HISTORICAL SHIFTS IN KNOWLEDGE, SKILL AND IDENTITY IN THE SOUTH AFRICAN PLANT BAKING INDUSTRY: IMPLICATIONS FOR CURRICULUM

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COMPULSORY DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

Signature:_____ Date:_____

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and

My long-suffering family and friends

My most sincere thanks

ABSTRACT

The South African economy, as with the rest of the world economy, has been influenced by the trends of globalisation and the knowledge economy (Castells, 2001). The South African plant (large scale) baking industry is an industry undergoing significant change with the introduction of cutting edge technology and automation. The aim of this study is to examine the shifts in organisation of work in the South African plant baking industry and, in doing so, identify the corresponding shifts in knowledge, skill and identity of production supervisors. By examining how the work organisation of the bakeries has changed, as well as the adaptations of knowledge, skill and identity, the aim is to draw implications for the development of production supervisors in the future. This, combined with an analysis of the current curricula, is then drawn on to consider the possible implications for a curriculum that addresses the needs of production supervisors in the changing plant baking industry.

This qualitative research made use of a case study approach. The first phase of the study examined views on shifts in the organisation of work, and the relative importance of knowledge, skill and identity, via interviews with employees of a national plant baking company that has multiple bakeries at varying stages of automation. Changes in the organisation of work and knowledge, skill and identity were then analysed through the lens of Marx' Labour Process Theory and Barnett and Coate (2005)'s model for professional curriculum, respectively.

The second phase of this study made use of documentary evidence of two different curricula currently available for the development of production supervisors; one developed by the South African Qualifications Authority and the other by the South African Chamber of Baking. This phase sought to examine their ability to address the new organisation of work identified in the first phase of the study, drawing again on the Barnett and Coate (2005) model for professional curriculum.

Findings from the first phase of the study point to changes to the organisation of work as seen in the decrease in the amount of labour required to operate an increasingly automated plant and a shift in the role of the production supervisor. These changes have resulted in shifts in the relative importance of knowledge, skill and identity, according to those interviewed. The most significant of these shifts was the perceived increase in the relative importance of identity as interviewees identified the need for a strengthened occupational identity for production supervisors, and a relative devaluing of skill within the bakeries as the role of operators has shifted more towards monitoring instead of operating the machines.

These findings might be explained by the increase in automation that has led both to a weakening of occupational identity and a change in the knowledge base required by production supervisors. The need for multi-skilling has increased the need for context independent knowledge. At the same time the need for the situated, tactile, knowledge

of the bread making process remains. It is argued that it is this situated knowledge held by the older, more experienced production supervisors that enables the ability to solve problems on the line and potentially strengthens their occupational identity.

It was found that neither of the two curricula examined addressed the current and future needs of production supervisors. The findings of both the first and second phases of the study point to the need for a new form of curriculum that addresses the needs of production supervisors who are required to function within the new organisation of work. Conclusions are that it is not possible to confer an identity through formal curriculum alone and work experience remains central to the identity of a production supervisor. Yet there remains a need to provide production supervisors with the context independent knowledge base of, and skill in, the bread making process; elements that can be addressed within a formal curriculum framework. The development of a mixed disciplinary knowledge base that consists of both situated knowledge and context independent knowledge may provide a way for the changes in knowledge, skill and identity to be accommodated in a curriculum that caters more effectively for both workers and an industry whose drive towards automation continues.

1. INTRODUCTION

This study is seeks to answer the question: 'What are the curriculum implications of historical shifts in knowledge, skills and identity in the South African plant baking industry?' In order to do this, sub-questions were introduced to more clearly frame the study, namely:

1. What shifts have occurred in the organisation of work and how has this impacted on knowledge, skills and identity?

2. What are the current curricula?

3. How appropriate are the current curricula?

The researcher's ongoing interest in the production sector, combined with an interest in the curricula that serve it, led to the development of this research study. Prior knowledge of the plant baking industry and familiarity with the current training options that companies have to offer employees provided the impetus for the decision to focus on this particular industry and to include the curriculum element of the study. The South African plant (large scale, commercial) baking industry does not exist in isolation but is, rather, part of the larger manufacturing sector of the country and subject to the same forces and legislative requirements. The sector is also subject to the demands and changes brought about through the impact of globalisation. Under globalisation, it is necessary to consider the changes that have occurred in the organisation of work and, in so doing, further recognise the impact that this has had on the curricula required to address this.

The aim of this chapter is to provide the background for a larger perspective of the factors that influence the South African plant baking industry, as well the education and training within it. In order to fully unpack these, it is necessary to have an understanding, firstly, of the South African education and training landscape. This introduction to the education and training landscape will then be further unpacked through a more detailed examination of the global economic picture before returning to the more localised perspective of the South African economic situation. The chapter closes with an introduction to the sector in which the study is situated, namely the South African plant baking industry, in order to provide the reader with a contextual understanding on which to base the rest of the work.

1.1 THE SOUTH AFRICAN EDUCATION AND TRAINING LANDSCAPE

Within the education and training landscape in South Africa, the focus of the last 20 years has been on redressing the wrongs of the Apartheid era through the introduction of a new, integrated education system. Beginning with the *South African Qualification Authority Act* of 1995[1], which laid the foundation for the development of the National Qualifications Framework (NQF), there has been a move towards creating an integrated approach to education and training in South Africa (Akoojee, et al., 2005, p. 104).

According to Wedekind;

> Promulgation of a National Qualifications Framework (NQF) was the first step towards a new system that sought to introduce a modern, innovative system with three Bands (General, Further and Higher Education) with most work-based and vocational education located in the Further Education and Training (FET) Band.
>
> (Wedekind, 2010 in Wedekind, 2013, p. 5)

This system draws on the model used by countries such as Australia, New Zealand and Scotland (Allais, 2007 in Wedekind, 2013, p. 3) and aims to integrate the schooling and post-school systems into one system that allows for progression from one band to the next or movement between bands where equivalency exists. The quality assurance of the new system was originally split across two quality councils, namely, Umalusi (General and Further Education) and the Council for Higher Education (CHE). The quality assurance of workplace qualification rested with various Sector Education and Training Authorities (SETAs).

In 2008, the system was changed by the introduction of the *National Qualifications Framework Act* of 2008[2], which repealed the *South African Qualification Authority Act* of 1995. This Act changed the quality assurance structure of the vocational education sector by making provision for a third Quality Council to be established. The exact nature of this Quality Council was laid out by the *Skills Development Amendment Act* of 2008 and led to the introduction of the Quality Council for Trades and Occupations (QCTO), which is intended to function as the quality assurance body for all vocational qualifications. Current trends in the South African education and training system have focused on vocational training of skills needed to function in the workplace. The implementation of the new QCTO is instigating a shift in the approach taken to the training of vocational qualifications. What the ramifications of these shifts will be is not

[1] South African Qualification Authority Act No. 58 of 1995
[2] National Qualifications Framework Act No. 67 of 2008

yet entirely certain, however, it does provide the possibility for the re-evaluation of current training options and opportunity to consider new approaches.

In her analysis of the challenges facing the South African education and training landscape, Lloyd quotes Fenwick and Farrell to explain that 'we live in a time when the popular belief… is that any region's long-term growth is fundamentally linked with knowledge. This belief is nurturing a gnawing anxiety that we may not be producing enough knowledge or the right kind of knowledge to survive in the global economy.' (Fenwick; Farrell. 2007 in Lloyd, 2013, p. 8) If this is the case, then there is an urgent need to define what knowledge is actually the right kind of knowledge and how much of it is enough. The NQF of South Africa and its associated bodies play a vital role in making these determinations and, as Lloyd (2013) states:

> NQFs have a defined and definite space as Governments are increasingly seeing NQFs as educational reform mechanisms, promoting access, transparency, mobility, recognition and validation of all forms of learning, and lifelong learning.
>
> (Lloyd, 2013, p. 9)

With this vital role to play, it is imperative that the types of curricula developed within the NQF and approved by the South African Qualifications Authority (SAQA) meet the changing needs of the country in which they are situated. This is particularly essential in the continually developing sphere of business as new types of skills are in demand and the skills development sector is tasked with developing employees to meet these new skill requirements. The South African government has placed a high emphasis on skills development as a tool for meeting its developmental outcomes (Lloyd, 2013). This use of education and training as 'an instrument of economic policy, [means that] it becomes the domain of government, business and labour as tripartite economic decision-makers.' (Gamble, 1995, p. 13) Cooper and Walters suggest, that '[n]ever before in the history of the country have so many resources been made available to enhance workplace learning, but on a daily basis there are still discussions in the popular media on 'the skills crisis' or 'skills shortages' (Cooper & Walters, 2009, p. xix). The South African government has focussed specifically on addressing the skills shortages in commerce and industry through the development of Sector Education and Training Authorities (SETAs) and the implementation of the Skills Development Act and Skills Development Levies Act, both of which make provision for skills training of the labour force. [3]

[3] Skills Development Act No. 97 of 1998,
Skills Development Levies Act No. 9 of 1999
Skills Development Amendment Act No. 31 of 2003

Changes in many industries are happening rapidly, particularly in terms of the increased demand for technological advancement and the resulting impact that this has on the organisation of work. The manufacturing sector, by virtue of its continuous drive to bring down costs and increase outputs, is at the forefront of pioneering new forms of production technology. This push for change in the manufacturing sector dates back to the Industrial Revolution and is an ongoing process that has seen multiple changes over the last few decades in particular. The previous changes that have occurred may provide an indication of how the current changes will impact knowledge, the skills required for work, and the identities of those undertaking the work, which in turn affects the way that workers should be trained. Thus the aim of this research is to examine the curriculum implications of historical shifts in work organisation, skills and identity in the South African plant baking industry, an industry which is currently experiencing changes to its operations as the mechanised automation shifts to computerised automation.

Within the South African plant baking industry, in terms of training available for operators in the plant baking environment, currently there are two options. The first option available is a South African Qualifications Authority (SAQA) accredited learnership.[4] While this is available at both NQF levels 2 and 3, the qualifications are very similar and the focus tends to be on offering the NQF level 2 learnership. The second option is run by the South African Chamber of Baking and is a Certificate in the Theory of Breadmaking, which is not accredited by an external body.[5] The first qualifications, learnerships based on the NQF qualifications in plant baking, only have one training provider accredited to offer it, but they are not even being offered at this point. The South African Chamber of Baking certificate is being offered but many of the learners are not passing the examination. All training is undertaken by employers who are responsible for the decisions around whether or not to run learnerships and/or give employees the opportunity to sit the Chamber of Baking examination. A full examination of both of these curricula is conducted in chapter five.

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[4]NQF 3 National Certificate: Food and Beverage Processing: Plant Baking Processing (SAQA ID 20658) http://regqs.saqa.org.za/viewQualification.php?id=20658 (accessed 17 March 2013)
NQF 2 National Certificate: Food Processing: Plant Baking (SAQA ID 64029) http://regqs.saqa.org.za/viewQualification.php?id=64029 (accessed 17 March 2013)
[5]Certificate in the Theory of Breadmaking http://www.sacb.co.za/courses.html (accessed 17 March 2013)

1.2 GLOBAL ECONOMIC BACKGROUND

The South African economy, as with the rest of the world, is clearly influenced by current trends that indicate a move from an economy based on production of tangible goods to one which is centred on the production of knowledge (Castells, 2001). This move from tangible created assets to intangible created assets such as knowledge, became evident in the early 1990s with the shift in the ratio of intellectual to physical and financial capital to a point where intellectual capital now dominates the market value of organisations (Dunning, 2000, p. 9). Dunning goes on to state that '[t]hroughout economic activity, created intangible assets are replacing natural or created tangible assets as the main source of wealth augmentation in industrial societies.' (Dunning, 2000, p. 9)

This new economy is, however, still a capitalist one that relies on financial globalisation (Castells, 2001), with globalisation itself being the product of hundreds of years of capitalist expansion (Robertson & White, 2007, p. 59). Thus the development of the knowledge economy is only possible with the increase in globalisation, defined for the purposes of this discourse as 'the multiplicity of linkages and interconnections between the states and societies which make up the present world system.' (McGrew, 1992 in Dunning, 2000, p. 13) As this definition suggests, and Castells (2001) emphasises, this new economy based on globalisation is not just an economy based on the internet and internet companies, but rather one that encompasses a range of businesses and activities which generate value through their manipulation of information technologies. Information technologies, and by extension the internet on which it is based, enable the organisation of the new economy into networks (Castells, 2001), further enabling the interconnectedness of the systems and increasing the impact of globalisation.

As globalisation and information technologies have enabled companies to reduce production costs by centring their production wherever it is most cost effective, 'the value of knowledge and unique practices as a basis for competitive advantage has become even more pronounced.' (Sölvell & Birkinshaw, 2000, p. 83) The development of knowledge as the main source of value in the new economy means that there is also a shift in the type of labour required. This gives rise to the knowledge worker – the individuals whose ideas create value in the new knowledge economy (Audretsch, 2000). Although there is a shift in the type of labour required, Castells points out that

> [l]abour is still the basis of any economy – and this is particularly so of the new economy. It is the source of value creation. I wouldn't say that I believe in the labour theory of value but I believe in the value theory of labour in the sense that labour is the source of productivity and competitiveness in this new economy as it was in other economies. (Castells, 2001, p. 2)

Although labour remains the basis of the knowledge economy, the type of work done by these knowledge workers is no longer based on manual labour but is rather focused on 'the manipulation of knowledge and symbols,' (Clegg & Carter, 2007, p. 284) a

process of creating value from knowledge. This value creation process relies heavily on the use of technology to transfer information and knowledge. In turn, this impacts on the identity of the people involved in this type of work as they 'are gradually being defined socially less by a particular long-term job they hold than by the knowledge they have acquired by studying and working.' (Carnoy, 2001, p. 23)

The use of technology, as Castells calls attention to, 'does have a tremendous effect on the kind of work and the kind of labour market.' (Castells, 2001, p. 12) The main developments he refers to are the shift to more flexibility in the labour market and the development of what he refers to as 'self-programmable labour' which 'is labour that has the built-in capacity to generate value through innovation and information,' (Castells, 2001, p. 13) and is therefore capable of the constant change required by the knowledge economy. However, Castells does go on to point out that there is a large mass of generic labour without specialised skills that is also required and that exists alongside the unskilled and semi-skilled labour in developing countries (Castells, 2001, p. 13). Generic labour, as well as unskilled and semi-skilled labour are vital to the large scale manufacturing sector. The manufacturing sector is not, as it may seem by the trend towards a knowledge economy, disappearing but is instead transforming towards automation and technology (Castells, 2001). Indeed, Castells states that 'the most important thing is not electronics or Internet companies and so on, it's what's happening in the automated production sector,' (Castells, 2001, p. 10) a sector that is in a state of flux due to the influence of globalisation and the new economy but one which is also benefitting from the capitalist economy and technological advances.

It is not just the increased innovation of the information and communication technologies that is important but also 'the role of new and improved transport and production technology.' (Tonkiss, 2006, p. 4) The improvement in production technology is central to the development of the manufacturing sector as it enables the sector to cope with the demands of a capitalist economy. Thus, '[p]roductivity in the new economy requires a strong technological basis, of which the Internet is the most direct expression (Castells, 2001, p. 156). The increased levels of technology have led to transitions in the way in which even the more traditional industries are operating. The development of factories with the use of steam and water power, as a result of the Industrial Revolution, led to changes in the way in which both the economy operated and the way manufacturing happened (Ackrill, 1987, p. 4). This transition may not have been the first but it is a significant starting point for change in manufacturing and in turn opened the door for the development of further technological advances. These shifts had implications for the way in which work is organised (as discussed by Marx (Marx, 1976)) as well as the skills required from those working in the factories and the way the workers saw themselves in relation to what they are producing. The mechanisation of factories led to changes in the interaction between man and machine as, previously, 'the apparatus works as the servant of the man while in modern machines the inverse relation holds.' (Weber, 1923, p. 302) Further

discussion on Marx' labour process and the organisation of work will be dealt with in chapter two.

1.3 SOUTH AFRICAN ECONOMIC BACKGROUND

South Africa, as a developing country, is not immune to the new knowledge economy and the impact of globalisation. According to Castells, the South African economy is at risk of being overwhelmed by globalisation and is suffering due to the lack of linkages to other economies of the southern African sub-region as a result of Apartheid (Soludo, 2001). However, the impact of globalisation is not entirely negative as South Africa is also able to reap the benefits of being connected to the world economy through, for example, the free trade agreement with Europe and involvement in the Southern African Development Community (Soludo, 2001). Soludo disputes Castells' prognosis for the development of the African economy that 'technological dependency and technological underdevelopment, in a period of accelerated technological change in the rest of the world, make it literally impossible for Africa to compete internationally or in advanced services' (Castells, 1998 in Soludo, 2001, p. 53) and points out the current political and economic reforms taking place in the region as impetus for changes to the *status quo* (Soludo, 2001).

In terms of the South African labour market, although shifts have begun, these are taking a long time to show and the labour market in many respects remains very similar to what it was pre-1994. Nattrass explains that, historically, the development of the South African labour market differed from others because

> [t]he South African economy is unusual in that the causes that separated labour from the land, in the early periods of the development of the capitalist economy, differed markedly between the races, as indeed did the extent to which they were separated from the land. (Nattrass, 1981, p. 59)

The South African manufacturing sector, in particular, developed at the expense of the majority of the population who were discriminated against and were subjected to what could be termed 'racial Fordism' (Rogerson, 1991 in Nel, 2002, p. 83) leading to the situation where 'distinction between skilled and unskilled soon became to be more or less identified with the distinction between the races' (Houghton, 1964 in Nattrass, 1981, p. 72). In the 1970s Webster, in his study of the foundries in South Africa, found that the '[t]he colour of craft was white and those who performed the subordinate labouring jobs were black. However the beginnings of mass production were to transform the labour process, breach craft control, and open up job opportunities for 'coloured' machine operators.' (Webster, 1985, p. 23) Furthermore, applying labour market theory to the South African context at that point clearly shows up the 'racial dualism' of the labour market at the time (Webster, 1985). Bhengu proposes that the racial structuring of the South African workplace had implications for the organisation of work, the labour process, as well (Bhengu, 2010) – a proposal that is evidenced in

the demographic of the research population where the lower level jobs show a predominance of black and coloured labour while management remains predominately white. The changing structure of capitalism in the 1960s had further consequences for both the organisation of labour and the labour market. The increased automation meant that fewer workers were required to operate the machines and introduced a distinction in the labour types required not based on skilled/unskilled, but rather semi-skilled operators and supervisory labour (O' Meara, 1996, p. 175).

Manufacturing is still one of the most important components of the South African economy and, in the late 1990s, was responsible for a fifth of South Africa's Gross Domestic Profit as well as 27% of employment (Tustin, 2002, p. 9). However, the manufacturing sector is facing some significant challenges. These challenges are partly a result of the changes to the South African economy brought about by the changes in the political landscape but are also a result of the shift towards a knowledge-intensive economy and the need for continued innovation and the development of new ideas (Nel, 2002). Globalisation further impacts on the South African labour market through its tendencies to improve conditions for skilled workers while at the same time resulting in unemployment and the 'pauperisation' of the majority of the workforce due to changes in the workplace (Netshitenzhe, 2001). The labour market in South Africa is a reflection of current global trends in that outsourcing, casual labour use, and the increase in flexibility and decentralisation of management are as evident in the local production and manufacturing sectors as in other parts of the world where manufacturing occurs (Patel, 2001). A study of the manufacturing establishments in the Greater Johannesburg Metropolitan Area indicated that, on average, 75% of them make use of temporary labour due to their ability to provide flexibility, the lower costs involved and because the permanent workforce has been reduced (Tustin, 2002, p. 92).

1.4 PLANT BAKING IN THE SOUTH AFRICAN CONTEXT

Baking bread is not a modern invention. Evidence exists that shows that bread was baked in several ancient civilisations, including the Ancient Egyptians and Mesopotamians. Although bread making and baking began as a very basic process, it was developed through the ages into a much more specialised craft, particularly during the Greek and Roman civilisations. (South African Chamber of Baking, 2010; Marchant, et al., 2008). The Middle Ages saw a reversal in this development as bread began to be baked as part of the household activities instead of being bought from specialised bakers. The transition back to more specialised bakeries occurred as villages and towns began to make use of communal ovens or 'bakeries' in order to bake their home made loaves, however it is during the Industrial Revolution that there was a shift towards larger scale bakeries (South African Chamber of Baking, 2010). It is suggested that this was due, in part, to the lack of time available for making bread at home as factories began to develop (Acton, 1857).

According to the history of baking in South Africa provided by the South African Chamber of Baking, bread baking arrived in South Africa with the colonial settlers in the 17th century. The major shift, however, from the traditional approach of baking bread in the home to a more commercial approach began in South Africa as a response to '[t]he discovery of diamonds in 1868 and gold on the Witwatersrand in 1886 [which] led to the development of large towns and urban complexes.' (South African Chamber of Baking, 2005).

The Chorleywood bread process[6] was developed in the UK in 1961 and came into general use in 1965. This reduced the length of the fermentation period and speeded up the process (Baker Perkins Historical Society, 2013). The process was adopted by large plant bakeries as it decreased the number of stages in the production line and saved 60% of the time required to convert raw materials into product (Marchant, et al., 2008, p. 167).

This new process led to the development of new mixers. The high speed mixing process required pressure and partial vacuum to be applied. This was made possible with the development of a new mixer designed and engineered by Tweedy of Burnley (Baker Perkins Historical Society, 2013). These mixers have become ubiquitous in the plant baking industry and have become the preferred mixers for plant bakeries in many countries, including South Africa. However, this increase in speed as a result of the new mixing process had a far reaching impact on the rest of the process. Wood and Kelly quote Taylor in their analysis of the history of scientific management, making the point that 'if labour productivity was to be raised, then simultaneous improvements had to be effected in machine maintenance, materials and tools, supply, work flow and detailed supervision.' (Taylor in Wood & Kelly, 1982, p. 78) In terms of the overall process, the introduction of these new mixers led to an increase in the mechanisation of the rest of the process as well, in order to keep up with increased mixing speed. This meant a reorganisation of the work process in order to achieve maximum coordination between labour and machine as the focus shifted from labour to machines and an increasingly automated the process (Lewis, 1984, p. 112).

In the South African context, the increased number of large businesses in the 1960s saw the focus in industry shift towards a more mechanised approach that drew heavily on the concepts of Fordism and Taylorism (O' Meara, 1996, p. 174). These concepts were adopted widely in industry, including in the South African plant bakeries, and the

[6] Prior to the development of the Chorleywood Bread Process, dough had to be processed in the mixer for a much longer period of time before continuing through the rest of the bread making process. In the Chorleywood Bread Process, 'the previous lengthy bulk fermentation is replaced by an input of intense mechanical energy using special mixers which develop the dough matrix in a few minutes.' (Welch & Mitchell, 2000, p. 12)

South African plant baking industry still draws heavily on Taylorism and Fordism despite shifts in some sectors to more flexible forms of production that meet consumer demands. Drawing on Allen's explanation, the bulk of this industry displays neo-Fordist characteristics in that it still continues with certain elements of Fordism in terms of the industry's focus on mass production and a centralised, hierarchical managerial structure while at the same transforming the labour process through the increased use of technological automation and certain changes in working practices (Allen, 1992). This shift towards neo-Fordism is referred to by Piore and Sabel as 'the second industrial divide' and is categorised by 'changing technologies, new forms of economic competition and the reorganisation of labour processes' (1984, in Tonkiss, 2006, p. 89). The result of this is the introduction into the mass production sphere of the concepts of more flexible production techniques and workplace structures rather than the complete replacement of mass production with 'flexible specialisation' (Tonkiss, 2006).

The changes in the labour process in the plant baking industry have led to the deskilling of jobs and an increase in the control of the process by management. As Maree defined Taylorism, 'management decided what had to be done, how to do it, and in what time it had to be done.' (Maree, 2007, p. 588) Current trends in management are not dissimilar to what Taylor sought to do through his concepts of Scientific Management. Combined with the deskilling, Taylorism also sought to separate the design and planning of production from the execution (Clegg & Carter, 2007), which, when implemented, led to the separation of the workforce into those who were operating the machines and those responsible for overseeing the process. This had implications in terms of the identity of those operating the machines as their autonomy was removed. Despite certain shifts in the manufacturing industry in recent years, this autonomy has never been restored. Baugher points out that:

> The current research suggests, then, that work identities today are not as open as the concepts "post traditional society" and "subjective modernization" suggest, at least as far as workplace participants in blue-collar industries are concerned. One could argue that this is precisely because work teams and other participatory structures in these industries do not typically provide workers with opportunities for positional mobility and because these workers have not attained higher levels of education.
>
> (Baugher, 2003, p. 436)

The shift in industry towards knowledge management, drawing on the ideas of the current knowledge economy, is merely a change in nomenclature as knowledge management still strives to do what Taylor began. Clegg and Carter draw the correlation that 'Taylor sought to take the knowledge from the craft worker and place it in the hands of management; knowledge management seeks to codify tacit knowledge in the workplace.' (Clegg & Carter, 2007, p. 277) This results in the conclusion that 'more and more work in contemporary capitalist economies involved deskilling, routinisation and alienation.' (Braverman, 1974 in Tonkiss, 2006, p. 102)

Current information from the South African Chamber of Baking (2005) is that the South African plant baking industry employs approximately 8500 people in between 60 and 70 plant bakeries. Of the three types of bakeries supplying the market with bread, namely plant bakeries, in-store bakeries and retail bakeries, the plant baking sector supplies 50% of the total number of loaves (South African Chamber of Baking, 2005). Thus the plant baking sector is a significant player in the South African market and one which cannot afford to ignore the technological advances that would allow it to retain its market share. This means that it is important to ensure that employees are trained to cope with the new technology and that production supervisors, in particular, are well equipped to manage the processes involved in producing a product that meets customer requirements, both in terms of quality and availability.

The South African plant baking industry is an industry that, while still evidencing a very neo-Fordist structure and approach, is also one which is aiming to become more competitive with cutting edge technology. By examining the work organisation of the bakeries to determine how they have changed and adapted previously in terms of knowledge, skill and identity, it is hoped that it will be possible to gain insight into how these can be developed in the future to assist with the development of new production supervisors.

This need to educate production supervisors in order for them to cope with the changes sits in contrast to the deskilling, routinisation and alienation that results from the knowledge management process, thus the needs of the industry sit in tension with the needs of workers and supervisors for more meaningful, fulfilling work. Both sides must be considered and the tension between the two acknowledged. The question then arises as to whether it is possible to reconcile this dichotomy and create a curriculum that addresses both the needs of the industry and the needs of workers for a more meaningful relationship with work.

This thesis poses the question of what form of curriculum could address the needs of the more technologically advanced bakeries, and to what extent current curricula achieve this. In order to answer these questions, the thesis first examines how knowledge, skill and identity have shifted with the advancement of technology. The thesis will return to the question of the tension between the industry's needs, and the relationship of workers to the labour process, in the last chapter.

Chapter two focuses on the frameworks that the rest of the study will draw on for analyses, as well as providing an overview of the current literature in this field of study, while chapter three will elaborate on the research methodologies employed in the study. Chapters four and five present the findings of the research with chapter four focusing on the findings related to the organisation of work and chapter five focusing on the curricular findings. The implications of both of these sets of findings are discussed in depth in the final chapter, chapter six.

2. TOWARDS A CONCEPTUAL FRAMEWORK

This chapter seeks to lay out the conceptual framework upon which this research draws, as well as to provide an overview of the research literature in this field. This research is positioned in the field of work and learning and aims to provide insight into a particular section of this field, namely the implications for the vocational education field when the organisation of work changes. In order to effectively examine the organisation of work, it is necessary to first consider where these concepts are situated. This study of shifts in knowledge, skill and identity draws on Marx' Labour Process Theory to identify the shifts in the organisation of work and extrapolate from them conclusions about knowledge, skill and identity.

The first section of this chapter seeks to situate this study in the broader field of work and learning before expanding on the conceptual framework upon which the study is based, namely Marx' Labour Process Theory. This chapter then examines the framework necessary to effectively engage with curricula in a way that draws out the requirements for knowledge, skill and identity and concludes by fleshing out the concepts of knowledge, skill and identity to provide a common understanding on which to base the analysis of the findings.

2.1 LITERATURE ON WORK AND LEARNING

The study of work and learning is a diverse field and there is a 'proliferation of literature on work and lifelong learning, which is theoretically and methodologically diverse, with much borrowing from disciplinary-based knowledges such as sociology and psychology, and from more interdisciplinary based knowledges such as women's studies and adult education.' (Mojab, 2009, p. 4) This diversity of thought leads to a broad spectrum of approaches to the topic and, in turn, a diverse set of ideas and discourses on the topic from a variety of different disciplines. Within this diversity, it is necessary to streamline the approach taken to the topic into a concise section of the field in order to avoid becoming bogged down by the many approaches. The field of adult education, in itself, also proposes various approaches to the role of education in the workplace. This is often in contrast to the way in which business approaches education and training. When considering learning in the workplace, it is necessary to realise that 'learning is tremendously important for the on-going advancement of capitalism as well as its interest in the development of variable labour power and value-added waged labour.' (Avis, 2013, p. 1) Young suggests that, with the development of a new economy with a different mode of production in the 21st Century, there will come 'the emergence of new relations between education and the economy.' (Young, 1993, p. 208)

One of the more recent foci in the field of work and learning comes from the area of organisational development and examines how knowledge is managed within

organisations. This stems from Senge's notion of the 'learning organisation' and how organisations can leverage knowledge to the benefit of the company. Marsick and Watkins point out that the 1990s saw 'a shift away from a compartmentalised, almost assembly-line, approach to learning towards a holistic, integrated vision of a learning organisation.' (Marsick & Watkins, 1999, p. 199) Senge refers to the 'disciplines of the learning organization' (Senge, 1990, p. 5) that enable an organisation to become a learning organisation, namely: systems thinking, personal mastery, mental models, building shared vision and team learning (Senge, 1990). He defines a discipline as a 'developmental path for acquiring certain skills or competencies.' (Senge, 1990, p. 10) This is a distinct approach to learning in the workplace that aims to manoeuver individuals into a place of development that increases their skills and competencies, thereby ultimately increasing the profitability of the company. Organisational learning, however, is not entirely a straightforward concept as 'organisational learning is related to many different aspects of enterprise functioning, including information management, skill formation, culture history, job security, work organisation, and technological systems.' (Field, 1995, p. 154) These various fields all need to be considered in the development of a learning organisation to ensure that it functions as its designers envisage it should.

If Senge's view of learning as a 'shift of mind' (Senge, 1990, p. 12) were to be correctly implemented it should, in theory anyway, cause a major shift toward innovation in the organisation. This approach builds on the premise that any learning that takes place in a capitalist workplace should be to the benefit of the organisation within which it occurs. This idea is referred to by Avis (2013) as 'cognitive capitalism' and he suggests that, in this instance, 'free' labour is seen as increasingly important in the creation of value and it is for this reason that it is suggested in contrast to industrial capitalism '[and] is centered upon digital labour and the forms of collective and social engagement that are facilitated by digital technologies.' (Avis, 2013, p. 3).

For Vercellone, cognitive capitalism

> refer[s] to a system of accumulation in which the productive value of professional and scientific work becomes dominant and the central stakes in the valorization of capital relate directly to the control and transformation of knowledge into fictitious goods. (Vercellone, 2009, p119 quoted in Avis, 2013, p. 3)

As Vercellone's definition suggests, it is the centrality of knowledge in organisations that drives this approach to work and learning. Davenport and Prusak (1998) focus on this concept of 'working knowledge' and how knowledge must be put into action in order for it to achieve anything within an organisation. They define knowledge as 'a fluid mix of framed experience, values, contextual information, and expert insights that provides a framework for evaluating and incorporating new experiences and information.' (Davenport & Prusak, 1998, p. 5) This knowledge enables workers to function effectively by applying what they know or have learned in order to contribute to the organisation's efficiency and profitability. The counter to this however, is, as

Livingstone points out, that '[d]evelopment of workers' knowledge must be encouraged for the system to function but must also be discouraged beyond the boundaries of potential profits.' (Livingstone, 2013, p. 1) This implies that the development and training of workers is only necessary when the return on investment directly benefits the organisation's ability to increase their profits. Kogut and Zander proposed 'that a firm be understood as a social community specializing in the speed and efficiency in the creation and transfer of knowledge.' (Kogut & Zander, 1996, p. 503) Within a knowledge economy, this need for creation and transfer of knowledge is what drives organisations to attempt to implement ways that can leverage current knowledge of employees for the benefit of the organisation, often through the use of learning organisation methodology.

If, as Davenport and Prusak suggest, 'companies will [increasingly] differentiate themselves on the basis of what they know' (Davenport & Prusak, 1998, p. 13), then workplace learning and knowledge becomes ever more important for the development of the organisations as well the knowledge economy itself. Avis points out that 'the increasing speed of change means that a premium is placed on WPL [Workplace Learning] and aligns with the rhetoric of the knowledge society.' (Avis, 2013, p. 2) This emphasis on knowledge, both from the workers and within the organisation, can be seen in Livingstone's analysis of the differences between a knowledge economy and a knowledge society, pointing out that

> a "knowledge economy" in which human capital is developed and applied for profitable economic growth contends with a "knowledge society" in which popular demand for a growing array of sources of information is increasingly difficult to harness within the existing relations of production. (Livingstone, 2013, p. 1)

It is then the development of a knowledge society that appears to place greater strain on the current economy due to the need for transition from the current society to the knowledge society. In order for this transition from the current society to occur, Kondrup suggests that there 'is a widespread consensus amongst politicians and researchers, that lifelong learning and training is a prerequisite for the transformation from industrial to knowledge-based societies (Brine 2006, Biesta 2006),' (Kondrup, 2013, p. 1) with this increased focus on lifelong learning and training then driving the change process. Although lifelong learning and training drive the process, the development of cognitive capitalism stems more directly from what Avis calls the 'mass intellectuality' that developed as a result of the welfare state and universal education brought about as part of Fordism (Avis, 2013, p. 5). It is this greater exposure of more people to education that, in turn, allows for the lifelong learning and training required by the knowledge society. Central to lifelong learning becomes the need for workplace learning.

As referred to previously, workplace or work-based learning is a very broad term that covers a range of different concepts. Piercy points to two significant definitions, firstly drawing on Evans for a 'definition that allows for the consideration and inclusion of

workplace dynamics into the theorisation of workplace' (Piercy, 2013, p. 4) by defining the concept of workplace learning as '[l]earning in, through and for the workplace' (Evans et al., 2006 in Piercy, 2013, p. 4) and, in so doing, provides for an inclusive approach that incorporates all elements of learning in the workplace. Piercy contrasts this with Boud's claims that workplace learning is '…learning that is undertaken at work or directly for the purposes of work. Such learning is also typically utilised as part of some educational qualification' (Boud, 2005 in Piercy, 2013, p. 3) which provides a more defined approach to the concept of workplace learning. This second definition does not, however, take into account that 'most valuable knowledge and skills come from gaining experience.' (Kondrup, 2013, p. 8) Within the manufacturing sector in particular, a large proportion of learning happens 'on the job' and this therefore must be taken into consideration. Evans' definition of workplace learning then becomes more significant as it provides for the learning that takes place 'through … the workplace' (Evans et al., 2006 in Piercy, 2013, p. 4) and does not just focus on formal learning. This ties into the shift within organisations towards the idea that the organisation is an open system where all the elements are integrated and linked with each other so that the learning of one employee can affect the greater organisation (Marsick & Watkins, 1999).

These ideas of an integrated approach and the learning organisation model are not without critiques however. Marsick and Watkins highlight Darrah's critique that

> workplace training and workplace learning are linked and neither is a simple matter of efficient pedagogy. Rather, the organisation of work and the allocation of power deeply influence what is learned. (Darrah, 1995 in Marsick & Watkins, 1999, p. 212)

The issue of power is central to the learning organisation as, depending on where the power lies, the effectiveness of the learning intevention will be significantly different. Livingstone suggests that

> [m]ost theorists of knowledge-power relations have tended to make simple assumptions about continuity or change in structures of power, paid little attention to relations between employers and employees per se and underestimated the contradictory dynamic character of change in work and learning processes, as well as the importance of workers' knowledge in ensuring effective production processes. In particular, much of this research has ignored the underlying employment class structure of power. (Livingstone, 2013, p. 2)

This issue of power and, more importantly, where the power lies, is central to understanding the organisation of work. With the development of the knowledge society and, more importantly, the knowledge economy, the centrality of knowledge means that power rests with those who have the right knowledge. Within an organisation, this may not necessarily be the management, although they have the power to decide what constitutes knowledge within the organisation. This need to control the knowledge, and thereby gain power, has led to the development of the area of knowledge management, a discipline that 'has a much less emancipatory agenda,

and, at its crudest, might be described as extracting knowledge from the heads of employees, codifying it, and putting it into the hands of management to dispose of as just another corporate asset/commodity.' (Keep, 2002, p. 5) The issue of the control of knowledge is one that builds further on the Taylorist principles by carefully managing what each employee is required to know (Keep, 2002) to ensure that control is maintained, despite the idea that learning organisations are meant to be open places with less control from management. Power and control is further enforced by providing training that is specific only to what an employee needs to know in order to do their job and by employers shying away from providing skills that more holistically develop the employee beyond the job requirements (Keep, 2002). This is in direct contrast to Marsick and Watkins' proposal that 'workers are being trained to be proactive problem-solvers, with an emphasis on enhancing behavioural skills, sensitivity to the organisation's culture or way of doing business, and employee values and motivation.' (1999, p. 200)

The dichotomy between the learning organisation and the need for management to control the knowledge within an organisation sees its outplay in the way in which work is organised within the organisations. It also further impacts on the knowledge and skill employees are required to demonstrate. Kogut and Zander state that, '[f]irms provide a sense of community by which discourse, coordination, and learning are structured by identity.' (1996, p. 503) Thus this dichotomy also impacts on the employees' sense of identity within their work environment. The concepts of work organisation, knowledge, skill and identity will be examined in the rest of this chapter.

2.2 LABOUR PROCESS THEORY

> In order to comprehend the relation between work-life and the formation, maintenance or transformation of a learner identity it is critical to apply a theoretical framework sensitive to the relation between work and identity.
>
> (Kondrup, 2012, in Kondrup, 2013, p. 3)

Webster (1985) suggests that Marx laid the foundation for analysing the transformation of the labour process in the first volume of *Capital*. If, as Weber, suggests, we can learn about contemporary institutions through examining their history (Weber in Kieser, 1994), then examining the shifts in an organisation's labour process can provide the knowledge and understanding necessary to more effectively interact with the current organisation. In order to do this, however, it is necessary to understand the concept of the labour process more fully. Marx identifies the three elements of the labour process as:

1. Purposeful activity – work itself as performed by labour
2. The object on which that work is performed
3. The instruments of that work (Marx, 1976, p. 43)

Thompson defines a labour process as 'an activity between man and various components of "nature".' (Thompson, 1989, p. 38) Although the other two components are classified by Thompson as 'nature', in our modern manufacturing age instruments of work are no longer merely natural tools but have gained a level of sophistication not previously attainable. The object on which work is performed may still be fairly 'natural' – depending on what previous processes it may have undergone – and the final product may not have changed much over the centuries, but there are definite shifts in the production process and instruments of work that delineate the different periods of the history of manufacturing as it moves 'from *co-operation*, to *manufacture*, and then to *large-scale industry*.' [Emphasis original] (Thompson & McHugh, 1990, p. 43)

Marx states that '[i]t is not what is made but how, and by what instruments of labour, that distinguishes different economic epochs.' (Marx, 1976, p. 44) The stages, or epochs, of economic development that Marx identifies are classified by the changes in both the division of labour and the way in which work is performed. He classifies these stages as beginning with handcraft, where individual craftsmen make use of their own tools to produce goods, before moving to a period of co-operation between workers who performed the same task. This process of economic development then continues with a second stage that sees the development of the manufacturing stage which involved a more complex division of labour before the introduction of machines which led to the third stage, namely large scale industry. These developments are linked, particularly the third stage, to an increased use of machines for production. Nichols points out that 'the strictest discipline was imposed through the dependence of the worker on the continuous and uniform motion of the machinery.' (Nichols, 1980, p. 27) The increase in automation means that it is no longer a worker who uses tools to create a product but instead a machine which makes use of the worker to complete production – a reversal of the original approach (Marx, 1976).

The three elements of the labour process do not exist in isolation from one another and it is expedient to recall their interconnectedness when beginning any form of analysis, as it is the interrelationship between these elements that provides the framework for analysis of the shifts in the process. Changes to the instruments of work, most significantly the introduction of machines to take over certain tasks, must lead to changes in the act of work and the way in which the human component, or labour, undertakes the work. Whether the raw materials, the object on which work is performed, change or not, the labour process is a system whereby changes to one component must impact on the rest of the system. Webster (1985) suggests that the increased speed and automation of the system means that the worker has lost all control over his work rhythm and is now completely subject to the rhythm and motion of the system. This leads to a fourth stage of automated production, namely one where 'the worker's intervention is now limited to overall supervision and control.' (Palloix, 1978 in Webster, 1985, p. 9) This process of the 'homogenisation of labour', Thompson and McHugh (1990) suggest completes the trend towards Marx' idea of the collective worker. Furthermore, Thompson and McHugh draw from Ure to suggest that

‘neither the division of labour nor work values were sufficient for the purpose of achieving the goal of creating ‘factory hands’. Mechanisation was necessary to destroy old work habits and to tie the worker to the ‘unvarying regularity of the machine’.’ (Thompson & McHugh, 1990, p. 50) They further point to the trend of intensifying work instead of raising hours in order reduce labour cost (Thompson & McHugh, 1990). This intensification of labour is only possible with the development of modern manufacturing methods that shift the emphasis in manufacturing from that of a worker driven environment to one which is computer and machine driven. This leads to changes in the division of labour as less ‘unskilled’ labour is required as that role is absorbed by the machines. This new economic epoch, which Castells says is based on knowledge (Castells, 2001), sees the development of ‘[w]ork transformed by knowledge (as embodied by new technology) [which] leads to a fall in manual, manufacturing jobs.’ (Gamble, 1995, p. 6)

As well as the decrease in manual manufacturing jobs, shifts towards increased industrial bureaucracy have come with the technological changes and thus the characteristics of organisations shifted towards greater specialisation, new patterns of work supervision and a more detailed division of labour (Thompson & McHugh, 1990, p. 47). These changes in the division of labour in the manufacturing sector affect workers by creating a hierarchical system that includes a large class of unskilled labour as it is a system based on skill, training and wage (Thompson, 1989, p. 45). However, ‘the division of labour between formally trained skilled workers and the informally assimilated unskilled is one that is often not based on the task in hand but imposed upon it for the convenience of management’ (Ainley, 1993, p. 21).

The challenges posed by the changes to the division of labour as well as the organisation of work are clearly highlighted through the use of Marx’ Labour Process Theory as an analytical lens. The use of workplace learning as a tool for social change, as proposed by Freire (1970) and other schools, is not a direct intention of this study. However, through examining work organisation in order to use it to discuss changes in knowledge, skill and identity and, thereby, examining the requirements of curriculum, means that some form of social change is implied. Curriculum, in particular, is often a tool for social change in some form, whether by design or simply as a by-product of changing curricula. In order to examine the curriculum, it is necessary to develop a framework for understanding curriculum, particularly curricula in the workplace or vocational context. This framework for understanding curriculum is developed in the next section by drawing on the concepts provided for by Barnett and Coate (2005)’s analysis of curricula in higher education.

2.3 TOWARDS AN UNDERSTANDING OF CURRICULUM

Barnett and Coate (2005) propose that the pattern for a curriculum should consist of three distinct components, namely knowing, being and acting, which provide a frame 'through which to understand and communicate different patterns of curricula' (Barnett & Coate, 2005, p. 70). They provide an explanation for the use of this approach to curriculum that is based on the uncertainty of the modern world and the pressure this puts on the higher education sector to adapt accordingly (Barnett & Coate, 2005, p. 41). It is precisely this uncertainty that is mirrored in the vocational education sector. Changes in the economy, the development of new technologies and changes in the structure of the workplace all lead to uncertainty that needs to be addressed by vocational curricula.

An analysis of professional curricula indicates that all three components are present in professional curricula (Barnett & Coate, 2005, p. 77). As per Figure 1 below, these components are not equal in their weighting, with acting taking a larger role due to a 'strong orientation in curricula towards the practical, external demands of the professions.' (Barnett & Coate, 2005, p. 78)

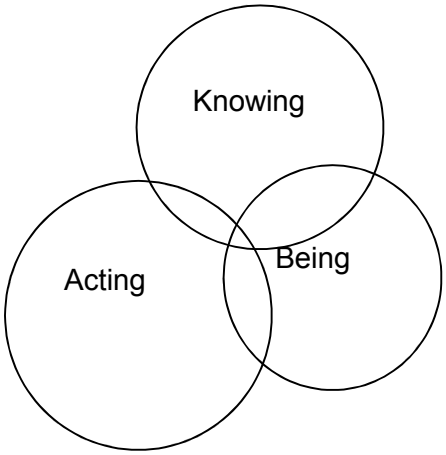

Figure 1: Curricula in professional subjects (Barnett & Coate, 2005, p. 77)

The use of this model enables analysis of the interplay between the three fields of knowledge, skill and identity as the three domains posited as knowing, acting and being are easily transposed into the vocational environment for operators in a plant baking environment. This is done through the correlation of each circle with one of the areas being examined – 'knowing' relating to the theoretical understanding of the process required, 'acting' referring to the skills and ability required to operate plant baking machinery and 'being' hinging on an operator's self-awareness and identity within the plant baking environment. Shifts in these three domains are strongly related and, therefore, as with the model, all three domains can be analysed even though an operator's ability to operate the machinery is still weighted more heavily than the other two. For this study, the Barnett and Coate model is used to analyse the knowledge, skills and identity that underpin the labour process within the plant baking industry. These analyses can then be used to guide future curricula in the industry.

2.4 KNOWLEDGE, SKILL AND IDENTITY IN THE WORKPLACE

In order to make effective use of knowledge, skill and identity in the vocational curriculum, it is necessary to clearly define what is understood by each of these concepts as it applies to the work environment. While a general understanding of these concepts can be derived, for the purposes of an accurate analysis of their interplay and the changes they have undergone, it is imperative that the definition used is one which encompasses the requirements of the workplace.

2.4.1 KNOWLEDGE

Knowledge, although a seemingly straight forward concept, is complicated by the different types of knowledge that may be encountered, sometimes even in the same environment. For the purposes of a conceptual understanding on which to base this research, knowledge, or knowing, was considered in two forms, namely 'knowing by attending to' which is able to be articulated and consciously codified, and 'knowing by relying on' which is not able to be articulated and is the tacit knowledge that underlies the former type (Ainley, 1993, p. 8). The focus in this research is the knowledge which can be articulated and consciously focused on, although the latter type cannot be entirely disregarded as it forms the basis for the former.

In considering what counts as knowledge in the workplace, Zuboff (1998, in Allsop and Calveley 2009, p. 59) is quoted as saying that 'alongside the loss of opportunity for skill development brought about by automation, lies the opportunity to acquire new knowledge by those who have to interpret or "informate" the information obtained.' This possibility of being able to develop new knowledge by interpreting the information obtained is in line with Castells' (2001) concept of a knowledge economy that makes use of knowledge as its medium of exchange. Knowledge is critical in order for workers to function in a production sector that is continually moving forward with technological advancements. These continual advancements impact on what knowledge is considered important and '[t]he most skilled are those having complete knowledge of an entire process and the ability to use understanding of working in one area to comprehend what is happening in another.' (Ainley, 1993, p. 8)

2.4.2 SKILL

Skill can be conceptualised in two ways according to More; 'either as a necessary input to the efficient production of goods or as social artefact which comes into being through the artificial delimitation of certain work as skilled,' (More, 1982, p. 109) both of which have certain merit. Generally 'skill is equated with the competency to complete a given task with absolute certainty of result.' (Ainley, 1993, p. 10) However, Ainley then goes to suggest that '[r]eal transferrable skills in fact represent a different order of general level ability from the certain completion of specific tasks.' (Ainley, 1993, p. 12) The issue of competence becomes separate from skill as, although there

is competence in being able to complete individual tasks, as tasks are simplified the skill becomes about being able to coordinate individual tasks and manage the possibility of uncertainty (Ainley, 1993).

Maree points to the fact that the conceptualisation of skill that is currently prevalent is the 'concept of skill as competency associated with the performance particular activities.' (Maree, 2007, p. 586) This idea is then broken down further into three types of competency namely; practical competence as performing a set of tasks, foundational competence as the ability to understand what is being done and why, and reflexive competence as the ability to integrate performance with the performance of others (Maree, 2007, p. 586).

It is necessary to remember that workplace technology and labour process contributes to "reskilling", "deskilling", "multiskilling" or "upskilling" of the workforce (Allsop & Calveley, 2009, p. 60). Gamble points out that the 'manufacturing economy is usually equated with a shift to automation, with resultant worker de-skilling and alienation, as argued in Marxist and neo-Marxist discourse.' (Gamble, 1995, p. 6) Both of these highlight the changes to skill brought about by the increased automation of the manufacturing sector.

2.4.3 IDENTITY

While it is a fairly straight forward approach to identify changes in the organisation of work, as it relates to Marx' Labour Process Theory (Marx, 1976), and the concept of skill as the ability to perform certain tasks, it becomes more difficult to reach an understanding of identity. Once cannot study identity without concepts from a study of structural processes, organisational design, control strategies or the impact of wider social formations (Thompson & McHugh, 2002 in Allsop & Calveley, 2009, p. 60). This incorporation of wider elements of the social structure must be linked, however, to the fact that 'work is one of the primary means by which adults find their identity and form their character.' (Gini, 1998, p. 708)

The idea that identity is drawn from work gives rise to Hegel's proposition that 'man is alienated because human labour is alienated' (Mandel, 1970, p. 15). One explanation for this is that

> work is regarded as little more than a means to making money. One of the underlying reasons for this is that so few see, understand and participate in the whole purpose, process and the final product of our work. We are, to use Marx' term, alienated from our labour. (Gini, 1998, p. 709)

Gini refers to the concept of alienation as expanded upon by Marx. Marx draws on Hegel's concept of the alienation of human labour and goes on to propose that the 'causes of existing alienation are rooted in capitalism which was born and bred in the dispossession of the working masses from the means of production' (Novack, 1970)

which leads to the separation of the producer from the product. In the current context this is even more obvious as the worker is even further separated from the product as the machine takes the lead in manufacturing. Deutsch, in his analysis of the sociology of the American worker, suggests that the attitudinal impact of automation 'rang[es] from feelings of threat of displacement to work alienation to the altered relationship between work and non-work.' (Deutsch, 1969, p. 63)

Marx, however, situates his concept of alienation as a 'specific result of specific forms of social and economic organization.' (Mandel, 1970, p. 17) This ties to Olesen who suggests that the working class culture is central to the identity of wage labour and '[i]n this life world the traditional work identity is produced and reproduced – a laborious, very male self consciousness of craft and hard labour (Willis, 1978),' thus using Willis to situate the worker's identity in their current circumstances and tying work based culture and identity together, as per Gramsci's ideas (Olesen, 1998, p. 195).

Sennett presents what he calls a 'terrible paradox' in the modern bakery (Sennett, 1998, p. 72) in that, although it has become increasingly technologically advanced and the machinery more 'user-friendly', the workers feel demeaned by this new work organisation and can no longer bake the bread themselves. The technological advances mean that workers interact with the bread purely through the computer interfaces and do not come into direct contact with the end product, causing a loss of skill that leads to the experience of what Marx calls 'alienation' in the work place (Sennett, 1998). Gamble points out that the 'manufacturing economy is usually equated with a shift to automation, with resultant worker de-skilling and alienation, as argued in Marxist and neo-Marxist discourse.' (Gamble, 1995, p. 6) Carnoy does point out, however, that '[t]he factory system separated workers from their tools, but put them into a new organisation of work that gave them a new social identity,' (Carnoy, 2001, p. 22) because they were able to associate with each other around the new job descriptions that they had been allocated.

The concept of identity is based, in part, on Marx' identity concept of alienation – a lack of connection felt by the worker with the final product being produced. This ties to Sennett's previous analysis of bakery staff which points to the disjuncture between worker and final product (Sennett, 1998). It is in examining the disjuncture that workplace identity can be determined. Identity, for the purposes of this study, was examined in the light of two main concepts, namely the concept of alienation, as discussed above, and the idea that supervisors see themselves in a specific way as a result of the way in which work is organised in their workplace and their sense of responsibility for the final loaf produced.

Billet and Somerville (2004, p. 313) draw on Lave and Wenger (1991) to suggest that 'the processes of thinking, acting and learning at work are simultaneous and include the formation of working identities or subjectivities' and, in so doing, draw workplace identity into the discourse of learning in the organisation context. Workplace identity

cannot, however, be as clearly delineated as it may have been prior to the changes brought about by the impact of globalisation (Gamble, 2009). The notion of a single, collective identity formed within an organisational context is now only one form of identity available, albeit one that Gee (2000-2001) suggests is used in the context of 'new capitalism' as an ideological device by organisations seeking to bind people to themselves (Gee, 2000-2001 in Gamble, 2009). In contrast to this stable identity is the idea that 'the weakening of stable, unambiguous collective resources for the construction of identities consequent upon this new period of re-organising capitalism has brought about a disturbance and disembedding of identities and facilitated new identity constructions' (Bernstein, 2000, p. 72 in Gamble, 2009, p. 4), which leads to a different, more flexible form of identity.

Drawing on these concepts of stable and flexible identities, Gamble (2009) provides a structure for defining workplace or occupational identities that is centred on the way in which knowledge defines this identity, proposing that

> Weak occupational identities draw on a relational knowledge base dispersed across networks of social relations or affinity groups and are contingent on the market to which they relate (hereafter called "market identity"). Strong occupational identities draw on institutionalised identity resources that are underpinned by a stable collectively-held occupational knowledge base (hereafter called "occupational identity"). (Gamble, 2009, p. 55)

Gamble further provides a matrix of identity positions, reproduced below in Figure 2, which situates individual occupations within the various quadrants, drawing on the work of Basil Bernstein (1973) who 'makes a direct connection between the disciplinary knowledge base of an occupation and the notion of occupational identity.' (Gamble, 2009, p. 65)

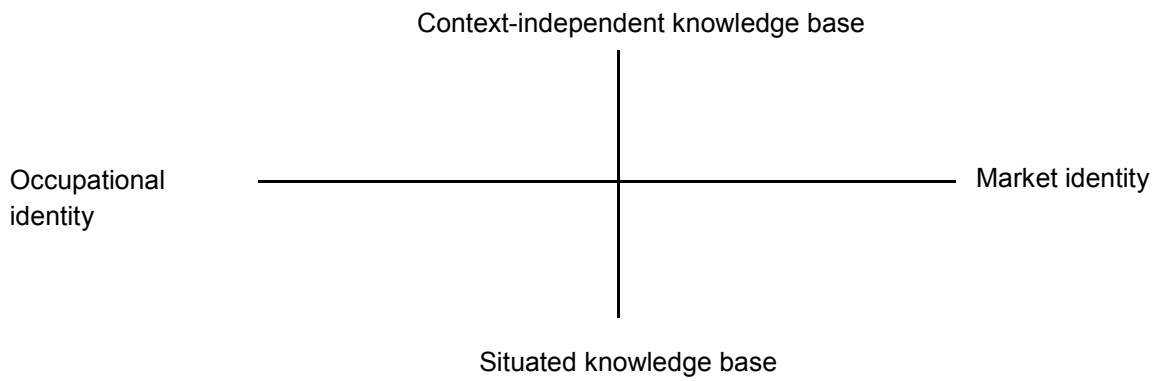

Figure 2: A matrix of identity positions in the workplace (Gamble, 2009, p. 61)

This matrix, which plots the interconnectedness of the disciplinary knowledge base and the strength of identity, will be drawn on in the final analysis in order to further unpack the findings on identity from chapter four. For the purposes of this study, the analysis of identity is extrapolated from the changes in the organisation of work that

result in changes to knowledge, skill and identity in the plant baking industry. Marx' Labour Process Theory, as discussed above, will be used as the lens to determine the changes to the organisation of work and, thereby, the changes to knowledge, skill and identity. These changes may then be fed into Barnett and Coate's (2005) framework in order to determine the potential implications for curriculum.

3. METHODOLOGY

This qualitative study focuses on shifts in knowledge, skill and identity of supervisors on the production line in the South African plant baking industry and the implications of this for curriculum aimed at providing them with training. The South African plant baking industry is one which has undergone, and is still undergoing, changes to its work organisation that make it a useful area of study for examining shifts in knowledge, skill and identity. The opportunity to study even one company in this industry provides insight into what changes are occurring in the industry and allows for a case to be made on how best to serve the industry through the curricula offered to its production supervisors. In considering an approach for this study, Altheide and Johnson's concept of analytical realism, which 'is based on the view that the social world is an interpreted world, not a literal world,' (Altheide & Johnson, 2011, p. 586) allowed for the incorporation of not just facts but also participant perceptions as forms of evidence to be considered. However, it is necessary to point out that in order to work from this perspective, 'it is imperative to embrace an interpretivist approach in our scientific and theoretical work.' (Altheide & Johnson, 2011, p. 582)

3.1 RESEARCH QUESTION

This study questions what historical shifts in the organisation of work, leading to shifts in knowledge, skill and identity, have occurred in the South African plant baking industry and what the implication of these shifts is for the curriculum used to train production supervisors. In order to do this, sub-questions were introduced to more clearly frame the study, namely:

1. What shifts have occurred in the organisation of work and how has this impacted on knowledge, skills and identity?

2. What are the current curricula?

3. How appropriate are the current curricula?

The second and third question allow for the identification of the current curricular landscape as a starting point in order to determine the need for changes to the curriculum, as well as providing insight into how this curriculum addresses knowledge, skill and identity. The first question focuses on the central element of the study, namely identifying what the impact changes to the organisation of work has had on knowledge, skill and identity. It is in analysing this impact that conclusions may be drawn in answer to the main question, what implication these shifts have for curriculum.

3.2 RESEARCH DESIGN

The aim of this qualitative study is to uncover the shifts in the organisation of work and their impact on knowledge, skill and identity in the South African plant baking industry by making use of Marx' Labour Process Theory as a lens. Labour Process Theory is used as a lens to examine the changes to the organisation of work in the bakeries in order to expose how the changes in automation that have occurred have impacted on labour and, therefore, knowledge, skill and identity. Max Weber suggested that 'in order to understand contemporary institutions one has to know how they had developed in history.' (Weber in Kieser, 1994, p. 609) Conducting a historical exploration of an industry allows for the identification of key periods in its history where the interplay between identity, skill and knowledge, as reflected in, and shaped by, the organisation of work, changed significantly. It is in the analysis of these key periods that it may be possible to identify changes in the way in which workers were trained as well as potential changes in their perception of themselves in terms of how they view their job.

This study does not, however, suppose to be a historiography or a purely historical study (Leedy, 1980, p. 89) but rather one which aims to use historical data to develop a chronology of events in order to provide a basis for further research on the implications that the chronological data has for curriculum development. The combination of historical data with data based on the participants' experiences could potentially make for a very broad data set if it is not contained within the bounds of a case study approach, particularly if the research is conducted across multiple plant baking companies with different approaches to the use of automation and that manufacture different types of bread products. Cooper and Walters (2009) suggest that the increasingly differential nature of learning and knowledge, as well as the specificity of knowledge to context, means that there is value in using the case study approach for research. Thus the decision was made to limit the extent of the study to one plant baking company in the South African industry. Furthermore, the case study approach allows for the retention of 'the holistic and meaningful characteristics of real-life events' (Yin, 2009, p. 4) that may be lost if the study becomes too broad. Although the case study was limited to one plant baking company, the company selected is one of the largest plant baking companies in South Africa with multiple bakeries in different provinces of South Africa and at different stages of automation.

3.3 DATA COLLECTION

3.3.1 DOCUMENTARY SOURCES

A key element of the original research plan was the use of archival resources from the South African Chamber of Baking (SACB) to provide the background information on the changes in the industry. An application was made to the SACB to gain access to these resources but the application was denied. This challenge necessitated a shift in approach in terms of the documentary sources and led to the decision to draw on a wider range of other sources of information. Similarities between the development of plant baking in the United Kingdom (UK) and South Africa allowed for the use of several UK sources which, when coupled with the use of the local information that was available in the public domain, provided a sufficient framework on which to base the analysis.

Further documentary sources were required to provide the necessary information on the current curricula. The SAQA (South African Qualifications Authority) qualifications addressed were drawn from the publicly accessible SAQA database (http://regqs.saqa.org.za/) of all qualifications currently registered on the National Qualifications Framework (NQF). Basic information about the SACB Certificate in the Theory of Breadmaking qualification was derived from their website while further information was sourced from the Learner Guide provided to candidates who have registered to sit the examination.

3.3.2 SELECTION OF PARTICIPANTS

Identification of an appropriate candidate company for the study was based on the principle of accessibility. Because of the need to have access to company employees in order to conduct interviews, as well as the possibility of exposure to sensitive information, permission had to be granted by the company management. The company chosen for this study was selected based on the ease with which access could be granted. In order to ensure a more representative sample, plants were identified from various provinces and at different stages in the automation process. Plants were selected from 3 different provinces – Gauteng, Western Cape and Kwazulu Natal – and from various regions in the provinces. A total of six plants were selected from the 13 bakeries that form part of the company. Table 1 indicates the spread of plants and number of interviewees at each plant.

TABLE 1: GEOGRAPHIC LOCATION OF PLANTS AND NUMBER OF INTERVIEWEES

Plant number	Province	Number of interviewees
1	Western Cape	2
2	Gauteng	4
3	Gauteng	3
4	Gauteng	3
5	KwaZulu Natal	4
6	KwaZulu Natal	3

The selection of these employees was based on their length of time spent in the industry as well as their knowledge of the changes that have occurred in the industry. Although the original focus was on the operators directly, this focus shifted to considering the role of a supervisor as they are the ones whose job aligns most closely with the original concept of what a baker is meant to be (i.e. the person responsible for baking bread). Original interviewees were identified based on the length of time spent in the industry, with the aim being to find those who had the most knowledge and experience in the industry. Further interviewees were recommended because they were identified as 'good' production supervisors. Table 2 gives an indication of the approximate length of time each interviewee has been in the baking industry. Interviewees were recommended either by the Human Resources Department or, in the case of many of the production supervisors interviewed, by the Bakery Managers of the specific plants. A snowball approach was used to identify further interviewees based on the recommendations of the original interviewees and a total of 19 interviews were conducted across the six plants.

TABLE 2: APPROXIMATE LENGTH OF TIME INTERVIEWEE HAS BEEN IN BAKING INDUSTRY

Interviewee	Number of years in industry					
	Unknown	0-5	5-10	10-15	15-20	>20
1.1	x					
1.2	x					
2.1						x
2.2				x		
2.3			x			
2.4						x
3.1			x			
3.2				x		
3.3						x
4.1						x
4.2						x
4.3				x		
5.1						x
5.2						x
5.3						x
6.1						x
6.2						x
6.3						x

3.3.3 INTERVIEWS

In-depth interviews of approximately an hour were conducted with all participants, first focusing on gaining an understanding of both how the labour process had shifted as well as the interviewees' personal work history within the industry. For the purposes of this study, interviews focussed on the actual bread production section of the bakery and the slicing and bagging section was excluded or only briefly mentioned. This was to enable more time to be spent interrogating the changes in that sector, and also because the slicing and bagging section makes use of a different workforce who require different knowledge and skills. Questions centred on how the interviewees viewed the industry as well the changes to the industry and machinery that they had personally witnessed. The questions asked were:

1. Please could you give me an idea of your work history in the baking industry?
2. How have you seen the industry change over the years in terms of labour and machinery?
3. What do supervisors have to know in order to do their job? (Knowledge)
4. What do supervisors have to be able to do in order to do their job? (Skills)
5. How do supervisors see themselves? (Identity)

There was, however, a subjective element to the interviews as it required interviewees to reflect on their own experiences of the workplace in order to explain their sense of workplace identity.

The second part of the interviews focused more specifically on knowledge, skill and identity and relied extensively on a methodology used by Mitchell in her study of curriculum in higher education (Mitchell, 2012). This methodology made use of the Barnett and Coate (2005) model for curriculum that depicts knowledge, skill and identity in relationship with each other using circles. Based on Mitchell's methodology, the approach was adapted to accommodate the expected abilities and skill levels of the proposed interviewees. Interviewees were asked to conceptualise three circles in relation to their answers to the questions on knowledge, skill and identity. The interviewer referred to their answers to the last three questions referenced above, to ensure they understood the three elements. The interviewee was then asked, for each of their answers to those three questions, to draw a circle on paper showing the importance of that aspect by relating the size of each circle to the importance of that particular element.

3.4 DATA ANALYSIS

3.4.1 TRANSCRIPTION AND COMPILATION

Due to the nature of the recordings and the quantity of interviews conducted, the decision was made to make use of a professional transcription service to transcribe the interviews. Due to the technical nature of certain of the terms used by the interviewees there were errors in the final transcriptions however, combined with the interviewer's notes, it was possible to report accurately on what was said.

The large number of long interviews produced a lot of data for analysis which needed to be compiled into a more usable set. This was done through the inputting of the data into a Microsoft Excel spreadsheet under appropriate headings. The classification of data into various headings allowed for a clear depiction of the findings presented in the interviews and enabled interpretation of the findings according to where they occurred in the interview and, therefore, what they applied to. The results of the second part of the interview, the circle exercise, were recorded according to the way in which the concepts were ranked by the interviewees. This information was also recorded in the spreadsheet.

3.4.2 ANALYSIS

Using the information gathered from the documentary sources, the first part of the interview was analysed according to changes in the labour process in terms of the way in which both labour and machines had changed. By examining the changes in the organisation of work as a result of the changes that had occurred in the interviewee's

work environment, it was then possible to examine the second part of the interview and determine what each interviewee considered to be the most important element in how production supervisors should be trained in order to cope with the changes in automation. It was also possible to look at how the changes had impacted on their understanding of what production supervisors needed to know and understand, as well as how they need to see themselves within the manufacturing environment.

The current curricula were analysed using the three elements of the Barnett and Coate (2005) framework, identified in the form of knowledge, skill and identity, as well as by looking at their approach to the organisation of work. These findings were then used as the basis for considering the appropriateness of the current curricula.

3.4.3 VALIDITY, RELIABILITY AND LIMITATIONS

The ability to establish an empirical base for the findings reported in chapter four (Brown & Dowling, 1998), results from the large number of interview candidates across a number of sites. The use of a range of interview candidates across different sites allows for the verification of data in terms of the triangulation of the reporting. After 19 interviews, a degree of saturation was reached and no new information was being communicated. The one concern raised in terms of the limitations related to the demographics of the study as, although it reflected the demographics of the company, only one female employee was interviewed and all the production supervisors interviewed were either coloured or African. The case study approach used, however, implies the need to focus the study on the company within which it is situated and, as result, draws on the idea that 'validity is relative to purposes and circumstances.' (Maxwell, 1992, p. 283)

Analytical realism proposed that 'all knowledge is contextual and partial;' (Altheide & Johnson, 2011, p. 581) and allows for the contextualisation of evidence, however the potential for the generalisation of the study's findings is limited by the interpretive case study approach used as the applicability of the findings to another company may influenced by the inclusion of extra, unknown, variables in the new context (Brown & Dowling, 1998). It must be considered, though, that despite the inability for empirical generalisations, there is still the possibility of generalisation in the realm of the theoretical concepts of this study. The approach to sourcing interview participants involved preselection by those in management, leaving open the possibility that findings may have been skewed towards a particular response as a result. This is, however, countered by the fact that participants were allowed to speak freely and assured of confidentiality of all information divulged. This leads to an increase in the feasibility of 'synchronic reliability' (Kirk & Miller, 1986) as interviewees' statements could be referenced to each other to ensure validity of reporting. Copies of all recorded interviews and transcripts have been retained for reference purposes.

For many participants it was not easy to conceptualise and talk about the knowledge and skills that they have. This means that certain of the participants may not have been able to fully explain themselves in their understanding of the knowledge and skills required – although the use of repetition and clarification in the questioning technique did appear to assist participants in more accurately explaining themselves. The use of Mitchell's (2012) tool also raised some concern as it was uncertain as to whether the participants would be able to grasp the transferral of the abstract concepts of knowledge, skill and identity into the circles they were required to draw as depictions. This concern was soon allayed as participants demonstrated a clear grasp of the abstractions required and were able to plot the circles in a way that reflected their approach to the importance of the three concepts.

3.5 ETHICS

The main ethical concern in this study relates to the confidentiality required by the industry and the company involved in particular. While no names are mentioned, competitive advantage is essential in order for companies to maintain market share and thus great care was taken in ensuring that only the bare minimum is included in terms of reporting on current automation trends that have been adopted by the company concerned. The name of the company concerned, together with the brands and all company-specific products, have been removed from the reported findings in order to maintain confidentiality.

In terms of the ethical considerations that come into play when conducting interviews, voluntary participation is essential and no employee was coerced into being part of the study (de Vos, et al., 2011, p. 116). All employees were informed that they could withdraw at any point and signed a consent form (see Appendix 1) stating that they were aware that the information was being used for research purposes. The forms were explained in detail to the interviewees and the opportunity for them to ask questions in order to gain clarity was provided. All signed forms have been kept on file should there be any queries. No information gained from the interviews was discussed directly with management and care was taken to avoid identifying interviewees in the reporting process.

4. WORKPLACE FINDINGS

This chapter focuses on presenting the information gathered as a result of the interviews and research process. A large quantity of information was gathered and has been classified into two main categories for the purposes of reporting; firstly information about the organisation of work in the various bakeries, further divided according to bakery type, and then information on knowledge, skill and identity drawn from the interviews conducted. The information in this chapter is drawn from the interviews conducted across all six bakeries, as well the circles drawn by the participants, observations of the work environment, and documentary sources. These findings provide an interesting insight into the situation that production supervisors find themselves in, as well as insights into how the bakeries are changing, and have changed, over the last few years, as reflected in their organisation of work.

4.1 ORGANISATION OF WORK

> technological innovations, such as computer-integrated manufacturing systems, will lead to an overall reduction in the amount of labour that is required; a shift in control away from machine operators to skilled technicians (Gamble, 1995, p. 9)

Within the plant baking industry, bakeries can be classified into three categories; manual, semi-automated and automated. This classification is based on the level of automation in the plant and their production capability (South African Chamber of Baking, 2010). The manual bakeries are the least automated type of bakery where the bulk of the processing requires manual labour and maintains a level of similarity to the original 'craft' bakeries by virtue of the need for human input into the process. Manual bakeries make use of a large labour contingent, many of whom perform unskilled jobs such as pushing trolleys full of pans in and out of proovers or adding raw materials into the mixers. Although semi-automated bakeries also make use of a certain amount of labour to perform unskilled jobs, many of these jobs have been automated, thereby reducing the size of the workforce (South African Chamber of Baking, 2010).

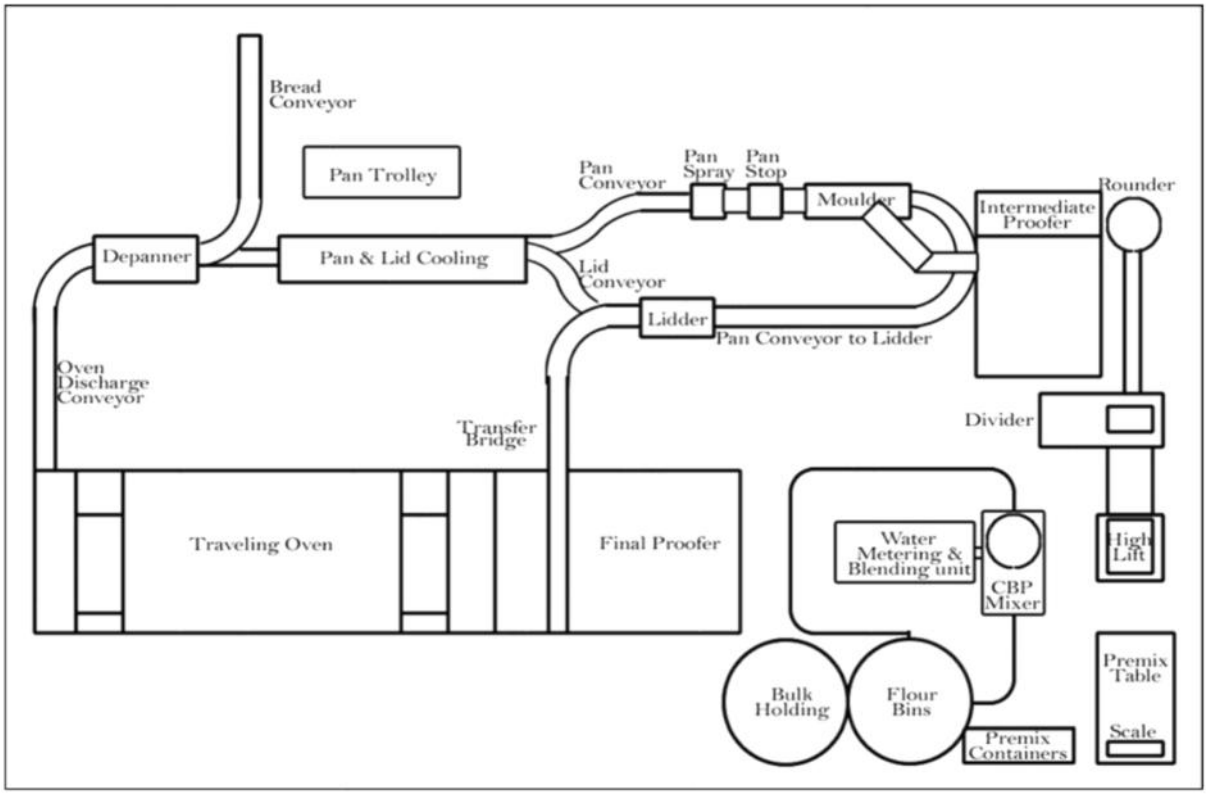

Figure 3: Diagram of a semi-automated plant bakery
Source: (South African Chamber of Baking, 2010)

Both the more manual and semi-automated bakeries make use of a batch production system whereby dough is mixed in batches in a high speed mixer before being fed into the rest of the production process. In the semi-automated bakery environment, as can be seen in Figure 3, premix is added directly into the mixer by hand while water, flour and yeast are pumped in by a computerised system. These ingredients are then mixed at high speed to form the bread dough. The development of the high speed bread production process, known as the Chorleywood bread process, in 1961 (Baker Perkins Historical Society, 2013), meant that large scale bakeries were able to drastically increase the speed of mixing and thereby increase the speed of production. High speed mixers came into general use in the UK by 1965 (Baker Perkins Historical Society, 2013) and were introduced in the 1970s into South African plant bakeries (Baker Perkins Historical Society, 2013), with the first mixers already installed by the time the first interviewees joined their bakeries. The mixers most commonly used in South Africa for this high speed process are called Tweedy mixers (see Figure 4) and they make use of pressure and vacuum systems which further increase the speed of the mixing and, therefore, the production process.

Figure 4: Example of a Tweedy mixer
(Source: http://www.wotol.com/images/thumbs/800x800/747222_750a5d9141ba7f16eb101b76a4d33e58.jpg)

From the mixer, the dough is transferred by a high lift into a hopper that channels the dough through the divider. The divider portions the dough out into the correct weight for an individual loaf before the dough is rounded and goes through the first proover. The proving process allows the dough to rest before it is moulded into the loaf shape and put into the pans. As the pan moves into position in order to be filled, it runs through a section that sprays oil into each pan to prevent the bread from sticking.

There are very few fully automated bakeries in South Africa as the technology is still very new (Interviewee 5.2). The most significant difference between semi-automated and automated bakeries is in the mixing system, with the transition from a batch mixing system that still requires an operator to run the machine to a continuous mixing system (see Figure 5) that no longer requires any direct intervention from an operator once it is running. The dough feeds directly onto a conveyor from the mixer and then moves into the rest of the production process. The rest of the production process is fairly similar to that of a semi-automated bakery although more use is made of robotics to perform previously manual tasks.

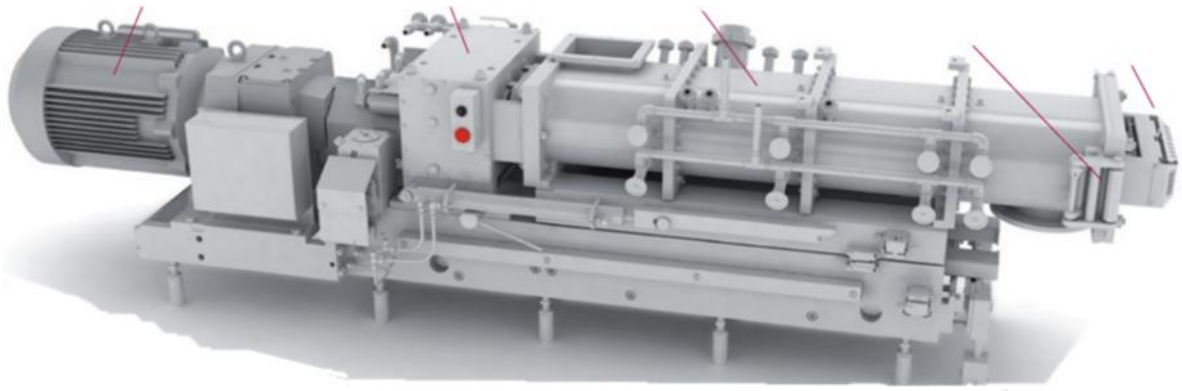

Figure 5: Example of a continuous dough mixer
(Source: http://www.wpib.de/fileadmin/downloads/broschueren/wpib/ZPM_Kneter-gb.pdf)

In more automated bakeries, conveyors are used to move pans around the bakery. Pans are normally banded together in sets and, depending on the type of bread being produced, a lid may be placed over each set before the pans are moved to the proover. The proving process allows the dough to rise before it goes into the oven and the proover time and temperature are carefully controlled to ensure the bread rises properly. The pans move through the proover at a set speed and then move into the oven for baking. Again the oven time and temperature are carefully controlled to ensure the optimum baking time. The use of travelling ovens where the pans move through the different sections of the oven at a set speed, entering on one end and exiting at the other, means that the production process runs continually and is not held up by bottlenecks at the proover and oven (South African Chamber of Baking, 2010). Once pans exit the oven, they are delidded and the baked bread is depanned before it enters a cooler and moves into the slicing and bagging section. Pans and lids are cooled and then moved back to begin the process again. Although in the more automated bakeries there are fewer unskilled jobs such as loading pans on and off the conveyors, operators are still required to run the machines and perform basic quality control functions. Depending on the bakery, production supervisors may fulfil the role of an operator for the oven and proover section due to the need to make decisions around time and temperature that affect the final product.

Each bakery in the study was at a different level in terms of the amount of automation it had undergone, with bakery six the most manual bakery in terms of machinery and bakery five on the other end of the spectrum as the most highly automated of the bakeries studied. The other four bakeries comprise a mix of manual tasks and automation with the emphasis on the continual upgrading of the plant towards being more automated but, currently, they can be classed as semi-automated. Within the plant, the machine that controls the process and determines the speed of the rest of

the line is the mixer (South African Chamber of Baking, 2010). When making changes to the mixing process, the rest of the line is directly impacted. This means too that the mixer operator is seen to have seniority in the plant and it is generally mixer operators who progress to become production supervisors (Interviewee 2.2). Because the mixers are often more technologically advanced, the mixer operators very often also need to understand how the mixer's computer interface works. All bakeries in the study make use of Programmable Logic Computers (PLCs) in order to control the machines on the plant. The use of PLCs is not new, with the first PLCs already being used in the early 1980s (Interviewee 3.3). There are, however, differences in their use now as opposed to previously. Previously they were very simple and only used on certain machines whereas their use is now widespread throughout the plant. The interface has also changed with the new PLCs making extensive use of touch screen technology.

The general consensus from those interviewed was that the actual baking process has not changed much in the last 30 years, the changes were only to the machines themselves in terms of increasing automation (Interviewee 2.3). The raw materials, although added differently, are still the same and the machines, despite the automation, still operate on the same principles. With the introduction of the upgraded mixers also came changes to the way in which raw materials were delivered to the mixer. Originally, the ingredients were added manually to the process and operators were required to add sacks of flour directly into the mixer (Interviewee 6.2). All plants now make use of flour silos whereby flour is automatically added directly to the mixer through a pipe system that is controlled by a computer system. Although the addition of the other dry ingredients is still manual in most plants (the exception being bakery five), they are no longer individually weighed out as the individual ingredients have been replaced by a premix which contains all the required ingredients and is delivered in one mix ready for weighing and adding. The other two most important raw materials are yeast and water, both of which were added manually originally but are now added to the process using a computerised system. This is particularly significant for the addition of water as the computer is now responsible for calculating the required water temperature in order for the final dough released by the mixer to be at the correct temperature whereas, previously, the mixer operator or production supervisor was responsible for this calculation. Dough temperature is still closely monitored but, with the most automated systems, even the need to manually measure temperature readings has been removed.

When asked to identify the biggest change in their plants over the time that they have been involved in the baking industry, five of the 19 interviewees mentioned the increase in speed as the most significant change they had seen. As the plants have become more automated, there has been a marked shift in the speed at which the plants product loaves, with some bakeries doubling their production speed – bakeries four and five, for example, have doubled the number of loaves per hour that they are able to produce (Interviewee 5.2). This is mainly due to the increased automation of

their plants and in spite of the decrease in the number of operators required to run the plant. The increase in automation of the plants has led to a decrease in the amount of workers required to operate these plants. Previously, a much larger labour contingent was required to operate the plant as jobs such as the oiling of pans, moving of trolleys around the plant and loading and unloading of ovens, proovers and coolers was all done manually. This decrease in labour is most obviously seen in bakery five as it is the most automated.

4.1.1 ORGANISATION OF WORK IN A MANUAL BAKERY

Bakery six is a smaller bakery than the other five and has remained fairly manual, although it has undergone an automation process in certain parts of the plant. The three interviewees from bakery six have all been in the baking industry for approximately 20 years or more and, reflecting on how the bakery has changed, one interviewee who has been with the company for over 20 years, and in baking for over 30 years, recalled how:

> In those days there was a lot of manual work so a lot of heavy stress related work, you know like loading ovens and unloading and de-panning by hand and all that sort of stuff and being in the baking industry its 24 hour, 365 days a year, no break space.
> (Interviewee 6.1)

Because of the demands of working in a manual bakery, a much larger workforce was required compared to the current number of workers per shift. The plant, although still fairly manual, requires ten less workers per shift than it previously did (Interviewee 6.3). This is a result of the three rebuilds that have been done, each rebuild resulting in a more automated plant. Bakery six is the only bakery that does not make use of Tweedy mixers, opting instead for the Diosna mixer which, although it operates along the same principles, is not quite as technologically advanced as the Tweedy mixers (Interviewee 6.3).

It is not just the mixing process that differs in bakery six. Although Interviewee 6.1 mentions in his career history that he worked on the first travelling oven in the country in the mid-1980s, bakery six only changed much more recently from the old deck oven, where pans had to be slid in and out, to a more automated travelling oven. However, even though the oven is more automated, it still requires labour for the loading and unloading of pans onto the conveyor. Up until fairly recently the lidding and delidding of pans and the depanning of bread after baking were also manually done, however this process has now been automated. Automation is viewed as beneficial, not only because of the increase in speed and production, but also because, as one of the interviewees put it:

> it's continual improvements we have to do. With automation firstly we get less damages that way and obviously better quality, we get less stuff being touched and carried around so it's food safe as well and also we got to compete with continuous

> rise in costs which of course is fuel, electricity and ingredients you name it. So our main object is sort of focused on cost cutting all the time, which will be from labour down to, say automation. (Interviewee 6.3)

In this bakery the cooling process is also still done manually as the bakery does not have an automated cooler. Bread is left to cool on trolleys on the bakery floor before being moved to the slicing and bagging section. This is, however, envisaged to be the next section of the plant to be automated. This will have further implications for the number of workers per shift as they will no longer be required to load trolleys and move them around the floor. These changes to bakery six are a reflection of what appears to be a general trend in the industry, namely a moving away from manual labour and a corresponding increase in the level of automation.

4.1.2 ORGANISATION OF WORK IN SEMI-AUTOMATED BAKERIES

Although they were not all at the same level of automation, four out of the six bakeries at which interviews were conducted could be classified as semi-automated bakeries. Bakeries, one, two, three and four are all considered to be semi-automated as they make extensive use of computerised machines in the process, however they also still employ a fair number of workers as operators and, in some cases, unskilled labour for certain of the manual tasks still performed, such as loading and unloading pans on the conveyors.

Bakery one has undergone a fairly intensive automation process with almost all unskilled manual labour jobs being eliminated. Operators are, however, still required to run the machines and the plant makes use of Tweedy mixers that are controlled using PLC screens. Originally the plant was a manual one where flour was added from bags and yeast was added in block form whereas now flour, water and yeast are added through a batching system directly from the silos into the mixer bowl. There has also been an increase in the capacity of the divider that portions out the dough and the number of lines running has been increased from one to two, thereby increasing the capacity of the plant from 4000 to 6000 loaves per hour (Interviewee 1.1). Manual jobs such as oiling the pans before the dough is inserted, as well the manual loading and unloading of pans, are now also done by machines which decreases the number of workers needed per shift (Interviewee 1.2). Most machines are also now operated using PLCs and make use of inline scales to conduct quality checks, advancements which require additional skills from the operator as well the production supervisor managing the line, as will be discussed further below.

In the instance of bakery two, the bakery moved from very basic CC180 mixers to the Tweedy mixers which make use of vacuum pressure (Interviewee 2.1). The bakery's production scale has also been increased by increasing from two to four mixers in total, with two per plant. Despite these increases, the bakery remains fairly manual in certain respects, for example pans are still packed on and off the conveyor belts by hand, which means that the plant still requires a larger number of workers per shift

than the more automated plants – 22 per shift. Interviewee 2.4 from bakery two tied the increase in automation to the change in the product being produced. Previously South African bakeries were required to produce a standard loaf to government specifications whereas now the companies are able to differentiate themselves based on different types of bread loaves marketed under different brand names. Having been at the same bakery since 1988, when asked whether things had changed, the interviewee made the observation that:

> they have. Not that much because back then we didn't have things like vacuums and the pressure on the mixers and we were doing the standard bread which is, they call, what do they call, commodity bread. (Interviewee 2.4)

Also known as the government loaf, this loaf was strictly standardised and bakeries had no need to advance technologically as the product and price were standard. Once the government loaf was done away with in the early 2000s, however, technological advancement and increased quality became essential in order for companies to remain competitive. As an interviewee pointed out:

> back then we just made bread. We didn't care about you know those things, hygiene and stuff. But now you know people are so orientated into that thing, you know our bread has to be perfect. (Interviewee 2.4)

The changes in quality have further influenced the drive towards automation by enabling less human contact with product and thereby avoiding contamination.

Bakery three is considered to be an older semi-automated bakery although improvements have been made to the plant. According to Interviewee 3.3, speaking from a maintenance perspective, the plant is 'in good working order' but will eventually need to be further upgraded. Interviewee 3.1 pointed out that there is room for further automation as the plant still uses labour for certain parts of the process, such as loading and offloading pans from the conveyors. Changes have been made to the PLCs on the plant with the PLCs becoming smaller and more efficient. The increase in automation is seen as increasing the efficiency of the plant, as control is removed from the operators and the focus has shifted from operating to monitoring the process. In terms of the effect that this increase in automation has had on the operator's sense of responsibility for what they are doing, the view of one of the interviewees was that:

> It's just taken that control out of their hands, but you know the function that they do is so vital and critical. We need to go a step further, much more automation, much more control and it will have to be, it will have to be programmed. You know, computer programmes that need to be controlled and alert you of problems. (Interviewee 3.3)

Thus, as this interviewee points out, the increase in automation has removed responsibility from the operators as the control that they once had over the machines has been removed and, instead, been programmed into the computers that now run the system. There is a definite opinion that increasing the automation of the plant is

necessary and good for the company, although this was countered by Interviewee 3.3's observation that the increased speed and changes in products have also caused problems from a maintenance perspective.

Bakery four has undergone three upgrades and over the years has become more automated, particularly in terms of the control functions. Control of machines was originally done using an electrical relay control panel whereas it is now done using more PLC and computer controls. Although computerisation and automation has increased, the only real difference for the operator using the control system is that it is now a touch screen instead of a physical button to be pressed.

Many of the changes to bakery four were only implemented from the early 2000s onward and, prior to the upgrades, the plant was very manual and produced only 2 000 loaves per hour (Interviewee 4.2). Operators followed a manual recipe, manually loaded the ingredients into the Tweedy mixers and had to manually load and unload the proover and oven. The upgrades made to the plant have increased the automation of the mixers and computerised the raw material loading. These changes, together with the other upgrades on the plant, have increased production to 4000 loaves per hour on the old plant. A second, more modern, plant has also been installed at the bakery and this plant produces 6000 loaves per hour (Interviewee 4.2). Not only has production increased but the overall quality of the bread, as well as process hygiene and food safety standards, have also improved as approximately 95% of the product is handled by machines (Interviewee 4.2). One of the interviewees who has been in the industry for over 20 years and who has worked his way up from being a cleaner, recalled that:

> Technology helped us a lot. Most of us we are afraid when technology comes in, we're gonna, we gonna, lose our jobs, but the company was growing and growing and the plant was upgraded to another site of this factory. (Interviewee 4.2)

The biggest challenge that did arise from the plant was the increase in the speed of production, from 2000 to 4000 loaves per hour.

Changes to the organisation of work did, however, allow interviewee 4.2 to move from working as a cleaner to working in the baking process itself. This was due to decisions made by the company to focus only on the core business of bread production and to outsource support functions such as cleaning to external companies. These changes removed certain unskilled jobs from the company's division of labour, in this instance allowing interviewee 4.2 to move into baking.

The changes to the organisation of work through the increased automation of semi-automated bakeries have been significant. These changes in automation have, in turn, caused changes in the division of labour within the bakeries, particularly in terms of the reduction of unskilled jobs, as the amount of manual labour required on the plants decreased with each upgrade.

4.1.3 ORGANISATION OF WORK IN AN AUTOMATED BAKERY

The original plant at bakery five, opened in 1991, was still a fairly manual semi-automated system using Tweedy mixers and a batching system. The new, fully automated plant was built recently with the biggest change, compared to the previous plant, being the installation of a continuous mixing system instead of the previous batch mixing system. This required a completely new type of mixing machine and the continuous supply of raw materials into the process. Raw materials, including the premix which still had to be added manually in the semi-automated system, are now added continuously in computer measured quantities directly from the silos.

Interviewee 5.2, who has been with bakery five for approximately nine years and was directly involved in the commissioning of the new continuous mixing plant, made the observation that the biggest change has been the increase in speed over the last three to five years whereby now 'you need to run keep up with the pace' in comparison to the previous plant. This is seen directly in the production output of loaves per hour – previously the old plant produced 4000 loaves per hour while the new plant now produces 8000 loaves per hour (Interviewee 5.3). Despite this doubling of production, the number of workers per shift has actually decreased. The old semi-automated plant required 15 people to run the production line whereas the new automated plant only requires five (Interviewee 5.3). This reduction by two thirds is due to the reduced need for operators to interact with the product directly. It is now almost possible for a loaf to move through the process almost untouched by human hands.

Interviewee 5.2 also mentioned the impact of the increased automation on the current production supervisors who had come from the previous plant. After the original implementation of PLCs in the old plant, there was a tendency of operators and production supervisors to make mistakes due to 'finger trouble' – pressing incorrect buttons. With the commissioning of the new plant, one or two of the supervisors latched on the new system quickly, seeing it as a way of 'making their lives easier' while some of the older (old or older in this context refers to time in the industry as opposed to chronological age) supervisors battled to adapt. As interviewee 5.2 states:

> I think that's the only thing that the old school supervisors might be a bit scared of, they see this fancy screens and they freeze. But the knowledge that they got in baking bread I think is still the most important you know, to know their product, to know when something goes wrong, where to start looking, then he can go back on track again.
> (Interviewee 5.2)

The nature of the automation means that the focus of the operators is also less on the direct operation of the machines and more on monitoring the process. This subsequently impacts on the production supervisor whose role also becomes more managerial as they are then tasked with managing operators more than managing the process (Interviewee 5.3). Supervisors are still responsible for the inputting of recipes and temperatures into the process using PLCs but at the same time have been given

greater control around the managing of their work team. The role of the artisan in maintaining and problem solving on the machines has also increased as they are the ones familiar with the technology and most able to rectify problems or reset the process (Interviewee 5.2).

4.1.4 DIVISION OF LABOUR: THE ROLE OF THE SUPERVISOR

The role of the supervisor has changed with the increase in automation and the change in the organisation of work as well. Where previously the mixer operator simply needed to add the correct amount of each raw material directly into the mixer (Interviewee 6.2), now the production supervisor is required to programme the recipe into the mixer in order for the silos to deliver the correct amount of raw materials directly into the system. There is, however, no longer a need for the production supervisor to calculate the required water temperature as this is now controlled by the automated system. The control of the system has also shifted with much less control resting with the operators and more control resting in the monitoring of the process by the production supervisors. This shift in control is most obviously seen in the automated bakery, bakery five, with the reduction in the number of operators required to run the plant (Interviewee 5.3). Interviewee 5.3 also pointed out that in the automated bakery, the role of the supervisor becomes more managerial as they are tasked with managing the operators as well. This shift in the role of the supervisor directly impacts on the knowledge, skill and identity that they require to function in that role effectively.

4.2 KNOWLEDGE, SKILL AND IDENTITY

According to the interviewees, the shifts that have occurred in the organisation of work, particularly with the increase in automation, have led to changes in the knowledge, skill and identity required by both the operators and production supervisors, although the shift is most significant for the production supervisors. They can no longer merely exist in the role of a 'glorified operator' as a lot more pressure has been placed on them and they are required to take on much more responsibility than previously.

4.2.1 KNOWLEDGE

Mirroring the statement that while the machines have changed the bread making process has not, is the finding that the knowledge required has not changed very much over the period examined. If knowledge is defined as what someone needs to know in order to do their job, the knowledge required remains limited to the process of bread making. Bread making knowledge focuses on the raw materials and machinery required to make the bread, with a small section of knowledge on bread faults. There have, however, been some extensions to the knowledge with the introduction of automation as the minimum knowledge required has expanded to include literacy and numeracy as prerequisites, as well as some computer literacy, whereas before these

could be progressively developed while already employed. The current minimum requirement for employment is a grade 12 matriculation certificate whereas previously it was possible to bring in someone at a much lower level of education (Interviewee 5.3).

The change in the entry requirements is not the only difference in the knowledge required by production supervisors. Although literacy and numeracy have increased in importance as production supervisors are required to fulfil more reporting requirements, different bakeries place importance on slightly different areas of knowledge. The more automated the bakery becomes, the more the emphasis is placed on production supervisors needing to be literate as well as trained in the baking process. For bakery six, the most manual bakery, when an interviewee was asked what production supervisors needed to know in order to do their job in the bakery, the response centred on the supervisor's knowledge of the basic operating instructions for the plant and that 'they basically need to know how to run that machine, what faults occur on the machine, how to solve those faults.' (Interviewee 6.1) In comparison, at bakery five, the most automated of the bakeries studied, the need for production supervisors to have a higher level of literacy and numeracy is important as they need to understand the process in order to effectively oversee it. The supervisors are required to interact with the PLC screens and to be able to complete production calculations (Interviewee 5.3). The change in what supervisors need to know between the manual and automated bakeries impacts on how they perform their tasks. Interviewee 3.3, who has spent 28 years in the baking industry at various bakeries, explained that:

> …in those days they [production supervisors] weren't equipped with the knowledge of the product, technical knowledge. Today they are [while] then it was purely experience, which worked because they were so experienced they could, they could rectify something by just looking at the product and knowing what to do. And whereas the guys now look at the product with technical knowledge and tell [sic] what to do. If you understand what I'm saying. They know the effects of what they done or if they see a result they'll know why it's no good. And they'll go back and fix it.
>
> (Interviewee 3.3)

This increase in the problem solving knowledge requirement enables production supervisors to more effectively manage the process and machines that they are responsible for. The problem solving knowledge ties in with the supervisor's knowledge of bread faults and should provide them with the knowledge to be able to solve problems effectively on the line. Problem solving is an area that actually falls under all three elements of knowledge, skill and identity as, once the supervisor has the knowledge, they then need to develop the skill of implementing that knowledge on the production line and it needs to feed into their confidence in their identity as production supervisor.

4.2.2 SKILL

With skill being defined as what the operator must be able to do in order to do their job, the ability to operate the machines remains important. However, particularly for production supervisors, this has been overshadowed by the need to monitor machines as opposed to directly operating the machines. The bulk of the operational element has now been migrated to a computerised system which decreases the skill component in terms of actual operation. An interviewee from the most automated bakery, bakery five, stated that skill had been devalued with the increase in automation and knowledge and identity were now the most important elements (Interviewee 5.1).

The skills required for the current semi-automated and automated plants have become more focussed on recording requirements and the operator's ability to follow the machine's Standard Operating Procedures – documents that tell the operator what to do in a step-by-step approach. The use of PLCs requires basic computer skills although, particularly in the most automated bakeries, the systems are very simple to operate, as alluded to by one interviewee from bakery five, who stated that 'if you can operate a cell phone you can do most of this.' (Interviewee 5.2)

Skills required by production supervisors have extended further into the realm of 'soft skills'. Whereas previously it was sufficient merely to be able to operate all the machines on the line, current production supervisors are also required to manage their team and solve problems on the line. The communication and people skills required to function as a production supervisor are at a much a higher level than before and something that all the supervisors interviewed saw as a critical component of being a supervisor. The need for communication and people skills is directly linked to the need for production supervisors to function in a junior management role instead of being strictly in a production role. For certain of the bakeries, this need for junior management skills has extended to requiring production supervisors to be able to operate in the area of basic human resource management skills, for example the handling of simple disciplinary hearings (Interviewee 2.4). Previously this would not have been in the skillset of a production supervisor as they were only expected to have production skills.

4.2.3 IDENTITY

The shift in skill requirement is directly linked to a shift in the identity of the production supervisors away from simply being an operator with extra responsibilities to one of being part of the management team. The devaluation of skill referred to by interviewee 5.1 was linked to an increase in the importance of identity for production supervisors as they felt this was more necessary in order for the production supervisor to function effectively in their current role in an automated bakery. Figure 6 shows the results of part two of the interviews where interviewees were asked to depict the importance of knowledge, skill and identity in the form of different sized circles.

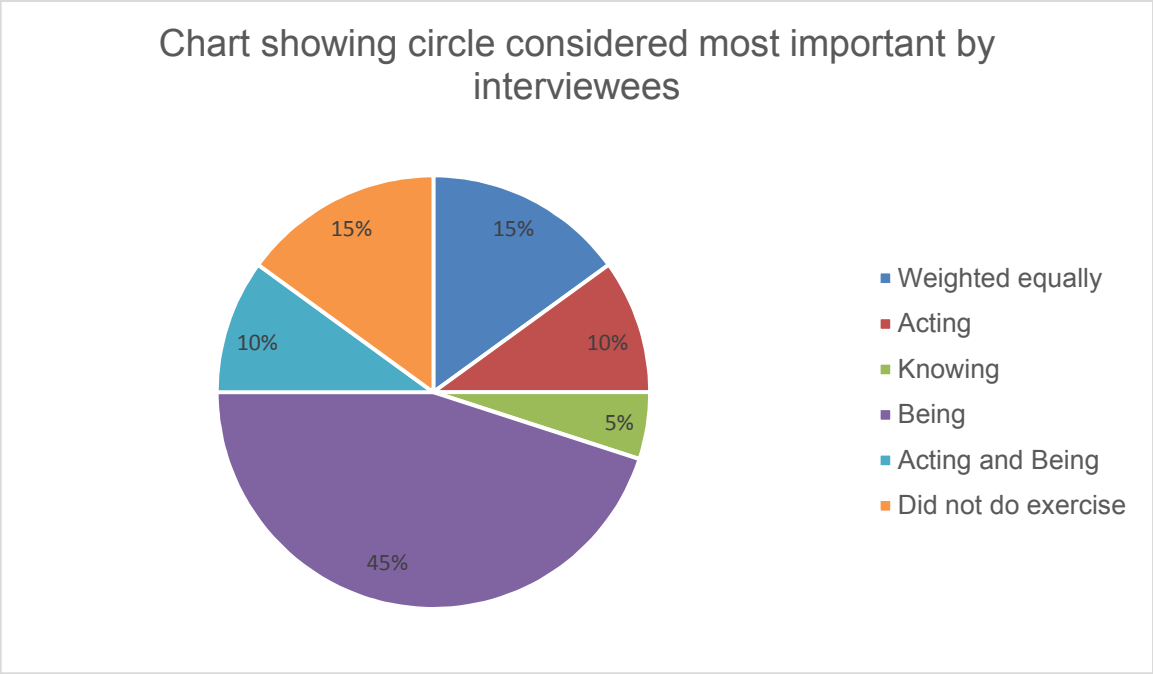

Figure 6: Chart showing circle considered most important by interviewees

It is evident from this chart that the largest percentage of those interviewed consider the concept of being, referred to in the interviews as identity, as the most important element in the development of a curriculum for production supervisors. 45% of those interviewed weighted being as the most important element while 15% weighted all the elements equally and 10% weighted acting and being as the most important. A further 10% weighted acting as the most important element and only 5% weighted knowing as the most important. 15% of the interviewees did not complete the exercise.

All the interviewees agreed that the old production supervisors who had come into the position when the bakeries were still fairly manual viewed themselves as bakers. Because of this, current production supervisors still defer to the older supervisors in the area of problem solving as the new ones lack confidence and the older supervisors are seen as the ones who know the bread making process more intimately and are much more familiar with the final product. While more than half of those interviewed maintained that production supervisors still fulfil the role of a baker, in general there was a distinction between having to be 'just a baker' and the idea that the current production supervisors are required to be 'more than just a baker.' This distinction comes due to the shift from operator to junior management as their responsibilities move from just managing the process to managing their team, food safety and quality and the bread making process. There is a definite increase in their sense of responsibility; however, linked to the development of their team leadership role, is the perception on the part of six of those interviewed that some production supervisors are no longer interested in seeing themselves as bakers, having shifted instead to the idea that they are only responsible for the people in their team. Interviewee 6.1 stated that the production supervisors '[s]till see themselves in the role of a baker but more like in a supervisory position than to actually doing the job themselves.'

4.3 CONCLUSION

The organisation of work in the plant baking industry has shifted substantially with the increase in automation. Within each of the three categories of plant bakeries discussed change to the organisation of work is evident, with the drive towards automated bakeries clearly evident in the changes that have been made to each bakery. The increased automation of the 'tools' or machines has directly impacted on the division of labour in the bakeries with a decrease in the amount and type of labour necessary to operate the more automated bakeries. These changes in the division of labour are evident in the findings that there has been a decrease in the number of manual tasks that need to be performed, as well as in the way in which the operators' control of the machines has been removed and they have been moved into more of a monitoring function instead.

In terms of the requirements for production supervisors operating in the more automated bakeries, the change in the division of labour and, thereby, the role of the supervisor, has led to shifts in the knowledge, skill and, in particular, the identity they require, according to those interviewed. The shift in identity has been significant, particularly in terms of the emphasis placed on it by the interviewees, with the idea that production supervisors are no longer required to be 'just a baker' but, instead, are now required to be 'more than just a baker' in their role. They are now required to demonstrate a greater responsibility for the team that they oversee, as well as for the quality of the product that they are producing.

The most obvious change, however, comes in the area of skill. Skill is no longer considered quite as important as previously, due to the increase in automation which results in the role of the production supervisor being focused more on monitoring than directly operating the machines. There is, at the same time, an increase in the need for production supervisors to make use of the 'soft skills' such as interpersonal and management skills. While the increase in automation has resulted in extensions to the required knowledge, as well as a more definite need for literacy, numeracy and computer literacy, overall there have been only limited changes to what production supervisors are required to know.

These changes, particularly in the organisation of work, raise the question of how production supervisors are trained. It is necessary to look at the way the in which they are being trained to determine whether the requirements of the changing organisation of work are being addressed appropriately. The following chapter examines the current curricula which are being used to train production supervisors.

5. ANALYSIS OF CURRENT CURRICULA

Reporting on the current curricula is drawn from copies of the qualifications available on www.saqa.org.za as well as curriculum information from the South African Chamber of Baking (SACB) website (www.sacb.co.za) and a copy of their qualification's learner guide. As noted in chapter one, there are currently two different approaches to the training of potential production supervisors in the South African vocational education environment, both of which will be examined in this chapter. The qualifications offered as part of the South African Qualification Authority (SAQA) National Qualifications Framework (NQF) system differ significantly in approach from the Certificate in the Theory of Breadmaking offered by the SACB, although both aim to equip learners to operate in the plant baking environment. In this chapter, both qualifications will be analysed through the lens provided for by the Barnett and Coate model which divides curricula into the elements of acting, knowing and being (Barnett & Coate, 2005). These elements of acting, knowing and being translate into the concepts of skill, knowledge and identity, respectively, and it is in this way that they will be used to examine the curricula.

5.1 SAQA QUALIFICATIONS

The two training options focus on very different approaches to the training of plant baking operators. The SAQA accredited learnership is focused directly on equipping the learners with the skills required to operate in the workplace and knowledge forms only a very small component of the qualifications as most outcomes are focused on assessing the learners' competence as an operator. There are two qualifications on the NQF that are available to those wishing to pursue a learnership in the baking industry. These qualifications are:

1. NQF 3 National Certificate: Food and Beverage Processing: Plant Baking Processing (SAQA ID 20658)[7], registered for the first time in 2012.

2. NQF 2 National Certificate: Food Processing: Plant Baking (SAQA ID 64029)[8], which was registered on 2012 as a replacement for the previous NQF 2 National Certificate: Food and Beverage Processing: Plant Baking Processing.

Each qualification is made up of a set of unit standards. Each unit standard consists of a series of specific outcomes and assessment criteria that stipulate what the learner should know and be able to do in order to be found competent against that particular

[7] http://regqs.saqa.org.za/viewQualification.php?id=20658 (accessed 17 January 2014)
[8] http://regqs.saqa.org.za/viewQualification.php?id=64029 (accessed 17 January 2014)

unit standard. Each unit standard has a credit allocation attached to it and learners are required to complete a minimum of 120 credits in order to achieve the qualification. Unit standards in each qualification are divided into three categories:

1. Fundamental unit standards are compulsory and cover criteria related to communication, mathematics and basic scientific principles, for example unit standard number 119456: *Write/present for a defined context.*[9]

2. Core unit standards are those that the Standards Generating Body (SGB) determined contain the essential outcomes for achieving the qualification and are compulsory, for example unit standard number 259382: *Operate and control a bread packaging machine.*[10]

3. Elective unit standards comprise the last part of the qualification and are supposed to enable a certain degree of specialisation in terms of areas of competence that may not be required by all learners. These are unit standards that may only apply in certain manufacturing contexts, for example unit standard 10703: *Control the cooling process of baked bread manually in a bread plant bakery.* [11] For the NQF 2 qualification, the electives enable differentiation between manual and semi-automated bakeries while for the NQF 3 qualification it enables the learner to achieve unit standards that focus on process control, for example unit standard number 10699: *Control and manage plant baking packaging operation.* [12]

5.1.1 NQF 2 National Certificate

The focus of the NQF 2 National Certificate: Food Processing: Plant Baking is evident in the Exit Level Outcomes (ELOs) of the qualification, i.e. what qualifying learners should know and be able to do by the time they exit the qualification. The ELOs of the qualification are:

1. Demonstrate a basic knowledge of the bread plant baking environment and the related personal and food safety practices.

2. Perform basic pan handling, cleaning, sanitation of equipments [sic], and mixing of dry ingredient tasks within the bread plant bakery.

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[9] Ibid.
[10] Ibid.
[11] Ibid.
[12] http://regqs.saqa.org.za/viewQualification.php?id=20658 (accessed 17 January 2014)

3. Operate and control the equipment in a bread plant baking environment according to industry standards.

4. Demonstrate an understanding of fundamental bread plant baking related concepts, principles and procedures.[13]

These ELOs are met by achieving the required amount of credits in fundamental, core and elective unit standards. The fundamental unit standards consist of four mathematics unit standards, four communication unit standards and one unit standard focused on 'introductory principles of chemistry and physics'[14] and contribute a total of 38 credits. There are nine core unit standards in this qualification, which are worth 58 credits and focus specifically on meeting the ELOs of the qualification. The remaining 24 credits of the 120 are allocated to the electives, with the idea being that elective unit standards selected will include the unit standards focused on either automated, semi-automated or manual bakeries. This selection will depend on the level of automation within the bakery where they will be working.

Upon unpacking the individual unit standards required, the split between the knowledge and skill required becomes clearly evident. In the core section of the qualification, which underpins the qualification and around which the qualification is centred, there is only one unit standard that deals specifically with knowledge that learners are required to demonstrate. A further three of the nine unit standards imply a knowledge component but it is focused on the application of the knowledge and not just the knowledge itself. While ELOs one and four require learners to demonstrate knowledge of plant baking, the knowledge required is at a very basic level and provides an entry level understanding of the environment. Although the fundamentals form part of the knowledge component of the qualification, the unit standards are not job or industry specific and, although they do provide basic literacy and numeracy, do not directly add value to qualification in terms of meeting the ELOs.

Eight of the nine core unit standards focus on the skills that learners are required to demonstrate, with four of these focused specifically on skill in operating machines in the plant. The skills required to achieve these unit standards speak directly to the qualification's ELOs, all four of which have a skill requirement in their 'associated assessment criteria'.[15] A selection of fourteen unit standards of varying credit values is provided for the elective component of the qualification, however the main focus is on skills that the learner may require in order to function in the plant baking environment even though not all of them will be addressed in every learnership offered. Three of the unit standards offered as electives provide generic skills such as

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[13] http://regqs.saqa.org.za/viewQualification.php?id=64029 (accessed 17 January 2014)
[14] Ibid.
[15] Ibid.

computer literacy and time management while nine focus on the specific skills necessary to operate machinery or perform certain tasks in one of the three categories of bakery. There are only two electives which introduce a potential extra knowledge component to the qualification, although both are written from the context of generic knowledge combined with application and are not focused on knowledge on its own.

It is evident that this qualification was written to address the previous organisation of work in that it does not make provision for increased automation. The core unit standards address the labour process of the industry as it was at the time of writing and, although the electives do provide an element of flexibility, this is not sufficient to provide learners with the knowledge or skill to cope with the changing nature of the organisation of work. The rationale for this qualification, given in the qualification document, is that the 'qualification fulfils the workplace-based needs of the bread plant baking industry that is expressed by employers and employees, both now and for the future.'[16] This rationale must, however, be questioned as currently there is only one training provider in the country accredited to offer the qualification and none of the large plant bakeries are running the learnership.[17]

5.1.2 NQF 3 NATIONAL CERTIFICATE

The NQF 3 National Certificate: Food and Beverage Processing: Plant Baking Processing is designed to build on the skills offered by the NQF 2 qualification and provide learners with insight into the control of the plant baking process. This is evidenced in the ELOs for this qualification:

1. Manage and control plant bread quality.
2. Operate and control bread plant processing operations.
3. Maintain and apply occupational health, safety and food safety practices within plant bread environment. [18]

The NQF 3 qualification is similar in credit breakdown to the NQF 2 qualification with 39 credits allocated to the fundamental unit standards, 60 credits allocated to the core unit standards and 21 credits allocated to elective unit standards. The immediate difference in this qualification is the evident focus of the core unit standards on not just operation but control of processes.

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[16] Ibid.
[17] Personal experience
[18] http://regqs.saqa.org.za/viewQualification.php?id=20658 (accessed 17 January 2014)

Fundamental unit standards in this qualification consist of four communication unit standards, three mathematics unit standards and one unit standard focused on 'produce and use spreadsheets for business'.[19] As with the NQF 2 qualification, these are generic unit standards that, while enhancing numeracy and literacy, are not job or industry specific. It must, however, be acknowledged that there is a greater need for literacy and numeracy at this level in order for the learner to fully comprehend certain aspects of the knowledge required by this qualification. The knowledge component of this qualification is greater than that of the NQF 2 qualification, with learners being required to demonstrate knowledge of a greater range of principles in the baking process, as well as occupational health and safety, food safety, and business principles. At least six of the nine core unit standards in this qualification contain a knowledge component in addition to the need for application, for example the unit standard requiring learners to apply microbiological principles starts with outcomes focused on knowledge of microbiological principles.[20]

The need for application of knowledge and skill in the core unit standards is still of great importance, although there is a definite shift in terms of the language in the core unit standards and ELOs to reflect the focus on monitoring and control skills as opposed to the direct operation skills of the NQF 2 qualification. This is also evident in the elective unit standards as, of the eight possible unit standards that can be selected, five of them focus on controlling, managing or supervising people or processes, for example unit standards 10699 and 10981; 'Control and manage plant baking packaging operation' and 'Supervise work unit to achieve work unit objectives (individuals and teams)' respectively. The remaining three unit standards, while not focused on control, are also unit standards that require a higher level of skill or knowledge than would be needed to simply operate in a plant baking environment.

Although the NQF 3 qualification is aimed at the training of production supervisors and, according to the rationale, 'reflects the workplace-based needs of the plant bread baking industry that is expressed by employers and employees'[21] there are currently no training providers listed as accredited to offer this qualification[22] and therefore no learnerships are being offered by the industry for learners to attain this qualification. Currently, the only training being offered to production supervisors is the South African Chamber of Baking *Certificate in the Theory of Breadmaking.*

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[19] Ibid.
[20] http://regqs.saqa.org.za/showUnitStandard.php?id=9147 (accessed 3 September 2014)
[21] http://regqs.saqa.org.za/viewQualification.php?id=20658 (accessed 17 January 2014)
[22] Ibid.

5.2 SOUTH AFRICAN CHAMBER OF BAKING CERTIFICATE IN THE THEORY OF BREADMAKING

The South African Chamber of Baking (SACB) was started in 1938 and gives as its vision: 'To be the recognised home of the baker and the South African Baking Industry.' (South African Chamber of Baking, 2008) The Certificate in the Theory of Breadmaking was originally developed by the SACB in 1995 and is now in its 4th version. It was developed to 'teach the theoretical aspect of plant baking.' (South African Chamber of Baking, 2010, p. III) This Certificate is opposite to the SAQA qualifications in nature as it is solely a theory-based programme and is not registered on the National Qualifications Framework. In this instance, learners are trained only on the theoretical aspects of the bread making process and are assessed only by means of an examination.

This qualification envisages as its target population those at the level of production supervisor or, alternatively, those who wish to further their career in the baking industry (South African Chamber of Baking, 2010, p. III). Although it is ostensibly open to anyone who wishes to apply, the only proviso being the ability to read and write in English, it tends to be offered by the large baking companies who identify the employees that they want to achieve the qualification.[23] It is also left to the companies to determine how they will prepare their employees for the examination. This is conducted by the SACB directly as they award the certificate and not the companies. The training involves assisting learners in working through the learning material provided by the SACB and is generally conducted by facilitators sourced from the baking industry with many years of experience in the industry, often who have been working for the company concerned in that time.

This qualification is not aligned to any NQF qualifications and therefore does not have ELOs or unit standards. However, the current edition of the learning material lists seven main goals of the qualification, namely:

1. To give the Learner a basic insight into the history of bread making, to review the quality of bread from the consumers' point of view, and to outline the current regulations and controls over the baking industry.

2. To explain the equipment and principles involved in the various plant bread making processes.

[23] Personal discussion

3. To outline the important properties of the wheat grain and the processes involved in converting this to flour.

4. To detail the importance and functions of the ingredients used in bread making.

5. To guide the Learner in recognising bread faults as well as identifying their causes.

6. To explain the need for hygiene and sanitation standards in a food production environment.

7. To acquaint the Learner with the safety factors, rules and regulations relating to safe bakery operations.

(South African Chamber of Baking, 2010)

As can be seen by the goals listed above, as well as the name of the qualification, the focus of this qualification is the theoretical elements of the bread making process. While it provides learners with insight into the processes that underpin bread making, it does not equip them with the skills necessary to function as a production supervisor in a large scale plant bakery. Furthermore, the labour process to which this qualification speaks is rooted in the previous organisation of work as it does not take into consideration the increased levels of automation present in the latest bakeries. This, however, may also be related to the historical basis on which this qualification was developed and the fact that the edition under examination was developed in 2010 which was prior to the implementation of continuous mixing system technology in the South African industry.

Although the focus of the qualification is plant baking, continual reference is made to the way in which processes would be performed in a craft bakery. Several pages are also devoted to the layout of a craft bakery while semi-automated and automated plant layouts are addressed at only a very basic level.

The knowledge that a potential examination candidate is required to know before writing the examination is at a particularly high level and is covered in great depth. As indicated in the goals, candidates are required to understand and explain the importance and functions of the various raw materials as well as explain the principles and equipment of the bread making process. While a great deal of depth is given for raw materials, concepts that a production supervisor may need to be aware of but that are not necessarily significant for their job function, limited knowledge is provided on the equipment that a production supervisor encounters on a daily basis. There is, however, a chapter that focuses on bread faults, the knowledge that underpins the problem solving skill that production supervisors require.

While this qualification may serve a purpose in providing the knowledge required by someone who wishes to further their career in the baking industry (South African Chamber of Baking, 2010, p. III), the depth of the knowledge provided is beyond the needs of a current production supervisor. Although the entry requirement is the ability

to read and write English, the level and depth of the material makes it inaccessible to many, particularly in the South African context, who have progressed from an operator to becoming a production supervisor but have low levels of English literacy. This difficulty is further evidenced by the inability of many candidates to pass the examination despite being trained on the material.[24]

5.3 CONCLUSION

Despite there being two different types of qualifications available for the development of production supervisors, neither of them appear to be addressing the needs of production supervisors. The SAQA qualifications focus mainly on the skills required while the SACB is purely theoretical in its approach. Both qualifications also remain anchored in the labour process prior to the increase in automation and seem incapable of addressing the changing work environment of the plant baking industry. It is necessary, though, to provide some form of training for production supervisors to assist them in functioning effectively in their position and the following chapter aims to engage with the findings of the last two chapters in order to examine their implications for the training of production supervisors.

[24] Personal discussion

6. IMPLICATIONS OF FINDINGS

The findings reported in chapters four and five, in particular those reported in chapter four, provide an interesting insight into the South African plant baking industry and raise several points that require further discussion. This chapter aims to analyse the findings of both chapters, drawing on some of the conceptual frameworks reviewed in chapter two, in order to draw out the possible implications thereof. In order to do so effectively, the chapter is divided into two main sections; the first attempts to address the issue of identity as raised in chapter four, while the second section draws on the findings around knowledge and skill from chapters four and five, as well as the implications thereof for future curriculum.

Central to the findings reported in chapter four is the way in which the organisation of work has changed with the increase, to a greater or lesser extent, in the level of automation in the bakeries. This increase in the level of automation has impacted on the division of labour within the bakeries, as is evidenced most obviously in the decrease in the amount of labour, particularly manual labour, required to operate bakery five, the most automated bakery. The shift in the organisation of work has also impacted the role of the production supervisor with the focus, as identified by Interviewee 5.3, shifting to a greater monitoring and more managerial role.

The impact of the increased levels of automation in all of the bakeries is further seen in the findings on the relative importance of knowledge, skill and identity. Figure 7, drawing on the original framework given by Barnett and Coate (2005) aims to graphically depict for the reader the relative importance placed on knowledge, skill and identity as viewed by 45% of interviewees, demonstrating the relative decrease in the importance of skill and the relative increased importance of workplace identity.

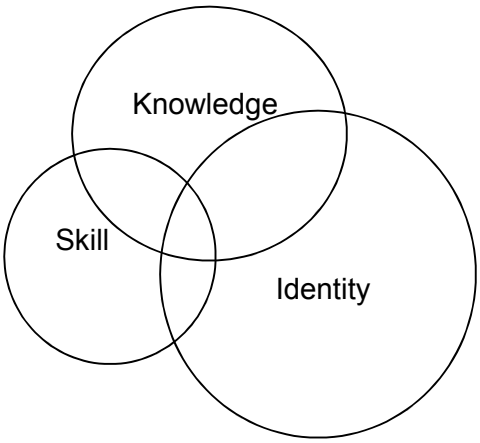

Figure 7: Relationship between knowledge, skill and identity as a result of shifts in work organisation

The current curricula, as examined in chapter five, do not address these changes in the organisation of work.

6.1 CHANGES IN WORKPLACE IDENTITY

The perceived relative increase in the importance of identity as a result of the shifts in the organisation of work is one of the most significant findings in this study. Sennett speaks of the way in which the routine of work creates an identity, particularly within a Fordist approach to the organisation of work, and how the changes in the 'rhythms of work' brought about by 'the new language of flexibility' can negatively impact the occupational identity of workers (Sennett, 1998). These changes and resultant loss of occupational identity are what Sennett calls the 'terrible paradox' in the modern bakery as, while the machinery becomes more technologically advanced and 'user-friendly', the workers feel demeaned by this new work organisation and can no longer bake the bread themselves (Sennett, 1998, p. 72). The change in the organisation of work, and the resultant change in identity, is further seen in the shifting role of the production supervisor, as discussed in chapter four.

Where previously the interviewees associated the identity of the production supervisor with that of a baker, the identity of the current production supervisor is not seen in the same light. According to those interviewed, the new organisation of work no longer allows for the notion of the production supervisor as a baker, as a result of further distancing the production supervisor from the final product through the increased use of automation and, in particular, PLCs. This is a distance that Marx (1976) proposes leads to alienation. Indeed, as they are further removed from the bread they are producing, and without a tactile connection to the bread being baked, the identity of the production supervisor as a baker becomes less and less tenable.

Daniels and Brooker (2013, p. 3) draw on Tomlinson (2010) to make the argument that, with the advent of globalisation, identity is 'a fluid and flexible process, so success depends on the workers' or students (future workers)' abilities to shape, adapt, and apply themselves, as employees, to the needs of a particular role; not only once, but many times throughout their working life.' In this arises a tension between the firmly held occupational identity that comes with a particular role (in this study, that of the production supervisor as 'baker') and the flexible identity that comes with continual development and workplace change (the production supervisor as 'more than a baker'). Gamble (2009) clearly points to this in her analysis of market versus occupational identities as discussed in chapter two. In the explanation she gives, a market identity, also known as a weak occupational identity, draws on a knowledge base that comprises of 'networks of social relations or affinity groups and are contingent on the market to which they relate' (Gamble, 2009, p. 55) while a strong occupational identity, what Gamble refers to as occupational identity, draws on a more stable knowledge base that is tied to the knowledge held by all members of that occupation.

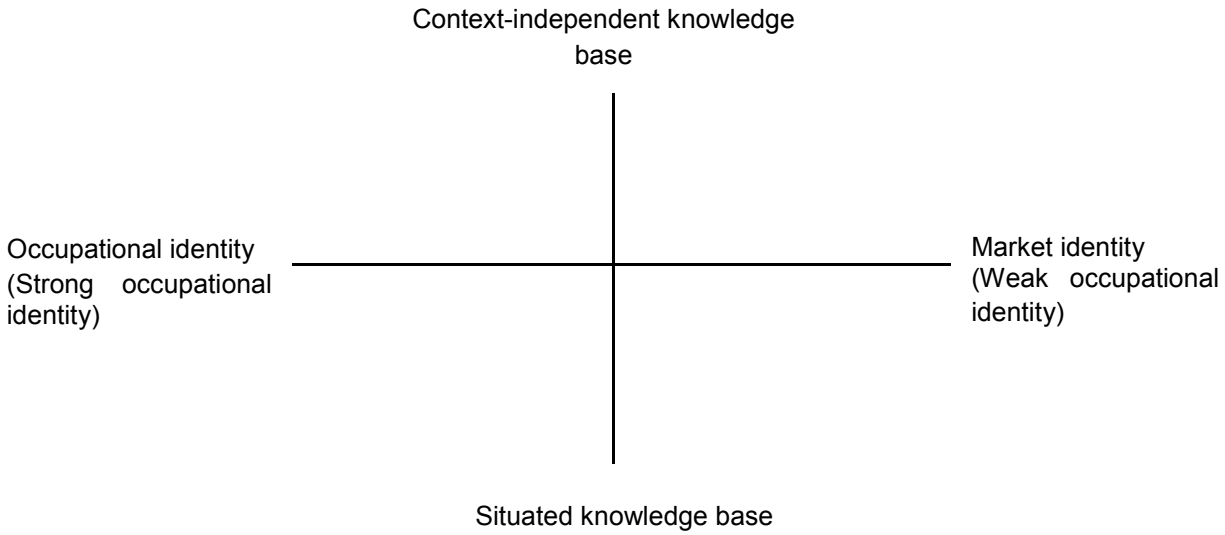

Figure 8: A matrix of identity positions in the workplace (Gamble, 2009, p. 61)

Examining the identity of the production supervisor in light of Gamble (2009)'s constructs, it becomes clear that the production supervisor's identity has moved further to the right of the scale in Figure 8, i.e. has become a weaker occupational identity, because it has come to rest more heavily on what Carnoy (2001) refers to as a 'social identity' that is developed through the allocation of a job description or role within the organisation. This is evidenced by the need of current production supervisors to be 'more than just a baker' because of the requirements placed on them by management's expectations.

According to Gamble (2009), occupational identity is further influenced by the nature of the knowledge base of the occupation. As reported in chapter four, knowledge in this case study is limited to the realm of the bread making process and is therefore very definitely situated within the industry and, to a degree, the processes of the bakery itself. Up until recently, the occupational identity of a production supervisor has been a stable, fairly strong one, with a situated knowledge base and limited room for flexibility. This stable identity, however, seems to be disappearing with the inevitable loss of the older production supervisors – those who viewed themselves as bakers and possessed the tacit or 'bodily' knowledge (Ainley, 1993) needed to function in the bakeries. Despite the newer production supervisors' identity being given as 'more than just a baker' there is still a deference shown to the old production supervisors who have gained knowledge through experience, i.e. situated knowledge. This is most obvious as it relates to the ability to solve problems on the line, with Interviewee 3.3 explaining the need to rely on an older supervisor's experience to determine the root cause of a problem because they have tactile experience with the product.

This continued reliance on the situated knowledge of older production supervisors is likely to lead to problems in the future as they leave the bakeries and take their experience with them. Despite the attempts, particularly of the South African Chamber of Baking (SACB) qualification, to provide the more general and theoretical knowledge

required to function in the plant baking environment, it is argued that it is not possible to confer an identity through formal curriculum alone and work experience remains central to the identity of a production supervisor. In this, the professional identity of the production supervisor still recognises its craft base which is passed from the older production supervisor to the new generation of supervisors. It is through the transfer of this knowledge base that a stronger occupational identity of a production supervisor can be conferred.

While it may not be feasible to 'educate' production supervisors into a strong occupational identity, the role of curriculum in providing a knowledge base must be acknowledged. The strengthening of the workplace identity also relies on a strengthening of the context independent knowledge base of the occupation (Gamble, 2009). The second half of this chapter seeks to address the findings related to the shifts in knowledge and skill that resulted from the changes to the organisation of work, and, as a result, examine what should be taught.

6.2 MULTI-SKILLING AND THE KNOWLEDGE BASE

As referred to in chapter two, the biggest element in the Barnett and Coate (2005) model for professional curriculum is the element of acting, as extrapolated to the concept of skill. In drawing on this model to analyse the requirements for a vocational curriculum, it becomes apparent in the views of those who participated in this study that the role of skill has been devalued with the increase in the level of automation in the bakeries. Although the importance of skill has diminished, it cannot be removed from the curriculum as production supervisors still require skill to be able to function in their role. The production supervisor, particularly in the less automated bakeries, must still have the skill to be able to operate any of the machines in the bakery should the need arise. Indeed, the capability of operators to move into the role of production supervisor is often demonstrated by their ability to operate a variety of machines as required.

Gamble points out that '[f]lexibility through *multi-skilling* is … deemed as having the capacity to construct a bridge between labour market sectors.' [Emphasis original] (Gamble, 1995, p. 11) The concept of skill is drawn on by Gamble in suggesting that multi-skilled workers are able to handle uncertainty in a wider range of activities (Gamble, 1995). The South African Qualifications Authority (SAQA) learnerships, with their focus on training skill, do address this by including unit standards that require learners to operate the various machines in the bakery. The notion of a multi-skilled operator and, as a result, a multi-skilled supervisor feeds into the new division of labour as it allows for a smaller labour contingent to run the bakery. Thus the development of multi-skilled workers is of benefit, not only to the workers themselves in being better able to handle uncertainty as well as carrying increased responsibility, but also to employers as 'through multi-skilling, workers can be deployed differently as economic demands and production processes change.' (Gamble, 1995, p. 14) The result of this

is, however, that '[t]he new forms of work organisation associated with flexible specialisation set quite new criteria for the curriculum.' (Young, 1993, p. 1) Gamble suggests that the development of multi-skilled workers changes the way in which the curriculum must be developed with the focus shifting from context specific learning to the acquisition of more context independent competencies instead. Gamble goes on to draw from Perkins and Salomon who point out 'that there are general cognitive skills but that they always function in contextualised ways.' (Perkins and Salomon, 1989 in Gamble, 1995, p. 19) It is these general skills and, by implication, knowledge that may provide the opportunity for the development of a more context independent knowledge base.

However, while there have been changes in the work organisation of the plant baking industry, the knowledge base around the bread making process has not changed significantly. Although globalisation and the development of the knowledge economy have had an impact, within this field, plant baking rests on a neo-Fordist approach to work organisation. Jones and Wood (1984, in Wood, 1987) suggest that existing working knowledge and tacit skills are important in effectively implementing and utilising new technology. This existing knowledge is the situated, contextualised knowledge base that underpins the industry. They give the example in their study of the longest serving employee being selected for the monitoring of a new ice cream manufacturing plant 'because he could translate in his mind the performance feedback from the automated plant into a concrete appreciation of the texture of the ice cream.' (Wood, 1987, p. 13) This ability to be able to problem solve as a result of the work experience and tacit skills that the long serving employees have, is a key element in considering how a curriculum might best equip the production supervisor to function optimally in the bakery environment. Thus the context independent knowledge base is not sufficient on its own as it is not possible for production supervisors to solve problems in abstract; they need situated knowledge in order to do this, as is evidenced by the reliance on the tactile experience of the older production supervisors. Yet it is not just knowledge and skill that enables these long term employees to effectively problem solve; as the findings of this study suggest, it is also determined by their confidence to engage in the problem solving process, something, it is argued, which cannot be taught but is a result of the occupational identity they develop.

As is evident by the findings of chapter five, this need for multi-skilling and a combination of situated and context independent knowledge is not addressed by either of the current curricula. The SAQA qualifications provide, to a limited extent, the opportunity for learners to develop certain of the skills required for multi-skilling but these are not sufficient to address the requirements of the new organisation of work. In contrast to this, is the SACB qualification which does not address the issue of skill and has as its focus the more context independent knowledge of the bread making process. Thus neither of these qualifications are adequate for addressing the need for multi-skilling and a combined knowledge base that consists of both situated and context independent knowledge.

6.3 CONCLUSION

It is therefore evident that there has been a perceived increase in the relative importance of identity for production supervisors alongside a progressive weakening of the strong occupational identity that they had previously held. This weakening of occupational identity seems to have resulted from a combination of factors, most significantly an increase in automation and its accompanying alienation, the shift towards a more managerial role, and the loss of the previous, more situated, knowledge of the bread making process.

There is an increased need for multi-skilling and managerial skills, which both rely on a more context independent knowledge base. This context independent knowledge base would enable production supervisors to function more effectively in the managerial functions that they are required to undertake. . At the same time, a purely context independent knowledge base is also not sufficient as production supervisors still require the situated knowledge of the bread making process. This tactile and experiential situated knowledge, and its resultant occupational identity, are not able to be imparted via curriculum. Currently neither of the two curricula offered address the need for both context independent and situated knowledge. Thus neither of the curricula can adequately address the needs of production supervisors in a way that enables them to function effectively in their role.

It is clear that there is no straightforward solution to the problems of creating an occupational identity for production supervisors and developing a curriculum that meets their needs. It is, however, still possible to consider the ramifications of these findings and then attempt to develop a strategy within the plant baking industry to address the needs of production supervisors as well as the requirements of industry. The development of a strong occupational identity for new production supervisors through consultation with the old production supervisors and a form of work-based transfer of tacit learning remains possible as long there are still older production supervisors in the industry. How this can be tackled once that resource is no longer available remains a challenge that may possibly be addressed by creating space in the curriculum for production supervisors to engage with the product in a tactile way, for example through craft baking work experience. The development of a mixed disciplinary knowledge base that consists of both situated knowledge and context independent knowledge may also provide a way for the changes in knowledge, skill and identity to be accommodated in a curriculum that caters more effectively for both workers and an industry whose drive towards automation continues.

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APPENDIX 1: CONSENT FORM

TITLE:

Historical shifts in knowledge, skills and identity in the South African plant baking industry: implications for a new curriculum

RESEARCHER:

Colette Tennison (Masters Student under the supervision of Dr Linda Cooper at the University of Cape Town)

CONTACT DETAILS:

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NAME OF PARTICIPANT:

NATURE OF THE RESEARCH:

Semi-structured interviews investigating the participants' work history in the plant baking industry and their perceptions of their workplace identity.

PARTICIPANT'S INVOLVEMENT:

The participant is requested to undergo an interview with the researcher for an approximate time period of 1 hour.

Permission to do so has been granted by the management of the organisation and the time period of the interview has been agreed to by the Bakery Manager.

There is no remuneration given to the participant and the time cost is covered by the organisation as the interview is conducted during working hours.

The participant:

- Agrees to participate in this research project.
- Has read the consent form and the information it contains and has had the opportunity to ask questions about them.

- Agrees to their responses being used for education and research purposes on condition their privacy is respected, subject to the following:
    - Participants understand that personal details may be included in the research however participants' identity will be obscured.
- Understands that they are under no obligation to take part in this project.
- Understands that they have the right to withdraw from this project at any stage.

SIGNATURES:

Signature of participant:

Name of participant:

Signature of person who sought consent:

Name of person who sought consent: Colette Tennison

Date: