with senior management, discussing reasons and motivation behind training apprentices (Rothboeck, 2014).

India has two major types of apprenticeships under the Apprentices Training Scheme (ATS); these include a long scheme which is a 2-3 year scheme and a shorter one year tenure apprenticeship. The one year apprenticeship is due to learners attending vocational training colleges on a full-time basis for two years. This is the preferred way of qualification in India. There is also a fouryear training scheme under the Swiss Indian Vocational Education Training (SIVET) (Rothboeck, 2014). The concept of measuring the benefit-to-cost ratio of training in India is similar to the Swiss, German and Canadian methodology as cited by Muehlemann (2010) and the Canadian Apprenticeship Forum (2009). Consequently the costs of training are also similar, if not exactly the same, as the Swiss, German and Canadian Methodology (Canadian Apprenticeship Forum, 2009).

Table 5 provides a summary of the five case studies, including the cost-to-benefit ratio and ROI per trade and the length of apprenticeships.

Table 5: Benefit-to-cost ratio and ROI of apprentice training in India (Rothboeck, 2014)

ROI of Apprentice Training in India				
Company/Industry	Training Occupation	Duration in years	Benefit to Cost Ratio	ROI
Hotel: Hospitality Industry	Clerk	3	1.9	90%
Hotel: Hospitality Industry	Cook	3	1.7	70%
Hotel: Hospitality Industry	House Keeping	2	1.4	40%
FMCG: Food Industry:	Sales	1	1.8	80%
Heat induction Manufacturing Industry	Mechanical artisans	1	1.16	16%
Heat induction Manufacturing Industry	Mechanical artisans	2	1.5	50%
Mould and Dies: Engineering	Mechanical artisans	1	1.5	50%
Food/Engineering Plant	Mechanical artisans	1	1.08	8%
Food/Engineering Plant	Mechanical artisans	4	1.6	60%

The findings in the cost-to-benefit ratios show that both the ATS and SIVET apprentices training systems yield a positive cost-to-benefit ratio which should encourage companies to train and develop youth and build a pipeline of skills for the future of the company. India's one year apprenticeship system is different from the European apprenticeship system in that it yielded a benefit after the first year of apprenticeship. Various European apprenticeships cite a one year apprenticeship as being too short to yield any positive return. The reason for the difference in the Indian system is that apprentices are exposed to various forms of practical training during their two year vocational training at

colleges, hence they are productive in their first year of apprenticeship (Rothboeck, 2014).

2.2.6 Apprentice Training in South Africa:

The governance of artisan training in South Africa is managed by the Sector Education and Training Authority's SETAs. SETAs were established under the Ministry of Higher Education and Training in 1999 (Republic of South Africa, 1998). There are 23 SETAs in South Africa, and each SETA is responsible for a particular industry. One of 23 SETAs is MerSETA; MerSETA was developed to facilitate skills development and higher education in the manufacturing sector including: metal, auto, component, tyre and plastic manufacturing industries.

Artisan skills in South Africa are developed in one of the following ways: an apprenticeship, a learnership via completion of a national vocational certificate at a Further Education and Training (FET) college supplemented by an internship at an appropriate company or a recognition of prior learning (RPL) (Underhill Corporate Solutions (2012), as cited in (Republic of South Africa, 1981).

The South African apprenticeship programme is similar to the Swiss dual apprenticeship where apprentices spend approximately 25% of their training time at a FET college and 75% of their training time at a firm (Underhill Corporate Solutions, 2012). The RPL is aimed at accommodating individuals who wish to undergo apprenticeship training but do not meet minimum school subject requirements for college acceptance, hence they are allowed to qualify as artisans under section 28 of the Skills Development Act (Republic of South Africa, 1999). RPL apprentices are required to have a minimum of four years of related industry experience, supplemented by training schedules as dictated by the SETAs (Underhill Corporate Solutions, 2012).

In 2011, there were 16500 artisans registered by MerSETA alone, excluding the 22 other SETAs (Underhill Corporate Solutions, 2012). Whilst the numbers may

be staggering, there is no published literature on the ROI of apprentice training in South Africa.

2.2.7 Why companies decide against apprentice training

A common risk in all the literature cited is the risk of poaching. Firms are afraid of training apprentices as they believe that apprentices may be approached by firms who do not train; this results in a loss of time and money invested (Wolter, 2012). According to Wang et al. (2010), some firms were prepared to make counter-offers to apprentices to remain in the firm during the apprenticeship period, this was commonly the case when apprentices become productive and are approached by non-training companies. The qualitative aspect of the study conducted by the Canadian Apprentice Forum cited the following reasons why firms do not take on apprentices; these include (Canadian Apprenticeship Forum, 2009):

- The interruptions in apprentice availability when they were sent for college training
- The opportunity costs and time taken for the supervision of apprentices.
- A lack of interest or response from potential apprentices.
- Companies did not have sufficient continuous or secured work to provide apprenticeships.

2.2.8 Why do individuals decide against apprenticeships

There were many reasons why individuals chose not to follow the apprenticeship route, these included:

- Substitution: Substitution occurred when apprentice wages were lower than non-skilled workers, resulting in firms constantly turning over new apprentices because they were cheaper than unskilled unionised workers (Backes-Gellner et al., 2010).

- Contract reneging: There was risk of firms reneging on apprenticeship contracts and providing poor quality training (Backes-Gellner et al., 2010).
- Employment guarantee: There was a lack of certainty regarding employment contracts after completion of the apprenticeship (Rothboeck, 2014).
- Career Path: There was a lack of progression paths between the apprenticeships and further career development (Rothboeck, 2014).

2.2.9 The transfer of training to the workplace

The aim of all types of workplace training, be it general administration training, bookkeeping or human resource training, is to advance both behavioural and cognitive changes in individuals and consequently develop core competencies that enhance job performance (Grossman & Salas, 2011). According to Salas and Stagl (2009), effective training can benefit the organisation by improved productivity, improved quality and a decrease in errors, improved employee engagement and motivation and subsequently improved competitive advantage. The issue with most types of training was whether the training received was transferred to the workplace in order to achieve the desired performance and competitive advantage.

A survey conducted by Saks (2002) suggested that 40% of trainees fail to transfer immediately after training, a staggering 70% of trainees fail to transfer their training a year after the programme and only 50% of training investments results in individual or organisational benefit and improvement. A training transfer model developed by Baldwin and Ford (1988) cite three critical factors that enable the effective transfer of training - these include:

- The trainee's characteristics: including intellectual ability, the value that the trainee saw in training and the trainee's level of self-motivation (Baldwin & Ford, 1988).

- The training design including: behavioural modelling and a realistic training environment (Baldwin & Ford, 1988). Training had to be relevant in content in order to allow for transfer to take place (Bates, 2003).
- The work environment: The transfer climate was required to support opportunities to practice and have the necessary technical support (Baldwin & Ford, 1988).

Whilst Baldwin and Ford's transfer model is almost 30 years old, the model was widely referenced by recent training transfer literature including: Blume, Ford, Baldwin, and Huang (2010), Grossman and Salas (2011) and Saks and Burke (2012).

According to Clarke (2002), the primary reason for poor training transfer was attributed to limited opportunity to apply the newly acquired knowledge on the job. Factors that improved training transfer included accountability and continuous trainee assessments conducted by management. According to Bates (2003), managers were required to create a culture that valued training by constantly assessing trainees regarding the level of training transfer on the job. Similar views were held by Kontoghiorghes (2004) who suggested that management held trainees accountable for their transfer of training by allocating them with new responsibilities based on training received.

The benefit of apprenticeships was that it conformed to all the requirements as prescribed by Baldwin and Ford (1988). Apprenticeships created an environment where training was transferred on the job over a prolonged period, generally three to four years. The training was progressive and done in phases where apprentices were required to master levels of expertise before advancing to the next level, hence there was constant assessment. As apprentices grew in knowledge and skill, they given more responsibilities, hence being made accountable (Canadian Apprenticeship Forum, 2009).

2.2.10 Conclusion of Literature Review and Propositions

According to Kirchberger (2008), most European countries have made vocational training a top priority in their fight against youth unemployment. This has resulted in more than 29% of European youth aged between 15 and 19 being engaged in a professional training scheme. Whilst Steedman (2012) agreed that there were positive associations between low youth unemployment and apprentice training, the author cautions that apprentice training should not be seen as a primary resolution to youth unemployment, but rather as an important tool to impart skills. Vocational training has thus seen renewed attention in recent years as it is seen as a tool for economic growth and social inclusion (Nilsson, 2010).

There was sufficient evidence noted that firm-based apprenticeship training could enhance productivity and companies received benefit-to-cost ratios as high as 1.47, suggesting a 47% return in investment in training. This should lead to several companies considering entering into contracts with apprentices. Consequently, companies were able to develop their own pipeline of talent and save on recruitment and retraining costs if they provided permanent employment once the apprentices qualified. High apprentice wages, as seen in Germany, resulted in no financial gain during the training period. Low apprentice wage (below minimum) may lead to apprentices being exploited as cheap labour and result in low levels of training imparted to apprentices.

There was a need for a well-regulated system with defined learning objectives that resulted in a mutually beneficial relationship between the employer and the apprentice. The objective of firm-based training was for the apprentice to be seen as a well-paid student and not as cheap labour, this could consequently appeal to school leavers (Wolter, 2012).

2.2.11 Research Proposition 1:

South African apprenticeship training has a positive return on investment during the apprenticeship period.

2.2.12 Research proposition 2:

South African managers who train apprentices recognise value in training apprentices.

3 CHAPTER 3: RESEARCH METHODOLOGY

This chapter describes the research design and methodology that was used to investigate the research propositions formulated in Chapter 2. The chapter begins with a brief introduction and definition of the research design and continues with the research methodology. Thereafter the process of data collection, analysis and interpretation are discussed, including comments regarding the external validity, the reliability and the replication of the research methodology.

3.1 Research methodology

This research followed a mixed methods methodology, as both quantitative and qualitative analysis was used to determine the return on investment of apprenticeship training in South Africa (Bryman, 2012). The quantitative analysis endeavoured to show the actual ratios of benefits-to-cost of apprentice training and the subsequent return on investment (ROI). The qualitative analysis aimed at determining managers' perception of the value that apprentices add during their apprenticeship. Similar methodology was used by the Canadian Apprenticeship Forum in 2009 to motivate why companies should train apprentices (Canadian Apprenticeship Forum, 2009).

3.1.1 Assumptions

The assumptions made in this research are based on similar assumptions made in previous studies. These assumptions include:

- The apprentice's level of productivity increases during the apprenticeship tenure (Rothboeck, 2014). It was assumed that the apprentice was used for production-type tasks as he/she advanced in the apprenticeship.
- Apprentices collectively have a linear learning curve (Wang et al., 2010). It was assumed that the rate at which an apprentice learned

and developed followed a linear progression based on his/her time served as an apprentice. This was seen as a potential weakness as some apprentices learned and developed much faster than others, resulting in a possible non-linear curve. Consequently, there could be apprentices that did not necessary understand concepts and principles the first time around resulting in a linear curve with a relatively small gradient.

- It was also assumed that the apprentice's level of dependence on supervision decreased as the apprenticeship period advanced.

3.2 Research Design

The study was conducted by means of a case study. This was due to the limitation of published data in South Africa regarding return on investment of apprentice training. According to Zainal (2007), case studies enable a researcher to meticulously study, explore and investigate existing occurrences within a specific context. Hence the objective of this research was to study the return on investment on apprenticeship training at Aveng South Africa. There were several types of case studies that could be used when conducting research, these included: explanatory, exploratory, descriptive, multi-case, intrinsic, instrumental and collective case studies (Baxter & Jack, 2008). A descriptive case study was used for this research. According to Yin (2003) a descriptive case study described an occurrence or intervention and the context in which it transpired.

Aveng has been training apprentices for more than 30 years; whilst the company had not previously calculated a benefit-to-cost ratio for apprentice training, there was sufficient data and documentation that could be reviewed to determine the benefit-to-cost ratio. The case study comprised semi-structured interviews with management from Aveng and a review of documentation to determine the cost-to-benefit ratio and ROI of apprentice training using a mathematical model.

3.2.1 Advantages of Case Study Research Approach

There were several advantages associated with case studies, these included:

- The data being examined was generally within the context of a real-life occurrence (Yin, 1984).
- Case studies allowed for both a quantitative and qualitative analysis of data (Yin, 1984).
- A case study allowed for an intimate and in-depth study into a specific occurrence, geography, person or organisation (Zainal, 2007).

3.2.2 Limitations of Case Study Research Approaches

There were also several disadvantages associated with case studies, these included:

- Case studies have limitations in their ability to generalise a phenomenon, one cannot make or state a general finding from a single case (Yin, 1984).
- Case studies may be biased or influenced, based on views to influence end results (Yin, 2003).
- Case studies may be time consuming to conduct as some case studies require a longitudinal approach, hence requiring the researcher to record a phenomenon over a prolonged period of time, resulting in added expenses (Baxter & Jack, 2008).

3.3 Population and sample

3.3.1 Introduction to the case site

Aveng Africa Limited is an infrastructure and manufacturing company that has been in operation for more than 125 years. The company has expertise in steel manufacturing, mining, engineering, public infrastructure and water treatment.

The company operates in Africa and Australasia. It employs more than 16000 employees and has an annual turnover in excess of R30 billion. The case site has been narrowed down to five Aveng business units. These business units are all situated in Johannesburg and are with a 20km range of each other. Each business unit has the infrastructure and facilities required to train apprentices. The scope of each business unit is as follows:

- Aveng Rail: Aveng Rail manufactures machines for mechanised maintenance of track machines for the railway industry. Aveng Rail offers five types of apprenticeship training including: mechanical fitting, boiler making, welding, electrical fitting and millwright apprenticeship training.
- Aveng Infraset: Aveng Infraset manufactures concrete products including paving bricks, roof tiles, pipes and rail sleepers. Aveng Infraset offers mechanical and electrical apprenticeship training.
- Aveng Dynamic Fluid Control (DFC): Aveng DFC manufactures valves and pumps for the water and sanitation industry. Aveng DFC offers mechanical, millwright and electrical apprenticeship training.
- Aveng Moolmans: Aveng Moolmans is a mining company that mine minerals. The company offers mechanical, millwright, earthmoving and electrical apprenticeship training.
- Aveng Duraset: Aveng Duraset manufactures steel rock reinforcement tendons (roof bolts) and cable anchors for underground mining and geotechnical applications. The company offers toolmaking, mechanical fitting and electrician apprenticeships.

3.3.2 Population sample and sampling method for quantitative analysis

A non-probability sampling method was used for the data selected for the quantitative analysis, hence the data sample was not random. The following criterion was chosen for the data sample:

- Only final-year apprentices were chosen for this sample. The reason for choosing final year apprentices was that a history of the productivity of the apprentices could be tracked from the first year to the final year. There was also minimal risks associated with final year apprentices dropping out of the programme as compared to first year and second year apprentices.

The data sample thus comprised 185 tasks on which 15 apprentices worked on during their apprentice training. Similar data sampling criteria were used by the Canadian Apprenticeship Forum (Canadian Apprenticeship Forum, 2009).

The sampling was conducted by means of reviewing the job-clocking systems and counting the number of productive hours that apprentices booked on tasks. This documentation was available for scrutiny on the company's database where the productivity of all technical staff was measured on a weekly basis against job-cards from both capital projects and general assembly tasks. Further input data for the mathematical model was retrieved from the company's human resources department.

3.3.3 Population sample and sampling method for qualitative analysis

A non-probability sampling method was also used for the qualitative analysis as the managers interviewed were not random individuals. The qualifying criteria for the managers interviewed included:

- The manager had to be a present employee of any of the five business units mentioned in paragraph 3.3.1 above.
- The manager had been involved in training apprentices for at least 10 years.

This was aimed at providing a greater level of understanding and perception regarding the value that managers saw in apprenticeships. A total of 12 managers were interviewed with saturation being reached at 11 managers. Similar criteria was adopted by the CAF study in 2009 (Canadian Apprenticeship Forum, 2009).

The sampling method entailed conducting semi-structured interviews with the managers selected. Interviews were structured around management's perception of the value of apprenticeship training. Table 6 provides a list of managers that were interviewed.

Table 6: List of managers for Semi-Structured Interview

AVENG MANUFACTURING GROUP OF COMPANIES		
Manager	Business Unit	Respondent
1	Aveng Infraset	Production Manager
2	Aveng Moolmans	Workshop foreman
3	Aveng Rail	Production Manager Mechanical
4	Aveng Rail	Production Manager Electrical
5	Aveng Rail	Plant Manager 1
6	Aveng Rail	Workshop Manager
7	Aveng Rail	Plant Manager 2
8	Aveng Duraset	Production Manager
9	Aveng Duraset	Workshop foreman
10	Aveng Duraset	Tool Room Manager
11	Aveng Dynamic Fluid Control	Production Manager
12	Aveng Dynamic Fluid Control	Workshop foreman

3.4 The research instrument

Being a case study and using mixed method methodology required the use of two different research instruments. As previously mentioned, the quantitative analysis involved the use of a mathematical model and the qualitative analysis entailed interviews with managers.

3.4.1 Mathematical Model

The model measures the return on investment by first calculating the actual costs and benefits of training. Thereafter, a ratio of benefit to cost was

calculated and converted into a ROI percentage. The model is similar to the models used by Canadian Apprenticeship Forum (2009) and D. Muehlemann (2010) to calculate the ROI in training apprentices. The model was adapted to cater for the costs and benefits associated with training and production at Aveng. The model was structured as follows:

Cost of training:

$$C = \sum_{y=1}^{Y} (C1 + C2)$$

$$C1 = \sum_{y=1}^{Y} \left(W_y + I_{y+} P_y + M_y \right)$$

$$C2 = \sum_{y=1}^{Y} ((\, A_y \times \, h_y \,) + (S_y \times h_{sy}))$$

Where:

- C: is the total cost of training per year
- y: is the year of apprenticeship from year one to final year of completion.
- C1: Apprentice costs per year
- Wy: is the apprentice salary per year.
- Iy: is the cost of infrastructure per year to render training
- Py: is the cost of personnel protective equipment per year
- My: Miscellaneous costs per year, including material and consumables.
- C2: Management costs per year
- Ay: Artisan costs per hour
- hy: total annual hour used for supervision from artisans
- Sy: is the cost per hour of management per year
- Hsy: total number of hours for management supervision per year.

Benefits of training:

$$B = \sum_{y=1}^{Y} ((\ R_{cy} \times\ h_{cy}\ ) + (\ R_{py} \times h_{py}) + (Dg)$$

- B: is the benefit of training per year
- y: is the year of apprenticeship from year one to final year of completion.
- Rcy: is the call-out rate whenever apprentices are sent out to conduct a job.
- Hcy: is the number of hours that an apprentice is sent on call-outs per year
- Rpy: is hourly tariff for in-house productivity of apprentices.
- Hpy: is the number of productive hours that an apprentice works per year.
- Dg: is the discretionary grant awarded by MerSETA

Return On Investment:

$$ROI = \frac{B - C}{C} \times 100$$

3.4.2 Interview schedule

Semi-structured Interviews were conducted with managers to determine their perception of the value of training apprentices. The questions posed in the interview were similar in context to the questions used by the Canadian Apprenticeship Forum (2009). The questions aimed at determining the improvements that managers saw in productivity when using apprentices, the dependency that management had on apprentices and the effect that was felt on production when apprentices were away at colleges. The interview schedule is attached as Appendix A to this document.

3.5 Procedure for data collection

Data for calculating the benefit to cost ratio and ROI were gathered from the company's data base; the following variables were captured and documented:

- The company's annual contribution to the Skills Development Levy.
- The annual wages per apprentice.
- The percentage of the apprentice's wages that gets subsidised by the SETAs.
- The costs to train apprentices (training centre fees)
- The infrastructure costs to train apprentices.
- The opportunity costs of journeymen who assist and supervise apprentices.
- The number of productive hours that gets booked on tasks by apprentices.
- The amount of hours that gets booked when apprentices are sent on call-outs.

Data for determining the perception of managers and apprentices was formally documented during the semi-structured interviews.

3.6 Data analysis and interpretation

3.6.1 Qualitative data analysis and interpretation

The data recorded during interviews were converted into text for analysis. Thereafter the text was analysed using various methods of content analysis. According to Male (2015), content analysis entails counting the number of times a specific word, phrase and item is found in text. The text was then made controllable by a process of data reduction by identifying themes and patterns (Richards, 2014). The themes and patterns were then categorised and grouped accordingly (Male, 2015).

The themes and patterns established from the data were tabulated or placed into matrices for the purpose of organising the data. This allowed for a quantitative analysis of qualitative data (Male, 2015). Once the matrices or tables were populated, observations were made regarding the number of occurrences of specific themes or patterns; this facilitated a conclusion from the data analysed.

3.6.2 Quantitative analysis and interpretation.

The first item measured is the average benefit-to-cost ratio for training. This was done to determine whether it benefits the firm to train apprentices. The benefit-to-cost ratio was qualified as follows:

- When $\frac{B}{C} < 1$, Training is not beneficial
- When $\frac{B}{C} = 1$, Training neutral
- When $\frac{B}{C} > 1$, Training is beneficial to company.

The benefit-to-cost ratio is thereafter converted into a percentage to determine the ROI of training as indicated in the ROI formulae. The results were then compared to similar studies, as mentioned in the literature review.

3.7 Limitations of the study

Being a case study, there were limitations regarding generalisation of the data that were produced, however data was in-depth and very specific. Limitations of this study included:

- This study was limited to the manufacturing sector and specifically, the engineering and heavy machinery subsector.
- Being a case study, it was further limited to the data being collected from one company.
- There may be several types of apprenticeships that can be offered in the manufacturing sector, however this study was

limited to mechanical fitting, earthmoving and electrical fitting apprenticeships.

3.8 Validity and reliability

According to Bryman (2012) validity discusses the trustworthiness and integrity of the research conclusion. Validity is further divided into the external validity and internal validity of the conclusion. External validity concerns the ability of the study to generalise, hence it questions whether the study can be applied to other similar studies (Merriam, 1995). Internal validity questions the findings of the study in comparison with reality, it also asks the question whether the study has measured what it was purposed to do (Merriam, 1995). The reliability of a study is determined by the study's ability to repeat itself (Bryman, 2012). Merriam (1995) explains reliability as the extent to which a finding can be found again.

3.8.1 External validity

This study cannot serve as a generalisation for the return on investment of apprenticeship training in South Africa as the population sample was not random, but limited to employees at Aveng who met specific criteria. However, it could be comparable with several organisations that train apprentices. The reason behind this statement is linked to the premise that this study uses similar research methodology as several other international countries, including Canada, USA, Switzerland and India as cited by the Canadian Apprenticeship Forum (2009), Dustmann and Schönberga (2012), Wolter (2012) and (Rothboeck, 2014).

3.8.2 Internal validity

The study uses a mathematical model to measure the productive benefits of apprentices against their costs. It also uses interviews with management to determine the value of apprenticeship. Validation of previous studies conducted

in India and Canada used a roundtable validation approach as cited by the Canadian Apprenticeship Forum (2009) and Rothboeck (2014). According to the Canadian Apprenticeship Forum (2009) a roundtable discussion is an engagement with the stakeholders to determine if any substantial costs and benefits have been excluded from the model; this provides for validating the conclusion of the study. A group of people interviewed were selected to validate if the conclusion is a reflection of what transpired in the interview; this method is commonly referred to as respondent validation (Bryman, 2012).

3.9 Demographic profile of respondents

The demographic profile of respondents targeted were managers that have been in the engineering profession and training apprentices for 10 years and more. The age of these managers varied between 33 to 65 years of age. This is similar to the demographic profiles chosen for the case study conducted by the Canadian Apprentice Forum (Canadian Apprenticeship Forum, 2009).

4 CHAPTER 4: PRESENTATION OF RESULTS

4.1 Introduction

This chapter presents data that was collected from Aveng's human resources data base, job-clocking systems and from interviews conducted with managers at Aveng. Interviews were conducted with 12 managers from five business units within Aveng namely: Aveng Rail, Aveng DFC, Aveng Infraset, Aveng Duraset and Aveng Moolmans. The interviews were formally recorded, transcribed into text format and coded into themes. The themes are presented and discussed in the following paragraphs. The data extracted from the company's data base was computed using the mathematical model to determine the ROI. All calculations are attached in Appendix B of this document.

The remainder of this chapter is structured as follows: Paragraph 4.1 presents the quantitative data based on the mathematical model as described in chapter 3, Paragraph 4.2 presents qualitative data based on the interviews with managers, as described in the semi-structured questionnaire in Appendix A.

4.2 Results from data collected at Aveng Rail

Aveng's apprentices either worked at the company's manufacturing workshops or at its mobile sites. The average mobile site accommodates four individuals, namely a site supervisor, a machine operator, a machine technician and an operator's assistant. Apprentices staffed at mobile sites were therefore classed as machine operator's assistants. Due to the nature of the mobile site, site-based apprentices were given special allowances for travel and meals and thus, generally earned more than workshop based apprentices. Site based apprentices' costs were recovered by means of fixed contracts with various clients, hence their costs were recovered by the company immediately. Apprentices based at Aveng's workshops were paid a standard apprentice salary as directed by MerSETA. The salaries of all 15 apprentices were

recorded from the period February 2015 to February 2017. The following details retrieved from Aveng formed part of the fixed inputs to the benefit-to-cost model:

- Aveng conducts a 3-year apprenticeship programme.
- The company receives R150,000.00 per apprentice for the total apprenticeship period. The money is received by means of a MerSETA discretionary grant paid in three tranches. This translates to R50,000.00 grant per year over a 3-year period.
- The cost of training and infrastructure is per apprentice is R53,120.00 over the three-year period. This translates to R17,706.00 per year.

4.2.1 Assumptions in calculations:

In calculating the cost of training, an assumption was made that the amount of supervision input would gradually reduce over the apprenticeship period. This is based on several interviews with managers who stated that the amount of supervision apprentices require reduces substantially during the apprentice period. The following assumption was made:

- It was assumed that 30% of the journeyman's time was spent on training in the first year.
- 20% of the journeyman's time was spent on training the apprentice in the second year.
- 10% of the journeyman's time was spent on training the apprentice in the final year of apprenticeship.
- 10% of the manager's time was contributed to training in the first year.
- 10% of the manager's time was contributed to training in the second year.
- Only 5% of the managers was spent on training and supervising the apprentice in his third and final year.

The remaining inputs were variable and dependant on whether the apprentice was site based or workshop based. The following paragraphs present the data collected and calculated for the workshop and site based apprentices accordingly. All inputs and calculations are attached as Appendix B to this document.

4.2.2 ROI for site based apprentices

An eleven-week provision was made for apprentices to attend training and college sessions each year, this translated to 440 hours that the apprentice spent away from the employer. Site and office based staff work a total of 1760 hours a year. Hence, the total hours recovered per apprentice per site was 1320 hours. There was no further data available for this group of apprentices as they were in their third and final year of apprenticeship. The managers from Aveng Rail who trained apprentices on mobile sites reassured that apprentices who work on mobile sites are charged out as operator's assistants right up until they qualify as artisans. Therefore, it was safe to assume the number of hours booked on mobile sites would be the same as both previous years because these sites are on specific contracts with clients, the hours worked are based on contractual obligations. Other critical third-year inputs into the mathematical model including: apprentice salaries, costs of training and costs of management were formally adjusted by the company in December 2016 and are fixed for 2017 till December of the same year.

Special attention was focused on whether benefit was reached within the first two years of training. Table 6 indicates the benefit-to-cost ratio and ROI of site based apprentices after the first year of apprenticeship. Table 7 indicates the benefit-to-cost ratio and ROI of site based training after the second year of training. Table 8 provides the indicative benefit-to-cost ratio and ROI of site based training after the third and final year of training. The average benefit-to-cost ratio and ROI for a three-year period apprenticeship is summarised in table 9.

Table 7: Benefit to Cost Ratio and ROI of Site-Based Apprentices in Year 1.

Year 1	Type of apprenticeship	Benefit/Cost Ratio	ROI
Apprentice 1	Mechanical Fitter	1.47	47%
Apprentice 2	Earthmoving Mechanic	1.10	10%
Apprentice 3	Earthmoving Mechanic	1.40	40%
Apprentice 4	Mechanical Fitter	1.11	11%
Apprentice 5	Earth Moving Mechanic	1.10	10%
Apprentice 6	Mechanical Fitter	1.18	18%
Apprentice 7	Electrical fitter	1.10	10%
Apprentice 8	Electrical fitter	1.10	10%
Average Benefit to Cost Ratio		1.19	19%

Table 8: ROI of Site-Based Apprentices in Year 2

Year 2	Type of apprenticeship	Benefit/Cost Ratio	ROI
Apprentice 1	Mechanical Fitter	1.62	62%
Apprentice 2	Earthmoving Mechanic	1.18	18%
Apprentice 3	Earthmoving Mechanic	1.54	54%
Apprentice 4	Mechanical Fitter	1.19	19%
Apprentice 5	Earth Moving Mechanic	1.18	18%
Apprentice 6	Mechanical Fitter	1.27	27%
Apprentice 7	Electrical fitter	1.18	18%
Apprentice 8	Electrical fitter	1.18	18%
Average Benefit to Cost Ratio		1.29	29%

Table 9: ROI of Site-Based Apprentices in Year 3.

Year 3	Type of apprenticeship	Benefit/Cost Ratio	ROI
Apprentice 1	Mechanical Fitter	2.14	114%
Apprentice 2	Earthmoving Mechanic	1.42	42%
Apprentice 3	Earthmoving Mechanic	1.99	99%
Apprentice 4	Mechanical Fitter	1.44	44%
Apprentice 5	Earth Moving Mechanic	1.43	43%
Apprentice 6	Mechanical Fitter	1.55	55%
Apprentice 7	Electrical fitter	1.42	42%
Apprentice 8	Electrical fitter	1.42	42%
Average Benefit to Cost Ratio		1.60	60%

Table 10: Average ROI After 3 Years of Apprenticeship.

Apprenticeship Year	Yearly Average Benefit to Cost ratio	ROI
Year 1	1.19	19%
Year 2	1.29	29%
Year 3	1.60	60%
Average after 3 years	1.36	36%

4.2.3 ROI for workshop based apprentices

When compared to site based apprentices, workshop apprentices were not immediately used for production type tasks. They were however, used as general assistants based on an hourly tariff of R45 per hour. The general assistant hourly tariff was used until apprentices gained in knowledge and experience and were able to work on repetitive tasks. Once placed on repetitive tasks and projects, apprentices were charged out at a rate of R200 an hour. This was evident in the job-clocking report as each apprentice's total hours booked on tasks varied for the first and second years. Like site based apprentices, the available hours that apprentices worked were 1320 hours a year when compared to all regular staff who work 1760 hours a year, this was due to the 440 hours that was allocated for attending colleges and training.

There was no further data available regarding hours booked on jobs for this group of apprentices. They were in their third and final year of apprenticeship. Managers from the workshops confirmed that all final year apprentices were placed on projects and repetitive jobs and a minimum of 80% of their available hours are recovered on jobs. Hence it was assumed that 80% of 1320 hours would be booked on production jobs. Other critical third-year inputs into the mathematical model, including apprentice salaries and costs of training and management, were formally adjusted by the company in December 2016 and are fixed for 2017 till December of the same year. Table 10 provides the benefit-to-cost ratio of workshop based apprentices for the first year of apprenticeship. Table 11 below provides the benefit-to cost-ratio and ROI of workshop based apprentices for the second year of apprenticeship. Table 12 provides the indicative benefit-to-cost ratio and ROI of apprenticeship after the third and final year of training.

The average benefit-to-cost ratio and ROI for a three-year period apprenticeship is summarised in table 13.

Table 11: ROI of Workshop Apprentices After Year 1

Year 1	Type of apprenticeship	Benefit/Cost Ratio	ROI
Apprentice 9	Mechanical Fitter	0.65	-35%
Apprentice 10	Electrician	0.83	-17%
Apprentice 11	Earth Moving Mechanic	0.55	-45%
Apprentice 12	Earth Moving Mechanic	0.76	-24%
Apprentice 13	Electrical Fitter	0.83	-17%
Apprentice 14	Mechanical Fitter	0.75	-25%
Apprentice 15	Electrical Fitter	0.82	-18%
Average Benefit to Cost Ratio		0.74	-26%

Table 12: ROI of Workshop Apprentices After Year 2

Year 2	Type of apprenticeship	Benefit/Cost Ratio	ROI
Apprentice 9	Mechanical Fitter	1.01	1%
Apprentice 10	Electrician	1.56	56%
Apprentice 11	Earth Moving Mechanic	0.86	-14%
Apprentice 12	Earth Moving Mechanic	1.10	10%
Apprentice 13	Electrical Fitter	1.34	34%
Apprentice 14	Mechanical Fitter	1.42	42%
Apprentice 15	Electrical Fitter	1.44	44%
Average Benefit to Cost Ratio		1.25	25%

Table 13: ROI of Workshop Apprentices After Year 3

Year 3	Type of apprenticeship	Benefit/Cost Ratio	ROI
Apprentice 9	Mechanical Fitter	1.40	40%
Apprentice 10	Electrician	1.68	68%
Apprentice 11	Earth Moving Mechanic	1.68	68%
Apprentice 12	Earth Moving Mechanic	1.68	68%
Apprentice 13	Electrical Fitter	1.68	68%
Apprentice 14	Mechanical Fitter	1.68	68%
Apprentice 15	Electrical Fitter	1.68	68%
Average Benefit to Cost Ratio		1.64	64%

Table 14: Average ROI After 3 Years of Apprenticeship

Apprenticeship Year	Yearly Average Benefit to Cost ratio	ROI
Year 1	0.74	-26%
Year 2	1.25	25%
Year 3	1.64	64%
Average after 3 years	1.21	21%

4.3 Results from interviews with managers

The interviews were semi-structured, using the questionnaire attached in Appendix A.

The questions posed to managers aimed at determining the value that they saw in training apprentices. The questions were structured along the lines of the effort that managers were required to put into training apprentices compared to the benefits they received from training apprentices. Feedback received from the interviews were categorised into themes. These themes were also compared to the themes found in the literature review. A total of 12 managers were interviewed, with saturation being reached after 11 interviews. The managers interviewed are hereafter referred to as participants and are allocated a number from 1 to 12. Questions to participants included:

- What value do you see in training apprentices?
- Would you personally be training apprentices if they did not provide any benefit to your company?
- Are apprentices seen to be beneficial to their journeymen or artisans that train them?
- What is the impact on production when apprentices are sent to training centres and colleges for their various block releases?

The themes that emerged from interviews included:

- Theme 1: Value derived from using resources efficiently.
- Theme 2: Dependency on apprentices.
- Theme 3: Company Pipeline development.
- Theme 4: National and Corporate Responsibility.
- Theme 5: Apprentice's impact on production.
- Theme 6: The importance of quality in training, including the attitude and aptitude of the apprentice.

Table 15 provides a summary of the participants' responses against themes in a matrix format. The character X is used to denote if a participant

acknowledged the importance of a specific theme. Each theme was further aggregated into a percentage to indicate the occurrence of the theme in the total number of interviews.

Table 15: Responses from Managers

Participant	Theme 1	Theme 2	Theme 3	Theme 4	Theme 5	Theme 6
1		X	X	X	X	
2			X	X		X
3	X	X	X		X	X
4	X	X	X		X	X
5	X	X		X	X	X
6	X	X	X	X	X	X
7		X	X	X		X
8	X	X	X		X	X
9	X	X	X	X	X	
10	X	X	X	X		X
11	X	X	X		X	
12	X	X	X	X	X	
Percentage Aggregate	81%	97%	97%	75%	81%	75%

4.3.1 Value derived from using resources more efficiently

Nearly all the participants saw immediate value in training apprentices, they also responded with a clear “yes” to the question on whether they saw value in training apprentices. The first benefit noted was that apprentices were seen as extra pairs of hands on various production tasks. Most jobs required both qualified artisans and general assistants. In saying this, apprentices automatically assumed the role of ‘general assistant’ in most production environments. Participants were questioned on what was the difference between general assistants and apprentices. Participant 7 noted that “the difference between general assistants and apprentices was that apprentices were constantly asking questions and learning whilst general assistants and labourers were generally non-enquiring.” (Participant 7, 2016). According to the

participants, apprentices were seen as constantly improving. They attributed this constant improvement to the added theory that apprentices learn and the formal training opportunities that they were given. Therefore, apprentices' value to the organisation was seen as constantly increasing as they learnt and developed their skill.

Apprentices were seen as being productive from as early as three months in some factories. This was based on the type of apprenticeship served and the tasks they are required to perform. According to participant 3, "Electrical apprentices are used for resetting and restarting failures on production lines after the first three months of trainin."(Participant 3, 2016). This was subsequent to just one formal phase (approximately 8 weeks) of training at Aveng's training centre in Boksburg. The participant noted that resetting or restarting equipment and systems were tasks that could be given to general assistants or labourers. Other participants saw benefits and improvements in production as early as six months into the apprenticeship.

Apprentices were also used for various repetitive tasks that would ordinarily be done by a qualified artisan. Participant number 8, a mechanical production manager, cited that approximately 60% of his apprentice's time was booked on actual production jobs within the first year of apprenticeship. He mentioned that he used mechanical apprentices for tasks entailing stripping of pumps, gearboxes and machines and for assembling small components. Once again, these tasks would ordinarily be done by a qualified artisan. More importantly, these tasks were in line with the requirements of training and seen to be mutually beneficial to the company and the apprentice. The general sentiment from participants was that artisans could be used more effectively and efficiently because of apprentices.

In growing in knowledge and experience, with time, apprentices become more productive and require less supervision. The general consensus was that nearly all apprentices were charged to production tasks after their first year of apprenticeship. This then allowed qualified artisans to be used more effectively and efficiently. Participants have also noted that second year

apprentices were used on jobs independently. They stated that some artisans completed as many as three tasks simultaneously when using second year apprentices as assistants. Apart from using the apprentices for productive tasks, there was also a cost savings aspect that apprentices brought to the fore. According to participant 11, “there is a saving of approximately 40% on production input costs by using apprentices.” (Participant 11, 2016). Whilst most participants were not able to quantify actual cost savings, nearly all participants unanimously agreed that using apprentices did reduce labour input costs substantially.

There was however participant number 2 who did not see immediate value in training apprentices. This participant managed a small low-production foundry within one of the Aveng business units. The foundry focused on manufacturing patterns for casting bespoke machine components. The participant cited little opportunity to use his apprentices for repetitive tasks in his low production environment. He did however mention that his apprentices would add value in high production environments as he had previously trained apprentices in such environments. This was however not the general case of the business unit concerned. High production areas within this business unit did see value as stated by a production manager, participant number 5.

Table 16 indicates the different business units at Aveng and the duration before managers began seeing value and used apprentices for production. These business units had multiple departments hosting apprentices. The average period before production of each department is listed as mentioned by the participants.

Table 16: Average period before apprentices were used for production

Business Unit/Department	Duration before productive (in months)
Aveng Rail /Mechanical Production	6
Aveng Rail /Electrical/Production	12
Aveng Rail/ Plant Operation	6
Aveng Duraset/Tool room	6
Aveng Duraset/ Mechanical Production	3
Aveng Duraset/ maintenance	8
Aveng Infraset/ Factory	3
Average	6.3

4.3.2 Dependency on Apprentices

Participants stated their dependency on apprentices both for production purposes and for technology purposes. The responses on whether apprentices were seen as beneficial to their journeymen was also positive. According to the participants, apprentices were hardly seen as a hindrance to a journeyman. Subsequently, they cited that journeymen were always looking for apprentices to teach as it allowed for the journeymen to be used more productively. Participants also stated that they benefited from ideas and newness in technology in which apprentices were exposed and trained. Participant 3 specifically stated that electrical apprentices were exposed to new electronic and electrical technology and they kept the older artisans abreast with new technology. Another interesting insight was the relationship that was built between the apprentice and the journeyman and how some journeymen went to the extreme of quarrelling with each other in order to get the best apprentice.

The value in training apprentices was also revealed when participants were questioned on the impact on production when apprentices attended their

mandatory training sessions at colleges and training centres. Nearly all participants noticed a decline in production. They all stated that apprentices became part of the production headcount. Apprentices formed an integral part of production teams and subsequently contributed to production. Participants felt aggrieved by having to seek alternatives or accept reductions in production. This impact was evident as artisans were no longer able to complete multiple tasks simultaneously. Participant 8 was able to quantify a "60% decline in production in repetitive tasks." (Particpiant 8, 2017). Apart from the workload increasing on journeymen and artisans, participants also mentioned that delivery times were subsequently increased. Participants involved in electrician training stated their discontentment as they preferred electrical tasks completed by the individuals who started them. They cited these tasks as complex and loathed having to change people in the middle of a job. Hence, they preferred apprentices to complete tasks before going on training at colleges. All the participants stated that they had to make alternative arrangements for the 11-week block release citing disruption in production, but emphasising their dependence on the skills of the apprentice.

4.3.3 Financial benefit

Participant 11 categorically stated that there was opportunity for companies to make money from training apprentices. He stated that companies received large sums of money in the form of discretionary grants for training apprentices. He further mentioned that bigger companies could benefit by pure economies of scale (Participant 11, 2016). These companies could recruit as many apprentices as possible, receiving a grant per apprentice. He also cited the annual apprentice salaries as being fairly low and that each grant could fund more than two years of an apprentice's salary (Participant 11, 2016).

Other financial benefits include the input costs of labour, as previously stated. Participants stated that they used their senior apprentices on charge-out jobs, they cited substantial financial benefit in these activities when apprentices were used. There were also financial benefits in terms of low labour input costs when

using apprentices on manufacturing projects. The general consensus from participants was that the financial benefit constantly increased as the apprentice grew in knowledge and gained independence. An apprentice in his third year of training was seen as being fully independent and is given his own tasks to complete. Participant 8 provided examples of financial savings including comparing the hourly cost of a general assistant at R45/hour whilst a first year apprentice's tariff was R30/hour, citing a 30% saving by using apprentices (Particpiant 8, 2017). The apprentice salary allocation was regulated and monitored by the SETA's. Subsequently, a final year apprentice's salary averaged at R52/hour. Participant 8 mentioned that he charged his apprentices on projects and repetitive jobs at R225/hour after the first year of apprenticeship, indicating substantial financial savings (Particpiant 8, 2017).

4.3.4 Company pipeline development

Another form of value cited by managers was the need to develop a pool of resources for the company. Participant 2, a foundry foreman at Aveng DFC mentioned his plight in searching for a pattern-cutting artisan as his existing pattern cutter was nearing retirement. He regretted not being able to find a qualified artisan for more than six months and further commented that there was a 20-year gap in young qualified artisans and the older artisans. Participants mentioned that apart from developing their own pool of resources, they were able to train apprentices in line with their specific equipment. Whilst every apprentice was given a standard training logbook to complete in order to qualify (as directed by MerSETA), participants preferred employing artisans that were familiar with their specific plant and equipment. Participants also mentioned that these apprentices also understood their business and were familiar with the safety standards and procedures.

Participant 1 stated that he also gave apprentices the opportunity to specialise in areas where they enjoyed working, this allowed for both the company and the apprentice to mutually benefit (Participant 1, 2016).

Participants really emphasised that the importance of being able to train apprentices on their specific equipment was imperative. They noted that if they were to employ an artisan from outside the company, they would still have to teach that artisan the specific manufacturing processes, equipment and procedures and this could take longer than six months and the person would have to learn and fit into the company culture. Further comments on developing the company pipeline included the company culture, company standards and procedures which managers believe as being important in developing a pipeline of resources for the future of the industry.

Participants also noted that training their own apprentices allowed them to employ the best talent on completion of training. This saved the company time and money when considering recruitment from the outside labour market. Participants cited that in-house training consequently served as a screening mechanisms for sifting through and retaining the best talent. Participant also stated that they preferred employing in-house trained apprentices as they had track records and proven work ethic that was verifiable. Nearly all participants were able to absorb apprentices after the completion of their training programme.

4.3.5 National and Corporate Responsibility

When participants were asked whether they would still train apprentices even if there was no benefit, all of them responded positively. They cited the responsibility that companies have to communities and to developing skills for the industry. Whilst citing the cost of training being substantial, participants nevertheless stated that they would still train apprentices as it improved skills in the industry to which they belong. They also referred to the skills gap in the country and the need to impart knowledge and skills in order to keep South African industry and the economy going. Two of the participants interviewed stated that they will train on the premise that they sign fixed contracts with apprentices in order for them to receive further value from the apprentice post qualification.

4.3.6 Quality of training, the attitude and character of journeymen and apprentices

Participants also alluded to the quality of training administered as being very important. They believed that only quality training yielded increased productivity and developed apprentice independence in the early stages of apprenticeship. Aveng had administered in-house training via the Aveng training centre for more than three decades. One of the participants interviewed also trained at Aveng during his apprenticeship. The general sentiment was that Aveng's training centre was of a high standard with stringent quality measures, hence the artisans they produced were of excellent quality. Participants stated that they saw huge improvements in the levels of productivity and quality of work as their apprentices returned from the Aveng training centre. Whilst participants noted the disruption in production due to the absence of the apprentices, they also appreciated the improvements they saw as apprentices grew in knowledge and became more independent.

Participants also cited the importance of character, attitude and aptitude of apprentices. They stated that not all apprentices would be beneficial to the company. Participant 2 was one such manager, he provided a clear example of one of his apprentices not having the aptitude required to understand principles in manufacturing within his trade. Participants who stated the importance of character noted that they were fortunate to have very good apprentices and that they saw value in recruiting the correct personality and fit for the training programme.

5 CHAPTER 5. DISCUSSION OF RESULTS

A positive return on investment in apprentice training indicates that the company administering the training benefits financially from the training. Apart from a positive return on investment, companies can also benefit from the value that apprentices may bring to the organisation. Whilst most forms of training can provide long term gains for companies regarding skills development and retention, apprentice training is unique in that it can provide both short term and long term gains.

This chapter analyses the data presented in Chapter 4 of this document. The first objective was to discuss the various benefit-to-cost ratios and ROIs presented in site-based and workshop-based training. The findings from these results were tested against Proposition 1. The secondary objective was to discuss managers' perceptions of training and the benefit or value that management saw in training. Findings from these results were tested against Proposition 2.

Furthermore, findings from the data presented in Chapter 4 were also compared with data and findings from literature presented in chapter 2. This was done to verify the results produced and develop an holistic view of the study. The remaining paragraphs in this chapter are discussed in four sections, namely:

- Paragraph 5.1 discusses and analyses the data presented for site-based apprentice training.
- Paragraph 5.2 discusses and analyses the data presented for workshop-based apprentice training.
- Paragraph 5.3 discusses and analyses the data presented based on interviews with managers involved with training.
- Paragraph 5.4 concludes the discussion.

5.1 Return on Site-Based Apprentice Training

The qualifying factor on whether training is beneficial on not is based on a cost-to-benefit ratio being greater than 1. This subsequently impacts the ROI, if there is neutral or no benefit then the ROI is either 0 or a negative percentage. Refer to the ratio explanation below.

- When $\frac{B}{C} < 1$, Training is not beneficial.
- When $\frac{B}{C} = 1$, Training neutral.
- When $\frac{B}{C} > 1$, Training is beneficial to company.
- Where “B” is the benefit of training and includes: accumulative charge-out rates, the actual hours apprentices book to productive jobs and the discretionary grants paid by MerSETA.
- Where “C” is the total cost to train an apprentice and includes: cost of wages, cost of colleges and infrastructure and the cost of supervision.

5.1.1 Results from training in year 1

The results presented for year 1 indicate that the return on investment on site-based apprenticeships are almost instantaneous. The average benefit to cost ratio is 1.19 after the first year of training, this indicates that the company realises a 19% ROI on training apprentices after just one year. The reason for the positive result is that apprentices are used for production tasks immediately. This concurs with Swiss and German literature which cite that returns are higher if apprentices are placed on production lines or used for production jobs fairly early in the training period (Dionisius et al., 2009). The other fundamental reason for realising a high return was the fact that apprentices were charged-out on high contract call-out rates when compared to their hourly salaries and the cost of their training.

The fundamental difference between the Canadian and South African results is the added advantage of the discretionary grant awarded by MerSETA for

training apprentices. If the discretionary grant was not awarded, the benefit-to-cost ratio would be reduced by 20%, resulting in a 1% loss in training. One could argue that the discretionary grant is an indirect return on money that the company paid into the Skills Development Levy and that it should not be part of the calculation. Nevertheless, companies that do not train apprentices are not entitled to claim the discretionary grant and are still required to pay 1% of their total salary bill into the Skills Development Levy as dictated by South African law (Republic of South Africa, 1998). Hence, there was benefit in using the grant and it formed an integral part of the benefit-to-cost ratio.

5.1.2 Results from training in year 2

The results from year two show an even greater return with an average benefit to cost ratio of 1.29. This indicates an average ROI of 29% generated from apprentices in the second year of training when compared to the cost of training. The reason for the increase in benefit is attributed to a reduction in the amount of supervision required from the journeyman. A reduction in supervision was expected as apprentices grew in knowledge and experience (Rothboeck, 2014). This was further corroborated by Canadian literature which acknowledged a decline in the amount of journeyman time required for supervision (Canadian Apprenticeship Forum, 2009). When compared to other publications including a Swiss publication by Muehlemann (2010), Aveng's average benefit to cost ratio compares better than the Swiss Average Ratio of 1.185 and ROI of 18.5% for three year programmes.

5.1.3 Results from training in year 3

The indicative results from the third year of the training programme show an average increase in benefit to 1.6. suggesting a 60% ROI on training. Once again, the only element that changed significantly in the calculation was the required amount of supervision, as cited by Rothboeck (2014). All other inputs were increased according to inflation, including the salary adjustments of management and apprentices alike. The overall average for the 3-year period

showed an average ratio of 1.36 indicating a 36% ROI in training. This result has increased at an average of 8% over the apprentice period. The result compares fairly well with Canadian studies which indicate a 47% ROI after four years of apprenticeship as an 8% increase in the fourth year of apprenticeship suggests a 44% ROI (Canadian Apprenticeship Forum, 2009).

Whilst this benefit-to-cost ratio was high, it may not always be achievable in all industries. According to the Canadian Apprenticeship Forum (2009), around 30% of Canadian companies chose not to train apprentices, citing a lack of secured work for a sustained period. Aveng Rail has been fortunate to use apprentices on long-term service and maintenance contracts. This had also allowed for apprentices to be charged out at a higher rate from the beginning of the apprenticeship period which meets the ideal conditions, as cited in Swiss publications (Dionisius et al., 2009).

5.2 Return on Workshop-Based Apprentice Training

5.2.1 Results from training in year 1

The first year of workshop-based apprentice training showed a loss of 26% with a cost-to-benefit ratio of 0.74. The reason for this loss was due to the low hourly tariff used when apprentices were utilised as general assistants and not artisans' assistants. Unlike site-based apprentices, workshop-based apprentices were only allowed to formally book jobs at higher rates when their managers believed that they had gained the necessary experience and were becoming productive. This result concurs with the German training programmes. German training programmes indicate low returns when apprentices are not placed on production lines fairly early in the apprenticeship period (Schönfeld, 2010). This finding agrees with recommendations from Swiss literature, suggesting that apprentices should be put on production jobs as soon as possible (Dionisius et al., 2009).

5.2.2 Results from training in year 2

The second year of training showed a substantial increase in the benefit-to-cost ratio. This was due to more hours being booked on productive tasks and a reduction in supervision hours as recommended by Muehlemann and Wolter (2014). The second year indicated a 1.25 benefit to cost ratio and a 25% ROI on training. There was however, one extreme data value recorded under Apprentice 11. This extreme value was based on the apprentice going away on maternity leave over a 4-month period. A prolonged period of absence during training may result in the company seeing no benefit in training. This speaks to the risks associated with training and the reasons why some firms choose not to train apprentices (Canadian Apprenticeship Forum, 2009). Other risks include the risk of non-training companies poaching apprentices when they start becoming productive (Canadian Apprenticeship Forum, 2009).

5.2.3 Results from Training in Year 3

The benefit-to-cost ratio for the third year of training was 1.64; this suggests a 64% ROI in the final year of apprenticeship. The reasons for the increase was the same as those stated in paragraph 5.1.3, including increased productivity and decreased supervision inputs. The three-year average benefit to cost ratio was 1.21; this showed a 21% overall ROI. Not only was this result positive, it also compared better than with Swiss industries who saw a 13% average ROI after three years of apprenticeship (Muehlemann, 2010). This observation was also corroborated by the Canadian Apprenticeship Forum (2009), citing the constant increase in benefit over the course of the apprenticeship.

Whilst the first year of training was not beneficial, it was nevertheless significant to mention. There is always the risk that apprentices may renege or drop out of training programmes within the first year, resulting in a 30% loss in training costs; this was also cited by Wolter (2012). In summary, the overall results showed that apprenticeships can provide positive returns on investment based on the benefit-to-cost ratios as presented.

5.3 Interviews with Managers

5.3.1 Value derived from using resources more efficiently

Aveng's managers confirmed that apprentices served as general assistants on engineering jobs and later graduated to accepting more responsibilities. This included stripping machine components, stripping gearboxes, putting together sub-assemblies and more repetitive engineering tasks. The value cited by managers was that it allowed them to use the qualified artisans on more technically difficult jobs or alternatively, complete as many as three less technical jobs simultaneously. This allows for higher efficiencies in production. This value is also cited by Canadian companies including Hydro Ottawa, who has stated that apprenticeship in their organisation led to increased efficiencies and productivity (Canadian Apprenticeship Forum, 2009).

Nevertheless, German and Indian studies caution that apprentices needed to be protected from being exploited as cheap labour, as cited by Wolter (2012) and Rothboeck (2014). According to Muehlemann and Wolter (2014), German apprenticeships were highly regulated and apprentice salaries were consequently higher when compared to Swiss apprentice salaries. Whilst this prevented the exploitation of apprentices, it conversely resulted in lower cost – o-benefit ratios. The Swiss apprentice training system was not regulated from a wage perspective, however apprentices were required to perform tasks that were aligned with their qualification (Wolter, 2012).

The South African apprentice training system is regulated on all aspects of training, employers are required to pay apprentices a monthly salary/stipend as directed by MerSETA. The training content is also highly regulated and has to be aligned with specifications as dictated in apprentice logbooks allocated by MerSETA (Republic of South Africa, 1981). The risk of exploiting apprentices in South Africa was thus mitigated by MerSETA.

5.3.2 Dependency on Apprentices

Managers noted progressive dependence on apprentices as they become productive. Consequently, journeymen also saw apprentices as a benefit. This finding agreed with views from Canadian literature where companies stated that apprentices are seen as a benefit to the journeyman that trains them (Canadian Apprenticeship Forum, 2009). According to the literature, more than 81% of employers who train apprentices believe that their journeymen benefit from training apprentices as well (Canadian Apprenticeship Forum, 2009).

The dependency on apprentices was further verified by the slowing-down or retardation in production when apprentices were away at colleges and training centres. The managers interviewed cited the need to make alternate arrangements in order to maintain viable levels of production. Coincidently, this is cited as a common reason why 30% of Canadian companies choose not to train apprentices as they are not able to manage the disruptions in production when the apprentices are away at colleges and training centres (Canadian Apprenticeship Forum, 2009).

Whilst Aveng's managers do not appreciate the disruptions in production when apprentices are away at colleges, they do appreciate the learning and development that an apprentice undergoes whilst at college. Managers have cited an increase in production capacity and knowledge when apprentices return from colleges and training centres. This is corroborated by a study conducted by Business Europe. Business Europe represents 41 employer federations from 35 countries (Steedman, 2012). According the study, companies rely on the apprentices to bring in the newest "know how" and technology from the vocational training centres and colleges (Steedman, 2012).

5.3.3 Financial benefit

The managers interviewed noted the financial benefit of employing apprentices by referring to the reduction in labour costs when apprentices are used on the production lines. Managers have further stated that they began using

apprentices almost immediately as general assistants. Thereafter, the apprentices were used for artisan type tasks as early as three months into the apprentice period. This was based on the work environment as tasks were fulfilled.

This concurs with literature from studies conducted in Swiss companies. According to Dionisius et al. (2009), the Swiss-based apprentice training required an apprentice to be used on productive tasks as soon as possible in order to be beneficial to the company. The financial benefit that managers cited included a labour cost reduction of almost 40%. Whilst published literature does not quantify the exact percentage of labour input savings, it does provide overall profit realised when using apprentices. According to Strupler and Wolter (2012), Swiss companies benefitted in revenue by approximately 500 million Swiss Francs in 2009 by using apprentices. The financial benefit of training apprentices was further corroborated by Canadian, German, America and Indian studies as cited by Canadian Apprenticeship Forum (2009), Muehlemann (2010), Wang et al. (2010) and Rothboeck (2014). In saying this, the financial benefit that managers refer to is in agreement with literature published.

5.3.4 Company Pipeline development

Industry skills development and company specific skills development was another qualitative benefit that managers saw in training apprentices. This benefit was also mentioned in the English apprentice training schemes where companies cite a better fit between the needs of the company and the skills of apprentices trained in-house when compared to recruiting qualified personnel from the outside labour market (Gambin, Hasluck, & Hogarth, 2010). Steedman (2012) further corroborates this sentiment by citing that companies are able to train apprentices according to their “practical requirements.” According to Breier and Erasmus (2015), there is also misalignment between what colleges train artisans for and what companies actually require, hence the preference of some companies training artisans for specific needs and requirements.

The comments from managers regarding saving cost of recruitment is also verified by Muehlemann (2010), acknowledging that Swiss firms benefit from being able to absorb the better apprentices on completion of the programme. According to Muehlemann (2010), firms are able to train and foster high quality employees who may be hard to find in the external labour market. This sentiment is also shared by Steedman (2012) who cites that companies develop a unique source of recruitment when employing artisans.

Apart from the practical fit between the apprentice and the company, Aveng's managers also cited that cultural fit was very important for the company. The company fosters the Aveng culture when training apprentices. This view was also shared by Steedman (2012), who cited that the appreciation of organisational culture is also important if apprentices are to fit into the company.

5.3.5 National and Corporate Responsibility

Managers mentioned that they would still train apprentices even if it was not financially beneficial to the company, citing their national and corporate responsibility and the current skills deficit in the country. Mangers have cited the importance for business to train apprentices for the industry, the country and ultimately, the economy. They have also mentioned that the skills shortage in the country poses a risk to industry's survivability. This was verified by Breier and Erasmus (2015), who cited skills shortages in the country as a major retardant in economic development.

According to Phillips (2014), South Africa qualifies an average of 3000 artisans a year; this is only 24% of the required 12500 artisans the country needs to qualify annually. It is imperative to train artisans in order to improve service delivery, grow the economy and ultimately, alleviate poverty (Van Rooyen et al., 2010). The skills shortages faced was not unique to South Africa; countries in Australasia and Europe face similar challenges regarding skills shortages (Mateus et al., 2014).

In keeping with national responsibility, a South African company, EOH, has partnered with government and issued a challenge to all South African businesses to employ at least 3% of their staff in the youth age category ("EOH 702 Youth Job Creation Challenge," 2016). The drive is to impart knowledge and skills to unemployed youth and develop skills resources for the future. According to Nilsson (2010), apprenticeships are seen as an important factor in social inclusion and reducing inequality. This confirms the drive that Aveng has in training for the future.

5.3.6 Quality of training, the attitude and character of apprentices

The quality of training was seen as an imperative in order for apprenticeships to be successful and beneficial. Dustmann and Schönberga (2012) attribute the previous failures in European apprentice schemes to poor quality in training and a lack of commitment from companies. This inadvertently resulted in low apprentice enrolments. The productivity of the apprentice during the training period is thus also dependent on the quality of instruction and training (Dustmann & Schönberga, 2012). According to Lerman (2014), well trained and quality apprentices provide firms with viable options for increasing production without compromising quality. Subsequently, well trained apprentices also assist when core staff is absent.

The general concern with high-quality apprentice training programmes was the higher gross cost of training. Lerman (2014) does well to dispel this concern by citing that high-quality apprenticeships are the most likely to have a positive cost-to-benefit ratio.

Aveng's managers have also stated that the character of the apprentice is important. It is important for the apprentice to fit into the business, to take the apprenticeship training seriously and to stay the course of the apprenticeship. According to Muehlemann (2010), many companies choose not to train apprentices because of the risk of apprentices reneging and apprentices not being fully engaged in the training programme. Hence, it important that people

who chose apprenticeships fully engage and learn. This sentiment was also shared by surveys conducted by the Canadian Apprenticeship Forum (2009).

5.4 Conclusion

The results from the both aspects of the qualitative study including site-based and workshop-based apprenticeships showed positive benefit-to-cost ratios, including a positive ROI. Understandably, the site-based apprenticeships showed better returns than the workshop-based training due to fixed contracts and immediate charge-out rates. The workshop-based apprenticeship showed a lower return, but was nevertheless still comparable with international literature. The quantitative analysis supports the proposition that apprenticeship training has a positive return on investment during the apprenticeship period.

The results from the qualitative analysis regarding the value that managers saw in training apprentices was congruent with results from similar qualitative studies carried out internationally. Both the short term value regarding efficiencies and savings and the long-term value regarding specific skills development, longevity and sustainability of trade were shared amongst managers from Aveng and managers in Canada, Switzerland, Germany, England, America and India. This supported the second proposition that managers see value in training apprentices.

6 CHAPTER 6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction:

South Africa has the fourth highest percentage of youth unemployment in the world. The youth face a major barrier to entry into the labour market due to their lack of skill and work experience. Whilst there are no specific government publications on the exact shortages of skills in South Africa, skills shortage is cited as one of the key factors that retard economic growth in the country. This being said, it is important to have skilled artisans and tradesmen to enable service delivery, infrastructure development, wealth creation, alleviation of poverty and ultimately, drive economic growth. Unfortunately, there are very few companies that train apprentices in South Africa. The country is required to qualify at least 12500 artisans annually; current data indicates that only 3000 artisans qualified annually.

6.2 Conclusions of the Study

6.2.1 Research Proposition 1: South African apprenticeship training has a positive return on investment during the apprenticeship period.

This proposition was supported by the quantitative analysis as discussed in chapter 5. The return on investment in firm-based apprentices is largely based on determining whether companies benefit during the apprenticeship period and if they see value in training apprentices. The results confirm a positive return on investment with average ROI of 36% and 21% for site-based and workshop-based apprenticeships respectively. These averages were calculated, based on a 3-year apprenticeship period and compared equally with both the Swiss and the Canadian apprentice training schemes.

6.2.2 Research Proposition 2: South African managers who train apprentices recognise value in training apprentices

This Proposition was supported by the qualitative analysis as discussed in chapter 5. Managers who train apprentices have cited value in training including improved efficiencies, improved company skills, development of future resources for the industry and better skills fit for specific company requirements. Managers have also confirmed that they would train apprentices even if there was no immediate financial benefit in training. This was largely due to the long-term value that they saw in skills development and being able to train according to company specific requirements. Firm-based apprenticeships allow for the development of recognised skills and experience. A quality apprenticeship may help young school-leavers develop a sustainable life-skill.

Whilst the results are positive, the requirements that enable positive benefit-to-cost ratios may not be attainable in all industries. This result may be seen as an outlier when compared to the benefit-to=cost ratios of other businesses. Industries are required to place apprentices on productive tasks and call-outs fairly early in the apprentice period. The study may also be limited to the size of the company administering training. Aveng is fortunately a large company with more than 50 employees, there may be negative results if the employer has a staff complement of less than 50 employees. There may be industries including power generation that will not use an apprentice on productive tasks within the first year of apprenticeship, due to legislative requirements. The study may also be limited to high production environments as it was tested in a high production environment that has a steady flow of work.

6.3 Recommendation for future studies.

Further research is however required as this study only looked into the average cost-to-benefit ratio for five types of apprenticeships within the manufacturing sector. The manufacturing sector alone has more than 10 different types apprenticeship that could be studied and each type of apprenticeship could be studied independently.

There is potential to conduct this type of study in other sectors that train apprentices. This could encourage even more companies to train apprentices based on the mutual benefits of training. Sectors to investigate could include:

- The mining industry.
- The power generation and distribution sector
- The automotive sector.
- The agriculture sector.
- The maritime sector
- The built environment sector.

The Canadian and Swiss developed designated apprentice training forums that allowed for a bigger sample of data to test ROI. It would be beneficial to have such forums in South Africa.

REFERENCES

Acha Leke, D. F., Richard Dobbs, Nomfanelo Magwentshu, Susan Lund, Christine Wu, and Paul Jacobson. (2015). South Africa's Big Five Priorities for Inclusive Growth. *Mckinsey Global Institue*, 1-7.

Aldrich, R. (1999). The apprentice in history. *Apprenticeship: Towards a new paradigm of learning*, 14-24.

Apprenticeship. (2005). Poland: Geddes and Grosset.

Backes-Gellner, U., Wolter, S. C., Mohrenweiser, J., & Backes-Gellner, U. (2010). Apprenticeship training: for investment or substitution? *International Journal of Manpower, 31*(5), 545-562.

Baldwin, T. T., & Ford, J. K. (1988). Transfer of training: A review and directions for future research. *Personnel psychology, 41*(1), 63-105.

Bates, R. A. (2003). Managers as transfer agents. *Improving learning transfer in organizations*, 243-270.

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The qualitative report, 13*(4), 544-559.

Blume, B. D., Ford, J. K., Baldwin, T. T., & Huang, J. L. (2010). Transfer of training: A meta-analytic review. *Journal of Management, 36*(4), 1065-1105.

Breier, M., & Erasmus, J. (2015). Skills shortages in South Africa: Case studies of key professions.

Bryman, A. (2012). *Social Research Methods* (4 ed.). New York: Oxford University Press.

Burger, R., Berg, S., & Fintel, D. (2015). The unintended consequences of education policies on South African participation and unemployment. *South African Journal of Economics, 83*(1), 74-100.

Canadian Apprenticeship Forum. (2009). It pays to hire an apprentice: calculating the return on training investment for skilled trades employers in Canada: a study of 16 trades, phase II: final report.

Clarke, N. (2002). Job/work environment factors influencing training transfer within a human service agency: Some indicative support for Baldwin and Ford's transfer climate construct. *International Journal of Training and Development, 6*(3), 146-162.

Collins, W. (Ed.) (2012) Collins English Dictionary- Complete and Unabridged Harper Collins.

Daniels, R. (2007). Skills shortages in South Africa: A literature review.

Department of Basic Education. (2011). *National policy pertaining to the programme and promotion reuirements of the National Curriculum Statement Grade R-12* Republic of South Africa: Department of Education Retrieved from www.education.gov.za/LinkClick.aspx?fileticket=spw4luemhQQ%3D&tabid=419&mid=2313.

Dionisius, R., Muehlemann, S., Pfeifer, H., Walden, G., Wenzelmann, F., & Wolter, S. C. (2009). Costs and benefits of apprenticeship training. A comparison of Germany and Switzerland. *Applied Economics Quarterly, 55*(1), 7-37.

Dustmann, C., & Schönberga, U. (2012). What makes firm-based vocational training schemes successful? The role of commitment. *American Economic Journal: Applied Economics, 4*(2), 36-61.

Education, D. o. H. (2016). Apprentices for the 21st Century Retrieved from http://www.dhetnews.co.za/apprenticeships-for-the-21st-century/

Egg, M. E., & Renold, U. (2015). The Swiss Vocational Education and Training System: What Can Spain Learn from Switzerland? *REVISTA DE INFORMACIÓN COMERCIAL ESPAÑOL, 881*.

EOH 702 Youth Job Creation Challenge. (2016, August 1).

Gambin, L., Hasluck, C., & Hogarth, T. (2010). Recouping the costs of apprenticeship training: employer case study evidence from England. *Empirical research in vocational education and training, 2*(2), 127-146.

Goodrum, P., Wang, Y., Haas, C., Glover, R., & Vaziri, S. (2007). Construction industry craft training in the United States and Canada. *Research Summary, Construction Industry Institute (CII), the University of Texas at Austin*.

Gospel, H. (1994). The survival of apprenticeship training: a British, American, Australian comparison. *British journal of industrial relations, 32*(4), 505-522.

Grossman, R., & Salas, E. (2011). The transfer of training: what really matters. *International Journal of Training and Development, 15*(2), 103-120.

Harhoff, D., & Kane, T. J. (1993). *Financing apprenticeship training: Evidence from Germany*. Retrieved from

International Labour Office for South Asia, World B. (2013). Possible futures for the Indian apprenticeship system: options paper for India.

Jordaan, N., & Barry, M.-L. (2009). Investigating the reasons for lack of skilled artisans in South Africa: The perspective of artisans. *South African Journal of Industrial Engineering, 20*(1), 173-184.

Kirchberger, A. (2008). TVET developments in Europe, Africa and Asia. *World Bank Institute. www. worldbank. org (26.5. 2013.)*.

Kontoghiorghes, C. (2004). Reconceptualizing the learning transfer conceptual framework: Empirical validation of a new systemic model. *International Journal of Training and Development, 8*(3), 210-221.

Kupfer, A. (2010). The socio-political significance of changes to the vocational education system in Germany. *British Journal of Sociology of Education, 31*(1), 85-97.

Lerman, R. (2014). Do firms benefit from apprenticeship investments? *IZA World of Labor*.

Male, T. (2015). Analysing Qualitative data. *Doing Research in Education: Theory and Practice*, 177.

Mateus, A. D., Allen-Ile, C., & Iwu, C. G. (2014). Skills shortage in South Africa: Interrogating the repertoire of discussions. *Mediterranean Journal of Social Sciences, 5*(6), 63.

Merriam, S. (1995). What Can You Tell From An N ofl?: Issues of validity and reliability in qualitative research. *PAACE Journal of Lifelong Learning, 4*, 50-60.

Meyer, T. (2006). *Vocationalising education or educationalising vocational training? A lab report from Switzerland.* Paper presented at the European Research Network on Transitions in Youth TIY Workshop, Vocationalisation of education: How, where, when, why and in what sense does it matter.

Muehlemann, D. (2010). The costs and benefits of apprenticeship training: Evidence from Swiss firms. *Canadian Apprenticeship Journal, 1*(1).

Muehlemann, S., & Wolter, S. C. (2014). Return on investment of apprenticeship systems for enterprises: Evidence from cost-benefit analyses. *IZA Journal of Labor Policy, 3*(1), 1-22.

Nilsson, A. (2010). Vocational education and training–an engine for economic growth and a vehicle for social inclusion? *International Journal of Training and Development, 14*(4), 251-272.

Participant 1. (2016, 28 November 2016) *Interview on Apprentice Training/Interviewer: D. Pillay*.

Participant 3. (2016, 7 December 2016) *Interview on Apprentice Training/Interviewer: D. Pillay*.

Participant 7. (2016, 7 December 2016) *Interview on Apprentice Training/Interviewer: D. Pillay*.

Participant 11. (2016, 7 December 2017) *Interview on Apprentice Training/Interviewer: D. Pillay*. (Vol 0116177000).

Particpiant 8. (2017, 10 January 2017) *Interview on Apprentice Training/Interviewer: D. Pillay*.

Phillips, J. J. (1996). How much is the training worth? *Training & Development, 50*(4), 20-25.

Phillips, J. J. (2007). Measuring ROI: fact, fad, or fantasy? *T AND D, 61*(4), 42.

Phillips, J. J. (2012). *Return on investment in training and performance improvement programs*: Routledge.

Phillips, T. (2014). Countering the dire shortage of technical personnel in South Africa. *Association of Municipal Electricity Distributors, 60*, 113-116.

Professional Bodies. (2015).

Republic of South Africa. (1981). *Manpower Training Act 56 of 1981*. Pretoria South Africa: Government printers Retrieved from http://www.labour.gov.za/DOL/downloads/legislation/acts/skills-development-act/Act%20-%20Manpower%20Training%20Act,%201981.pdf.

Republic of South Africa. (1998). *Skills Development Act 97 of 1998*. Pretoria South Africa: Government Printers.

Republic of South Africa. (1999). *Skills Development Levies Act 9 of 1999*. Pretoria South Africa: Government Printers.

Richards, L. (2014). *Handling qualitative data: A practical guide*: Sage.

Rothboeck, S. (2014). Using benefit cost calculations to assess returns from apprenticeship investment in India: selected SME case studies.

Saks, A. M. (2002). So what is a good transfer of training estimate? A reply to Fitzpatrick. *The Industrial-Organizational Psychologist, 39*(3), 29-30.

Saks, A. M., & Burke, L. A. (2012). An investigation into the relationship between training evaluation and the transfer of training. *International Journal of Training and Development, 16*(2), 118-127.

Salas, E., & Stagl, K. C. (2009). Design training systematically and follow the science of training. *Handbook of principles of organizational behavior: Indispensible knowledge for evidence-based management*, 59-84.

Schönfeld, G. (2010). *Kosten und Nutzen der dualen Ausbildung aus Sicht der Betriebe: Ergebnisse der vierten BIBB-Kosten-Nutzen-Erhebung*: W. Bertelsmann Verlag.

Seta, S. (2016). Voactional Education and Training. Retrieved from http://www.serviceseta.org.za/Learner/Pages/Vocational-Education-and-Traing.aspx

Statistics South Africa. (2016). *Quarterly Labour Force Survey Quarter 4, 2015*. South Africa: Statistics South Africa Retrieved from http://www.statssa.gov.za/publications/P0211/P02114thQuarter2015.pdf.

Steedman, H. (2012). Overview of Apprenticeship Systems and Issues ILO Contribution to the G20 Task Force on Employment. *International Labour Organization*.

Stone, P. W. (2005). Return-on-investment models. *Applied Nursing Research, 18*(3), 186-189.

Underhill Corporate Solutions. (2012). AATP Post Trade Test Tracer Study. *MERSETA*, 18.

Van Rooyen, L., Du Toit, D. H., Botha, E., & Rothmann, S. (2010). Artisan retention in an organisation in South Africa. *SA Journal of Human Resource Management, 8*(1), 8 pages.

Wang, Y., Goodrum, P. M., Haas, C., Glover, R., & Vazari, S. (2010). Analysis of the benefits and costs of construction craft training in the United States based on expert perceptions and industry data. *Construction Management and Economics, 28*(12), 1269-1285.

Wolter, S. C. (2012). Apprenticeship training can be profitable for firms and apprentices alike. *EENEE Policy Brief, 3*, 2012.

Wolter, S. C., Mühlemann, S., & Schweri, J. (2006). Why some firms train apprentices and many others do not. *German Economic Review, 7*(3), 249-264.

World Bank Group. (2016). *World Development Indicators 2016*: World Bank Publications.

Yin, R. K. (1984). Applied social research methods series Case study research: Design and methods.

Yin, R. K. (2003). Case study research design and methods third edition. *Applied social research methods series, 5*.

Zainal, Z. (2007). Case study as a research method. *Jurnal Kemanusiaan*(9), 1-6.

APPENDIX A: Questions for semi-structured interviews with management

Semi-Structured interview with management.	
1.	What value do you see training apprentices?
2.	Would you personally train apprentices if they did not provide any financial benefit to your company?
3.	Are apprentices seen to be beneficial to their journeymen or artisan that train them?
4	What is the impact on production when apprentices are sent to colleges for their block releases?

APPENDIX B 1: ROI Calculations for Site-based Apprentices Year 1

APPRENTICE COST FOR YEAR 1					
Apprentice	Apprentice Salary	Training and infrastructure cots	Cost of PPE	Miscellaneous costs	C1=(Wy+Iy+ Py+My)
Apprentice 1	R 72 634	R 17 706	R 2 200	R 3 632	R 96 171.9
Apprentice 2	R 141 301	R 17 706	R 2 200	R 7 065	R 168 271.6
Apprentice 3	R 82 865	R 17 706	R 2 200	R 4 143	R 106 914.0
Apprentice 4	R 138 618	R 17 706	R 2 200	R 6 931	R 165 454.9
Apprentice 5	R 140 005	R 17 706	R 2 200	R 7 000	R 166 911.5
Apprentice 6	R 123 451	R 17 706	R 2 200	R 6 173	R 149 529.1
Apprentice 7	R 141 168	R 17 706	R 2 200	R 7 058	R 168 132.4
Apprentice 8	R 141 168	R 17 706	R 2 200	R 7 058	R 168 132.4

MANAGEMENT COST YEAR 1					
year 1	Journeyman Costs/hour	Journeyman hours	management costs	management hours	C2=(Ay× hy)+(Sy×hsy)
Apprentice 1	R 145.0	528	R 232	176	R 117 392
Apprentice 2	R 145.0	528	R 232	176	R 117 392
Apprentice 3	R 145.0	528	R 232	176	R 117 392
Apprentice 4	R 145.0	528	R 232	176	R 117 392
Apprentice 5	R 145.0	528	R 232	176	R 117 392
Apprentice 6	R 145.0	528	R 232	176	R 117 392
Apprentice 7	R 145.0	528	R 232	176	R 117 392
Apprentice 8	R 145.0	528	R 232	176	R 117 392

Total Benefit for Year 1				
Year 1	Charge-out	Hours Worked	Grant Benefit	total benefit
Apprentice 1	R 200.0	R 1 320.0	R 50 000.0	R 314 000.0
Apprentice 2	R 200.0	R 1 320.0	R 50 000.0	R 314 000.0
Apprentice 3	R 200.0	R 1 320.0	R 50 000.0	R 314 000.0
Apprentice 4	R 200.0	R 1 320.0	R 50 000.0	R 314 000.0
Apprentice 5	R 200.0	R 1 320.0	R 50 000.0	R 314 000.0
Apprentice 6	R 200.0	R 1 320.0	R 50 000.0	R 314 000.0
Apprentice 7	R 200.0	R 1 320.0	R 50 000.0	R 314 000.0
Apprentice 8	R 200.0	R 1 320.0	R 50 000.0	R 314 000.0

Return on Investment for Site-based Apprentices after 1 Year								
Year 1	Cost of Training	Cost of management	Total Cost	Call-out benefit	Grant benefit	Total Benefit	Benefit Cost	ROI
Apprentice 1	R 96 172	R 117 392	R 213 564	R 264 000	R 50 000	R 314 000	1.47	47%
Apprentice 2	R 168 272	R 117 392	R 285 664	R 264 000	R 50 000	R 314 000	1.10	10%
Apprentice 3	R 106 914	R 117 392	R 224 306	R 264 000	R 50 000	R 314 000	1.40	40%
Apprentice 4	R 165 455	R 117 392	R 282 847	R 264 000	R 50 000	R 314 000	1.11	11%
Apprentice 5	R 166 911	R 117 392	R 284 303	R 264 000	R 50 000	R 314 000	1.10	10%
Apprentice 6	R 149 529	R 117 392	R 266 921	R 264 000	R 50 000	R 314 000	1.18	18%
Apprentice 7	R 168 132	R 117 392	R 285 524	R 264 000	R 50 000	R 314 000	1.10	10%
Apprentice 8	R 168 132	R 117 392	R 285 524	R 264 000	R 50 000	R 314 000	1.10	10%
						Average	1.19	19%

APPENDIX B 2: ROI Calculations for Site-based Apprentices Year 2

APPRENTICE COST FOR YEAR 2					
year 2	Apprentice Salary	Training and infrastructure cots	Cost of PPE	Miscellaneous costs	C1=(Wy+Iy+ Py+My)
Apprentice 1	R 78 445	R 17 706	R 2 200	R 3 922	R 102 273
Apprentice 2	R 152 605	R 17 706	R 2 200	R 7 630	R 180 141
Apprentice 3	R 89 494	R 17 706	R 2 200	R 4 475	R 113 875
Apprentice 4	R 149 707	R 17 706	R 2 200	R 7 485	R 177 099
Apprentice 5	R 151 206	R 17 706	R 2 200	R 7 560	R 178 672
Apprentice 6	R 133 327	R 17 706	R 2 200	R 6 666	R 159 899
Apprentice 7	R 152 461	R 17 706	R 2 200	R 7 623	R 179 991
Apprentice 8	R 152 461	R 17 706	R 2 200	R 7 623	R 179 991

MANAGEMENT COST YEAR 2					
year 2	Journeyman Costs/hour	Journeyman hours	management costs	management hours	C2=(Ay× hy)+(Sy×hsy)
Apprentice 1	R 156	352	R 281	176	R 104 368
Apprentice 2	R 156	352	R 281	176	R 104 368
Apprentice 3	R 156	352	R 281	176	R 104 368
Apprentice 4	R 156	352	R 281	176	R 104 368
Apprentice 5	R 156	352	R 281	176	R 104 368
Apprentice 6	R 156	352	R 281	176	R 104 368
Apprentice 7	R 156	352	R 281	176	R 104 368
Apprentice 8	R 156	352	R 281	176	R 104 368

Total Benefit for Year 2				
Apprentice	Charge-out	Hours Worked	Grant Benefit	total benefit
Apprentice 1	R 216	1320	R 50 000	R 335 120
Apprentice 2	R 216	1320	R 50 000	R 335 120
Apprentice 3	R 216	1320	R 50 000	R 335 120
Apprentice 4	R 216	1320	R 50 000	R 335 120
Apprentice 5	R 216	1320	R 50 000	R 335 120
Apprentice 6	R 216	1320	R 50 000	R 335 120
Apprentice 7	R 216	1320	R 50 000	R 335 120
Apprentice 8	R 216	1320	R 50 000	R 335 120

Return on Investment for Site-based Apprentices after 2 Years								
Apprentice	Cost of Training	Cost of management	Total Cost	Call-out benefit	Grant benefit	Total Benefit	Benefit Cost	ROI
Apprentice 1	R 102 273	R 104 368	R 206 641	R 285 120	R 50 000	R 335 120	1.62	62%
Apprentice 2	R 180 141	R 104 368	R 284 509	R 285 120	R 50 000	R 335 120	1.18	18%
Apprentice 3	R 113 875	R 104 368	R 218 243	R 285 120	R 50 000	R 335 120	1.54	54%
Apprentice 4	R 177 099	R 104 368	R 281 467	R 285 120	R 50 000	R 335 120	1.19	19%
Apprentice 5	R 178 672	R 104 368	R 283 040	R 285 120	R 50 000	R 335 120	1.18	18%
Apprentice 6	R 159 899	R 104 368	R 264 267	R 285 120	R 50 000	R 335 120	1.27	27%
Apprentice 7	R 179 991	R 104 368	R 284 359	R 285 120	R 50 000	R 335 120	1.18	18%
Apprentice 8	R 179 991	R 104 368	R 284 359	R 285 120	R 50 000	R 335 120	1.18	18%
						Average	1.29	29%

APPENDIX B 3: ROI Calculations for Site-based Apprentices Year 3

APPRENTICE COST FOR YEAR 3					
year 3	Apprentice Salary	Training and infrastructure cots	Cost of PPE	Miscellaneous costs	C1=(Wy+Iy+ Py+My)
Apprentice 1	R 85 452	R 17 706	R 2 200	R 4 273	R 109 631
Apprentice 2	R 166 236	R 17 706	R 2 200	R 8 312	R 194 454
Apprentice 3	R 97 488	R 17 706	R 2 200	R 4 874	R 122 268
Apprentice 4	R 163 080	R 17 706	R 2 200	R 8 154	R 191 140
Apprentice 5	R 164 712	R 17 706	R 2 200	R 8 236	R 192 854
Apprentice 6	R 145 236	R 17 706	R 2 200	R 7 262	R 172 404
Apprentice 7	R 166 080	R 17 706	R 2 200	R 8 304	R 194 290
Apprentice 8	R 166 080	R 17 706	R 2 200	R 8 304	R 194 290

MANAGEMENT COST YEAR 3					
year 3	Journeyman Costs/hour	Journeyman hours	management costs	management hours	C2=(Ay× hy)+(Sy×hsy)
Apprentice 1	R 168	176	R 300	88	R 55 968
Apprentice 2	R 168	176	R 300	88	R 55 968
Apprentice 3	R 168	176	R 300	88	R 55 968
Apprentice 4	R 168	176	R 300	88	R 55 968
Apprentice 5	R 168	176	R 300	88	R 55 968
Apprentice 6	R 168	176	R 300	88	R 55 968
Apprentice 7	R 168	176	R 300	88	R 55 968
Apprentice 8	R 168	176	R 300	88	R 55 968

Total Benefit for Year 3					
Apprentice	Charge-out	Hours Worked	Call-out Benefit	Grant Benefit	Total benefit
Apprentice 1	R 231	R 1 320	R 305 078	R 50 000	R 355 078
Apprentice 2	R 231	R 1 320	R 305 078	R 50 000	R 355 078
Apprentice 3	R 231	R 1 320	R 305 078	R 50 000	R 355 078
Apprentice 4	R 231	R 1 320	R 305 078	R 50 000	R 355 078
Apprentice 5	R 231	R 1 320	R 305 078	R 50 000	R 355 078
Apprentice 6	R 231	R 1 320	R 305 078	R 50 000	R 355 078
Apprentice 7	R 231	R 1 320	R 305 078	R 50 000	R 355 078
Apprentice 8	R 231	R 1 320	R 305 078	R 50 000	R 355 078

Return on Investment for Site-based Apprentices after 3 Years								
Apprentice	Cost of Training	Cost of management	Total Cost	Call-out benefit	Grant benefit	Total Benefit	Benefit Cost	ROI
Apprentice 1	R 109 631	R 55 968	R 165 599	R 305 078	R 50 000	R 355 078	2.14	114%
Apprentice 2	R 194 454	R 55 968	R 250 422	R 305 078	R 50 000	R 355 078	1.42	42%
Apprentice 3	R 122 268	R 55 968	R 178 236	R 305 078	R 50 000	R 355 078	1.99	99%
Apprentice 4	R 191 140	R 55 968	R 247 108	R 305 078	R 50 000	R 355 078	1.44	44%
Apprentice 5	R 192 854	R 55 968	R 248 822	R 305 078	R 50 000	R 355 078	1.43	43%
Apprentice 6	R 172 404	R 55 968	R 228 372	R 305 078	R 50 000	R 355 078	1.55	55%
Apprentice 7	R 194 290	R 55 968	R 250 258	R 305 078	R 50 000	R 355 078	1.42	42%
Apprentice 8	R 194 290	R 55 968	R 250 258	R 305 078	R 50 000	R 355 078	1.42	42%
						Average	1.60	60%

APPENDIX B 4: ROI Calculations for Workshop-based Apprentices Year 1

APPRENTICE COST FOR YEAR 1					
Apprentice	Apprentice Salary	Training and infrastructure cots	Cost of PPE	Miscellaneous costs	C1=(Wy+Iy+ Py+My)
9	R 108 924	R 17 706	R 2 200	R 5 446	R 134 276
10	R 58 560	R 17 706	R 2 200	R 2 928	R 81 394
11	R 58 560	R 17 706	R 2 200	R 2 928	R 81 394
12	R 58 560	R 17 706	R 2 200	R 2 928	R 81 394
13	R 58 560	R 17 706	R 2 200	R 2 928	R 81 394
14	R 58 560	R 17 706	R 2 200	R 2 928	R 81 394
15	R 58 560	R 17 706	R 2 200	R 2 928	R 81 394

MANAGEMENT COST YEAR 1					
Apprentice	Journeyman Costs/hour	Journeyman hours	management costs	management hours	C2=(Ay× hy)+(Sy×hsy)
9	R 145.0	528	R 232.0	176	R 117 392.0
10	R 145.0	528	R 232.0	176	R 117 392.0
11	R 145.0	528	R 232.0	176	R 117 392.0
12	R 145.0	528	R 232.0	176	R 117 392.0
13	R 145.0	528	R 232.0	176	R 117 392.0
14	R 145.0	528	R 232.0	176	R 117 392.0
15	R 145.0	528	R 232.0	176	R 117 392.0

Total Benefit for Year 1						
Apprentice	Rate as General Worker	Hours as General Worker	Rate as Artisan's Assistant	Hours Worked as Assistant	Grant Benefit	Total Benefit
9	R 45.0	966	R 200	354	R 50 000.0	R 164 270
10	R 45.0	966	R 200	354	R 50 000.0	R 164 270
11	R 45.0	1320	R 200	0	R 50 000.0	R 109 400
12	R 45.0	1051	R 200	269	R 50 000.0	R 151 095
13	R 45.0	966	R 200	354	R 50 000.0	R 164 270
14	R 45.0	1058	R 200	262	R 50 000.0	R 150 010
15	R 45.0	974	R 200	346	R 50 000.0	R 163 030

Return on Investment for Site-based Apprentices after 1 Year								
Apprentice	Cost of Training	Cost of management	Total Cost	Call-out benefit	Grant benefit	Total Benefit	Benefit Cost	ROI
9	R 134 276	R 117 392	R 251 668	R 114 270	R 50 000	R 164 270	0.65	-35%
10	R 81 394	R 117 392	R 198 786	R 114 270	R 50 000	R 164 270	0.83	-17%
11	R 81 394	R 117 392	R 198 786	R 59 400	R 50 000	R 109 400	0.55	-45%
12	R 81 394	R 117 392	R 198 786	R 101 095	R 50 000	R 151 095	0.76	-24%
13	R 81 394	R 117 392	R 198 786	R 114 270	R 50 000	R 164 270	0.83	-17%
14	R 81 394	R 117 392	R 198 786	R 100 010	R 50 000	R 150 010	0.75	-25%
15	R 81 394	R 117 392	R 198 786	R 113 030	R 50 000	R 163 030	0.82	-18%
						Average	0.74	-26%

APPENDIX B 5: ROI Calculations for Workshop-based Apprentices Year 2

APPRENTICE COST FOR YEAR 2					
Apprentice	Apprentice Salary	Training and infrastructure cots	Cost of PPE	Miscellaneous costs	C1=(Wy+Iy+ Py+My)
9	R 108 924	R 17 706	R 2 200	R 5 446	R 134 276
10	R 79 200	R 17 706	R 2 200	R 3 960	R 103 066
11	R 79 200	R 17 706	R 2 200	R 3 960	R 103 066
12	R 79 200	R 17 706	R 2 200	R 3 960	R 103 066
13	R 79 200	R 17 706	R 2 200	R 3 960	R 103 066
14	R 79 200	R 17 706	R 2 200	R 3 960	R 103 066
15	R 79 200	R 17 706	R 2 200	R 3 960	R 103 066

MANAGEMENT COST YEAR 2					
Apprentice	Journeyman Costs/hour	Journeyman hours	management costs	management hours	C2=(Ay× hy)+(Sy×hsy)
9	R 156	352	R 281	176	R 104 368
10	R 156	352	R 281	176	R 104 368
11	R 156	352	R 281	176	R 104 368
12	R 156	352	R 281	176	R 104 368
13	R 156	352	R 281	176	R 104 368
14	R 156	352	R 281	176	R 104 368
15	R 156	352	R 281	176	R 104 368

TOTAL BENEFIT FOR YEAR 2						
Apprentice	Rate as General Worker	Hours as General Worker	Rate as Artisan's Assistant	Hours Worked as Assistant	Grant Benefit	Total Benefit
9	R 45	553	R 216	767	R 50 000.0	R 240 557
10	R 45	62	R 216	1258	R 50 000.0	R 324 518
11	R 45	920	R 216	400	R 50 000.0	R 177 800
12	R 45	624	R 216	696	R 50 000.0	R 228 416
13	R 45	337	R 216	983	R 50 000.0	R 277 493
14	R 45	238	R 216	1082	R 50 000.0	R 294 422
15	R 45	208	R 216	1112	R 50 000.0	R 299 552

RETURN ON INVESTMENT FOR WORKSHOP APPRENTICES AFTER 2 YEARS								
Apprentice	Cost of Training	Cost of management	Total Cost	Call-out benefit	Grant benefit	Total Benefit	Benefit Cost	ROI
9	R 134 276	R 104 368	R 238 644	R 190 557	R 50 000	R 240 557	1.01	1%
10	R 103 066	R 104 368	R 207 434	R 274 518	R 50 000	R 324 518	1.56	56%
11	R 103 066	R 104 368	R 207 434	R 127 800	R 50 000	R 177 800	0.86	-14%
12	R 103 066	R 104 368	R 207 434	R 178 416	R 50 000	R 228 416	1.10	10%
13	R 103 066	R 104 368	R 207 434	R 227 493	R 50 000	R 277 493	1.34	34%
14	R 103 066	R 104 368	R 207 434	R 244 422	R 50 000	R 294 422	1.42	42%
15	R 103 066	R 104 368	R 207 434	R 249 552	R 50 000	R 299 552	1.44	44%
						Average	1.25	25%

APPENDIX B 6: ROI Calculations for Workshop-based Apprentices Year 3

APPRENTICE COST FOR YEAR 3					
Apprentice	Apprentice Salary	Training and infrastructure cots	Cost of PPE	Miscellaneous costs	C1=(Wy+Iy+ Py+My)
9	R 128 112	R 17 706	R 2 200	R 6 406	R 154 424
10	R 94 092	R 17 706	R 2 200	R 4 705	R 118 703
11	R 94 092	R 17 706	R 2 200	R 4 705	R 118 703
12	R 94 092	R 17 706	R 2 200	R 4 705	R 118 703
13	R 94 092	R 17 706	R 2 200	R 4 705	R 118 703
14	R 94 092	R 17 706	R 2 200	R 4 705	R 118 703
15	R 94 092	R 17 706	R 2 200	R 4 705	R 118 703

MANAGEMENT COST YEAR 3					
Apprentice	Journeyman Costs/hour	Journeyman hours	management costs	management hours	C2=(Ay× hy)+(Sy×hsy)
9	R 168	176	R 300	88	R 55 968.0
10	R 168	176	R 300	88	R 55 968.0
11	R 168	176	R 300	88	R 55 968.0
12	R 168	176	R 300	88	R 55 968.0
13	R 168	176	R 300	88	R 55 968.0
14	R 168	176	R 300	88	R 55 968.0
15	R 168	176	R 300	88	R 55 968.0

TOTAL BENEFIT FOR YEAR 3						
Apprentice	Rate as General Worker	Hours as General Worker	Rate as Artisan's Assistant	Hours Worked as Assistant	Grant Benefit	Total Benefit
9	R 45	0	R 231	1056	R 50 000.0	R 293 936
10	R 45	0	R 231	1056	R 50 000.0	R 293 936
11	R 45	0	R 231	1056	R 50 000.0	R 293 936
12	R 45	0	R 231	1056	R 50 000.0	R 293 936
13	R 45	0	R 231	1056	R 50 000.0	R 293 936
14	R 45	0	R 231	1056	R 50 000.0	R 293 936
15	R 45	0	R 231	1056	R 50 000.0	R 293 936

RETURN ON INVESTMENT FOR WORKSHOP APPRENTICES AFTER 2 YEARS								
Apprentice	Cost of Apprenticeship	Cost of management	Total Cost	Call-out benefit	Grant benefit	Total Benefit	Benefit Cost	ROI
9	R 154 424	R 55 968.0	R 210 392	R 243 936	R 50 000	R 293 936	1.40	40%
10	R 118 703	R 55 968.0	R 174 671	R 243 936	R 50 000	R 293 936	1.68	68%
11	R 118 703	R 55 968.0	R 174 671	R 243 936	R 50 000	R 293 936	1.68	68%
12	R 118 703	R 55 968.0	R 174 671	R 243 936	R 50 000	R 293 936	1.68	68%
13	R 118 703	R 55 968.0	R 174 671	R 243 936	R 50 000	R 293 936	1.68	68%
14	R 118 703	R 55 968.0	R 174 671	R 243 936	R 50 000	R 293 936	1.68	68%
15	R 118 703	R 55 968.0	R 174 671	R 243 936	R 50 000	R 293 936	1.68	68%
						Average	1.64	64%