Perspectives on skill: a study with a group of state training providers, manufacturing managers, and production workers in Oklahoma

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Abstract

There is a recognised and recurring projected skill shortage in Oklahoma's manufacturing industries. This research investigated how skill is perceived by a sample of people from three key groups in the manufacturing industry: state training providers, manufacturing managers, and production workers. The study adopted a qualitative approach, utilising focus groups and interviews with members of the key groups to explore their understandings of skill and how they assign responsibility for skill development in the current and future contexts of the manufacturing industry in Oklahoma. The study also explored how human capital theory, the concept of lifelong learning and a skill ecosystem approach provide different frameworks for understanding skill in manufacturing, with particular reference to Oklahoma.

The findings suggest that opportunities for learning and understanding skill and skill development are crucial for individuals and industry, from the perspectives of the participants. Managers can have a key role in nurturing workers to develop a desire for the development of skills. In addition, employability skills, focused on showing initiative to learn and grounded in the application of theoretical knowledge in manufacturing contexts, are imperative for students who want to enter manufacturing. The findings indicate that the best avenue that was perceived by these participants for developing employability skills is work-based learning that allows for the application of theory to develop skill. In terms of who has 'responsibility for skill', the notion of 'opportunity' emerged as key for skill development. The participants thought that manufacturers have opportunities to initiate skill development in partnerships with educational institutions and state workforce agencies but that management needed also to communicate how workers can acquire skill development and 'seize' those opportunities to learn the skills that are necessary.

Analysis of the participants' understandings of how Industry 4.0 (including automation and smart technology) will impact manufacturing's future skills revealed that the managers recognised that they had to think strategically about skill. Despite this, they and some production line workers focused on it being the individual worker's responsibility for 'seizing' opportunities to learn a new skill although this approach had enjoyed limited success. There were, however,

participants in each of the study's three groups who indicated interest in pursuing a dialogue between higher educational institutions and industry, and expressed support for better strategic thinking and funding options.

The findings from the study suggest that for industry in Oklahoma to better understand how to create opportunities for skill development and to better make opportunity for skill development a reality, it needs to form a strategic partnership with career and technology education and higher education. In addition, to increase successful adoption of skill development, managers need to dialogue with educators in order to have input into skill development, both in the design and the delivery process. This changed focus, the study concludes, requires a move away from human capital and individualised lifelong learning approaches to a skills ecosystem approach if industry in Oklahoma is to provide better access to skill development. Additionally, managers in partnership with state training providers need to provide clear skill and career progression for students and the current workforce that will align with the skills needed to adapt to Industry 4.0 and its associated technologies. It was concluded that managers, in partnership with state training providers, need to provide clear skill and career progression for students and the current workforce that will align with the skills needed to adapt to Industry 4.0 and its associated technologies.

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Dedication

This dissertation is dedicated to my husband, John, who has supported me throughout my Doctoral studies at the University of Glasgow. This dissertation would not have been possible without his encouragement, love and understanding.

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John, no words can adequately express how appreciative I am of you.

Thanks to each of you.

Author's Declaration

I declare that, except where explicit reference is made to the contribution of others, this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.

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Abbreviations

ACIS Accrediting Council for Independent Colleges and Schools

AG Agriculture

CTE Career and Technical Education

CVET Continuing Vocational and Education Training

GDP Gross Domestic Product

HCT Human Capital Theory

HE Higher Education

IOT Internet of Things

IVET Initial Vocational and Education Training

LLL Lifelong Learning

MEP Manufacturing Extension Partnership

NACE National Association of Colleges and Employers

NIST National Industrial Standards and Technology

OECD Organization for Economic and Cooperative Development

OJT On the Job Training

ODCTE Oklahoma Department of Career and Technology Education

OMA Oklahoma Manufacturers Alliance

OOWD Oklahoma Office of Workforce Development

QDAS Qualitative Data Analysis Software

ROI Return on Investment

RTW Right-to-work

STEM Science Technology Education & Math

SVQ Scottish Vocational Qualification

TIP Training in Industry Program

US United States

VET Vocational Education and Training

VP Vice President

WIA Workforce Investment Act

WIB Workforce Investment Board

WIOA Workforce Innovative Opportunity Act

Chapter 1 - Introduction to the Study

1.1 Statement of the problem

Since 2011, the rhetoric of politicians, industry, and educators in the United States (US) has focused on the claim that manufacturing as an industry is struggling to achieve an adequate supply of workers with the right skills to keep its growing businesses operational (Busemeyer & Iverson, 2014; Deloitte, 2018). Manufacturing is defined as:

> The process of converting raw materials, components, or parts into finished goods that meet a customer's expectations or specifications. Manufacturing commonly employs a man-machine setup with division of labour in a large scale production (Business Dictionary, 2019).

Contributing to this problem is the number of workers who are retiring. It is estimated that 10,000 workers retire on average each day in the US (Optis, 2016). The shortage is frequently referred to in general terms as a "skills gap" (Cappelli, 2012; Friedman, 2012; Hemphill & Perry 2012; Abraham, 2015). While the expression "skills gap" is used in various ways, the Organization for Economic Co-operation and Development (OECD), the World Economic Forum, and the Association of Training and Development in the United States tend to agree with the definition: the 'type or level of skills… different from that required to perform the job adequately' (World Economic Forum, 2016, p.7). Cappelli places the blame for the skills gap with 'the failure of the education system, especially K-12 public education to provide students with…. basic skills' (2015, p. 253).

Cappelli's view is also shared in the 2015 and 2018 reports published by The Manufacturing Institute, one of the leading policy institutes for manufacturing in the US. Its report 'The Skills Gap in U.S. Manufacturing 2015 and Beyond', drawn up by Deloitte (a global consulting and advisory company), concluded that employers projected that the skills gap in manufacturing would grow dramatically over the next decade. According to the Deloitte's (2015) findings, 'Nearly three and half million manufacturing jobs likely need to be filled'. Moreover, the skills gap is expected to result in over two million of those jobs

going unfilled ‘between 2018 and 2028’ (Deloitte, 2018, p.3). This data was generated from a quantitative survey of over 400 manufacturers around the US who were asked to project what they believed they would need in terms of future workforce numbers and required skills. The findings of these reports that manufacturing has an insufficient pipeline of future workers and that there is a substantial gap in skills required to perform jobs effectively is in line with the messages that have been emanating from industry, education, and policy makers for some time. Other research reveals that at a national level in manufacturing:

> 82% of manufacturers have a moderate to severe shortage of available, qualified production workers, with 64% noting that workforce shortages and skills deficiencies in production roles are having a significant impact on their ability to expand operations or improve productivity (Optis, 2016, p.2).

While the prevailing view is in line with the Deloitte and Optis reports regarding the existing “skills gap” in US manufacturing, other scholars, such as Osterman & Weaver (2014) and Pierce & Schott (2016), conclude that talk of a “skills gap” is exaggerated and that only a minority of manufacturers report difficulties hiring people with the correct skills for manufacturing. However, such positions that are sceptical of the existence of a “skills gap” are typically rejected because of insufficiencies in their statistical analysis (Pierce & Schott, 2016).

In the geographical context of this study, Oklahoma, the “skills gap” rhetoric permeates the local manufacturing sector and aligns with those that believe there is and will continue to be a “skills gap” in US manufacturing (OOWD, 2016; ODOC, 2018; State Chamber, 2018). Key stakeholders in the arena of skill development (politicians, education, workforce boards, and government and industry bodies) perpetuate the rhetoric that a skills gap exists and that it will increase over the long-term (Optis, 2016; Cappelli, 2017; Deloitte, 2018). Skill development is defined in our context as ‘the acquisition of practical competencies, know-how and attributes necessary to perform a trade or job in the labour market’ (European Commission, 2012, p.12).

Manufacturers feel paralysed because the stakeholders in skills development appear more focused on the long-term objective of increasing the pipeline of skilled manufacturing workers than on helping them in the immediate and short-term to address their needs for a skilled workforce (Cappelli, 2015; Cunningham & Villasenor, 2016; Unwin, 2017). Although these forces play out in the forefront of discussion that there is a large skills gap, in practice, manufacturers are unable to obtain enough staff with the right skills; what is more, they are not training current employees to acquire the new skills required to keep abreast of the changing manufacturing environment and overcome the challenges of future technologies (World Economic Forum, 2016; Elliott et al., 2017; Tisch & Metternich, 2017). As a result, manufacturing employers struggle in two major areas. First, they struggle to train current staff to develop the necessary skills. According to the literature, the skills which are considered to be lacking in the manufacturing sector are: employability skills, critical thinking skills, and a theoretical foundation of manufacturing principles (Grugulis et al., 2004; Little et al., 2006; Cunningham & Villasenor, 2016; Hurrell, 2016). Second, manufacturers struggle with how best to assign and deliver skill development within their organisations and to collaborate with education and workforce partners to create and sustain a skilled employee pipeline to meet their future needs. In Oklahoma manufacturing, these two challenges in addressing skills needs have led to disruption and to confusion in understanding skill.

1.2 Purpose of the study

Accepting what industry, education and politicians refer to as a “skills gap” and their concerns about being able to hire the right staff with the right skills, now and in the future, it is imperative to develop a clearer understanding of the skills discourse. If this is not achieved, industry, education and politicians will surely be unlikely to be able to help manufacturers recruit and retain workers with the required skills. Accordingly, the purpose of this study is to explore how key actors (state training providers, manufacturing managers, and manufacturing production workers) perceive skill as a concept within the context of Oklahoma manufacturing and how they understand the assigning of skill development within a manufacturing operation. For the purpose of this dissertation, I include all of the following in the state training providers’ group: education, training, workforce boards, and government and industry bodies.

Manufacturers are still falling short in developing skilled workers, even though the Oklahoma Office of Workforce Development (OOWD) and state training providers have designed and implemented several programmes over the last two decades as part of Oklahoma's Unified State Workforce Plan (WIOA, 2016) to address both the current and future pipeline of Oklahoma workforce. There is both an inadequate supply of qualified workers in the hiring pipeline and an inability of organisations to equip their current workers with the desired skills to navigate technological advances. Oklahoma workforce state projections indicate that a post-high school education gap exists and that this gap aligns with the manufacturing sector's need for post-high-school-educated skilled staff (WIOA, 2016). These are indications of the ways in which the shortage of skilled labour is not being adequately addressed by the Oklahoma government, state training providers and manufacturers.

As state training providers set the direction and content of skills education in the State of Oklahoma, it was important for this study that they be given a voice to share their understanding of skill because manufacturing managers and production workers respectively are the groups responsible for creating the environment for skill development and skill acquisition. Manufacturing managers and production workers often have a clear operational knowledge of the opportunities for and constraints to understanding skill within their manufacturing operation. Together all three key actors (state training providers, manufacturing managers and production workers) are pivotal in addressing the research question of this study: what does skill mean for Oklahoma manufacturing? Having established the purpose of this study, I move on to placing it in its industrial context next.

1.3 Industrial context of the study

The way skill can be understood in this study is by locating it historically in the context of Oklahoma and US Industry. It is by looking at the history, political influences, and educational structure that a clearer purpose and understanding of skill in Oklahoma manufacturing and our associated research questions can be investigated. Thus, the next section will look at the context of manufacturing in Oklahoma and the geographic influences, before providing an overview of the scope of skill and education as it impacts this study. Although I will be focusing

my research on the context of manufacturing in Oklahoma, it is important to note that since this topic has not been widely researched and documented within the State of Oklahoma, I will be referring to the wider national and international research on manufacturing and skill.

1.3.1 Manufacturing in Oklahoma

The boom times experienced during World War II, the post-war recovery, and the dramatic restructuring of the farm economy provided the conditions for Oklahoma in early 1970s to begin to experience significant success with the expansion of its manufacturing industry. The catalyst for this success was both Oklahoma's natural resources (oil, cattle and cotton) and the growth of military bases and defence-related industries relocating to Oklahoma (Warner, 2018).

Since 2017, manufacturing in the US has entered a new era of transformation, even though it too was affected in its business lifecycle by the economic decline and subsequent employment problems of the 1980s, the global economic bust of 2007, and the worldwide oil and gas price drop of 2015. As the US as a whole experiences a manufacturing expansion, Oklahoma manufacturing too is experiencing growth and renewed interest (Deloitte, 2018; State Chamber, 2018). Manufacturers in Oklahoma account for 10 percent of the state's total output and employ 7.6 percent of the workforce. Oklahoma manufacturing, as an industry cluster, is the second largest employer. Additionally, the role of manufacturing has become more relevant since the Oklahoma Office of Workforce Development (OOWD) identified manufacturing as one of its regional industry ecosystems (WIOA, 2016, p.6). Total state output from manufacturing was $80.9 billion between 2017 and 2019 (State Chamber, 2019).

The manufacturing sector in Oklahoma comprises approximately 3,500 manufacturing businesses of which 1 percent employ more than 500 employees and 99 percent employing fewer than 500 employees (OMA, 2018). Specific manufacturing industry sectors in Oklahoma include fabricated metal products, machinery, transportation equipment, chemicals, computer and electronics and plastics and rubber manufacturers. The top production worker jobs in Oklahoma manufacturing are assemblers and fabricators, machinists, welders and cutters, and material handlers (Economic Modelling Specialist Inc [EMSI], 2019).

Business, local and state taxes from manufacturing fund education and infrastructure. There were 141,000 manufacturing employees in Oklahoma in 2019 (Oklahoma Employment and Security Commission, 2019), of which 22.48 percent were women. Only 3.6 percent of these are production workers (EMSI, 2019).

The fact that the State of Oklahoma places its workforce strategic plan and initiatives alongside the Governor's Council for Workforce and Economic Development (GWED) and staffed by the Oklahoma Office of Workforce Development OOWD is an indication that its workforce efforts are driven by the economic development goals of the state (WIOA, 2018).

> The required elements in this section allow the State to develop data-driven goals for preparing an educated and skilled workforce and to identify successful strategies for aligning workforce development programs to support economic growth. (OOWD, 2018, p.12)

The Governor of Oklahoma has also placed the OOWD under the office of the Secretary of Commerce and renamed the office as the Secretary of Commerce and Workforce. This aligns it further with policy and the strategic direction of the economic goals of the state. The current lack of skill in the manufacturing industry of Oklahoma indicates that government, education and industry have been unable to deliver a workforce with the correct skills to perform their jobs (Busemeyer & Iverson, 2014; Deloitte, 2018).

In this context, given the importance of manufacturing to the fabric of Oklahoma, attention is given to educating its workforce with appropriate skills. As manufacturing continues to expand and transform, the demand for a skilled manufacturing workforce with the correct workplace skills to do the job has become acute.

1.3.2 Manufacturing in the United States

Manufacturing in the United States prior to 1940 undertook a precarious journey shaped by the political economic forces at play in society and its 'importance in relation to people' (Severson, 1960, p.357). Severson (1960) proposes that manufacturing's importance in the US is connected to people and their income

gained from employment and also to people who are the consumers of the manufactured products. Many scholars believe that it was the expansion of manufacturing during and after World War II that transformed the economic landscape and skills of the US workforce (Cobb, 1982; Carlton, 2003; Lewis, 2007). The reliance on federal and private investment in the manufacturing industry of the war furnished manufacturing with the "entrepreneurial skills" (Lewis, 2007, p.839) that catapulted the US to become a major global player in the industrialisation of the 20th century. US manufacturing has continued to be a major force within the national economy, producing 12 percent of the Gross Domestic Product (GDP), (Bureau of Economic Analysis, 2016). In the 1980s under President Reagan, the US saw a shift in its economic and social structure which has impacted education and skill in the country. President Reagan's policies were to lead to the deregulation of industry and an associated shift in responsibility of skill development away from the government (Harvey, 2007). This shift in responsibility is crucial for this study as it addresses the question of who is responsible for skill development today in US manufacturing. It was also at this time of shifting responsibility that lifelong learning (LLL) was gaining traction and shifting focus from learning information to developing the whole person, as Grace & Rocco state:

> The practice of adult education in its contemporary instrumentalized form, focused on information literacy and skill enhancement, aids and abets neoliberalism and its emphasis on process, production, and performance (2009, p.249).

The US manufacturing industry in 2017 invested $1,217 per learner, per annum - the highest investment in skill development of any US industry (Training Magazine, 2017, p.23). Nationally, manufacturing is the highest-paid industry occupation (Bureau of Economic Analysis, 2016). Consequently, it is an industry that receives national and state attention and is worthy of study from a skill perspective and below I outline my positionality in this study.

1.4 Positionality

Since the 1990s, social researchers have become cognizant of the researcher's 'standpoint' or 'positionality' when carrying out their research. What researchers generally mean when discussing their 'positionality' is the

acknowledgment that all people have overlapping identities from which they construct meaning, especially the meaning of social power relations (Kezar, 2002, p. 96). What this means for researchers is that they need to be aware of what their own identities, including their identity with respect to power, might be in relation to those they are researching. The researcher should be asking and answering several key questions. How am I positioning myself in this research? How might my research participants perceive my identity? What power or authority might my research participants presume I have in relationship to them? How is my relationship to the participants affecting my methods? How might my findings be influenced by my positional relationship to the participants? Here I will address my "positionality" in relationship to the participants in this research.

Hall (1990), writing on positionality, states, 'You have to position yourself somewhere to say something at all' (p.18). I understand this comment to mean that I must be conscious of the influence my positionality, including my overlapping identities from which I construct meaning, may have on the research process. But I also have to be forthright in communicating my positionality, what I perceive as my identity, in relation to the 18 participants who took part in the research.

My professional career, for the last 30 years, has been based in consulting, mainly in the area of training and development within education in the public and private sectors. When I look back on my career and its various roles and responsibilities in a variety of employment sectors, I consider them all learning experiences and building blocks that have contributed to where my professional career is positioned today. It is by reflecting on these career experiences and development opportunities that I discovered not only my motivation for the topic of study in this dissertation but also my varying relationships with the participants in this research.

According to Merriam, 'Positionality is thus determined by where one stands in relation to the 'other' (Merriam et al., 2001, p. 411). More specifically, this 'relation to others' refers to whether the researcher is an insider and/or outsider. Debate also exists as to whether a researcher can position themselves

only in one of these categories or might occupy both simultaneously. Gair (2012), writing on the dialogue of insider/outsider status of the researcher, comments that it can be 'understood to mean the degree to which a researcher is located either within or outside a group being researched' (p. 137). Regarding the knowledge that insiders and outsiders have, insider researchers tend to have a more intimate knowledge of the group being studied than outsider researchers who may not have an intimate knowledge of the group being studied before entry into the research site (Griffith, 1998). My own position as insider or outsider is now explained.

In relation to the 'others' of my research (that is, the participants), several observations can be made. First, since I was working as a consultant for the manufacturing industry in Oklahoma, I had interacted with all of the participants from the state training providers and employers' groups. Hence, I see my role with them as an 'insider researcher' (St. Pierre, 1997; Bourke, 2014; Breen, 2007; Merriam et al., 2001; Hall, 2014) in the research process. But I did not see myself as having any formal 'power' or authority over them nor did I perceive that they thought I had any power over them. My position with them was one of a professional equal, mutually concerned with advancing manufacturing in the state. Second, I also could be seen as an 'outsider' to these participants since I had never held any of their careers. They may have perceived me as a researcher with no specific experience of having done their jobs. Third, since I had no previous relationship with participants who were production line workers and since I had never worked on the production line (though I have taught those who train production line workers how to train), I see my relationship to them as more of an 'outsider' than with the state training providers and manufacturing managers groups. I assume they would also see me as an 'outsider' who does not know, from personal experience, how exactly to do their jobs and so they are unlikely to see me as someone who had any power or authority over them. Fourth, in addition to my role as a manufacturing consultant, I also see my role as an education researcher positioning me as an 'outsider researcher' (Merton, 1972; St. Pierre, 1997; Flores, 2018). All the participants knew that I was involving them in my research for an EdD and this position may have affected how they looked at me as someone with more education than them and that may have reinforced an outsider element.

Regarding how my position affected by research methodology, my 'insider researcher' identity did allow me to be positioned as someone who understands the industry of manufacturing in Oklahoma, the general responsibility each participant had in the industry, and the state agency and the relevant and prevalent discourses or jargon of the field. Because I was known to the state training providers and employer groups, that positively affected my capacity to gain their willingness to participate in the study. They were willing to participate because we had a previous positive working relationship. Also, since I did know them, that affected my choice of the method of non-probability sampling or, as I term it, participant selection (see section 3.7.1). But, as an 'outsider', in terms of power and authority in relation to all three participant groups, I could not compel any of participants to attend and contribute to the focus group discussions or interviews. That was important with respect to ensuring research participation was entirely voluntary and not, in any sense, coercive.

It was by reflecting on my own career experiences and development opportunities that I discovered my positioning and motivation for the topic of study in this dissertation. The critical reflective component, as an entrance into my EdD work, grounded me in what Rodgers (2002) identifies as 'a tool or vehicle used in the transformation of raw experience' (p.863). The person reflecting must be open to the possibility of change in their understanding of learning and throughout the study I sought to remain open to that possibility. Schön's (1983) and Brookfield's (1995) work on reflection within the individual's professional context provided the motivation to question and reflect upon my learning and career choices and to consider what drives me professionally. Taking time to reflect may appear self-indulgent to some but, as Dewey (1933) proposes, it is only when learners engage in the process of 'meaning-making', reflecting on their learning and experiences, that they will grow in their learning. As my topic of research is situated within my professional practice, the need for reflection is even more pronounced. In Chapter Three of this dissertation, I further situate and discuss the research topic in relation to my professional practice and, in Chapter Seven, I reflect upon the connection between the dissertation and my professional practice, specifically focussing on

how this dissertation process has changed and transformed my professional practice.

1.5 Research Questions

Having identified the problem, the purpose of this study (framed by the literature and theory) is to critically analyse the perspectives of the key actors (state training providers, manufacturing management, and production workers) regarding their understandings of skill for Oklahoma manufacturing. The review of the literature in this field of study, summarised in Chapter Two, demonstrates that confusion exists over how to define skill due to its 'intangibility' (Grugulis & Vincent, 2009), as well as the economic and political influences (Elliott et al., 2017). As a result, the key research question is:

> 1. How does one group of state training providers, manufacturing managers, and production workers in Oklahoma understand skill?

Elliott et al. (2017) note that one of the reasons for the confusion in the literature concerning skill is that its definition is approached differently by key stakeholders, who are influenced by various schools of economics, educational psychology, and sociology. The various definitions influence what the key actors in this study consider to be the skills required by workers in Oklahoma manufacturing. Consequently, the second research question for this study is:

> 2. From the perspectives of this study's participants, what skills are perceived as necessary in Oklahoma's manufacturing workforce?

These research questions indicate that I am not making claims for this small-scale study that suggest my data can or should be extended to all of the manufacturing sector in Oklahoma. The study participants may well reflect sector-wide views and practices but I make no claim to generalisability or representativeness here and discuss this further in Chapter Three and again in my concluding Chapter Seven. Additionally, if only current skills are considered in analyses of the sector, this is limiting both to industry and to the individual worker. If manufacturing is going to continue to grow, it is important in this study to also look at future skills. Today, the US is embarking on the next

industrial revolution (Herman et al., 2016). This industrial revolution and its concomitant technological advances are predicted to transform and disrupt manufacturing (Baena et al., 2017; OECD, 2017; Prudential, 2018). So, in seeking to understand the development of skill in the workforce, it is important in this study to also investigate what key actors interpret to be the related opportunities and constraints. Thus, this study will also ask:

3. What are the opportunities for and constraints to shaping skill in the manufacturing workforce according to the study's participants?

As manufacturing is a major industry in the US, and particularly in Oklahoma (NAM, 2018), I deemed it important to read about the theories that have impacted the understanding and development of skill in the neoliberal context of the US. I chose to use, as my theoretical lens, Human Capital Theory (HCT) and the lifelong learning approach (LLL), since, in the US, skill is seen as a commodity and a key driver of the individual's productivity and of the continuation of the US as a hegemonic, neoliberal society (Olssen, 2006; Yorke, 2006; Dalziel, 2017). Accordingly, this study asks:

4. Can Human Capital Theory and lifelong learning provide a framework to understand skill in Oklahoma manufacturing?

1.6 Methodology

While I develop the study's methodology in Chapter Three, here I provide a summary. This research study is located in empirical research and follows a qualitative approach in its design and analysis, as my preference was to rely on interview data (Carter & Little, 2007). The study followed an interpretivist paradigm with elements of a constructivist approach, with the aim of understanding the experiences and knowledge of the three participant groups (state training providers, manufacturing management, and production workers). With a total of 18 participants, I used a non-probability sampling approach to assist me selecting participants who would approach the focus groups with purpose (Ritchie & Lewis, 2003). The research methods chosen for the study were facilitated focus groups and one-on-one semi-structured interviews. These were selected as my preferred methods in order to provide an environment

within which the participant groups could share their practical and personal 'vantage points' (Hatch, 2001, p.15) of manufacturing experiences related to skill.

To understand the perspectives of the participants from the research data, I deployed Qualitative Data Analysis Software (QDAS), inputting codes and themes generated by the participants in the focus groups having constructed my own transcripts ahead of analysis. It is the intention of the research to focus on specific understandings of how skill is perceived by the participants in this study. The choice of sample chosen for the study as explained in section 3.6 was focused on state training providers and manufacturing managers in Oklahoma who had an interest in skill and workforce issues within manufacturing. The production workers came from a manufacturer within a specific machinery sector. To understand their perspectives, I deployed the Qualitative Data Analysis Software (QDAS), NVivo, on the research data, conducting my own transcript analysis and deriving codes and themes from the data generated by the participants in the focus groups and one-on-one interviews. The process will be explained in detail in section 3.6.4.

1.7 Theoretical framework

As discussed in sections 1.1 and 1.2, this dissertation is focused on answering How does one group of Oklahoma state training providers, manufacturing managers, and production workers in Oklahoma understand skill? The overall research focus is in response to the problem of Oklahoma manufacturers struggling to have an adequate supply of workers with what they deem the right skills for current and future jobs. I will explain how I initially addressed the question drawing on human capital theory (HCT) as the central theory (Schultz, 1961,1981; Becker, 1964; Bowles & Gintis, 1975; Ball, 2008; Valiente, 2014; Dalziel, 2017) along with concepts of Lifelong Learning (LLL) (Ohliger,1981; Coffield, 1999; Biesta, 2006; Grace & Rocco, 2009) to analyse the study participants' understandings of skill. HCT and LLL are discussed in greater detail in section 2.6.1 and again in section 2.6.2 but, in summary, HCT and LLL are used to illuminate the behaviour of the three key participant groups of this study: six state training providers, manufacturing managers from six companies, and six production workers from the selected manufacturing operation in

Oklahoma City. These two theories envision employees behaving according to ideal scenarios that are advantageous to employers. It will be stressed that this assumption provides an insufficient explanation for what is actually occurring in the practice of the study's participants in Oklahoma manufacturing, or in relation to the expectations of employers who continue to worry about a skill shortage. As my data shows, the shortage of what the participants perceive as skill is not adequately accounted for by HCT and a LLL approach and so the study draws on Finegold's (1999) and Buchanan et al's work (2001; 2017) on skill ecosystems to reflect on alternative understandings of skill and how it could be developed in Oklahoma manufacturing.

1.8 Dissertation Outline

This dissertation contains seven Chapters, including this introductory Chapter. Chapter Two presents a critical review of the literature that pertains to defining skill and to discussing what skills are valued by employers today. I also review the literature that discusses risks to skill and the impact of workplace learning. There is an exploration of policy centred on the skill discourse and the language used. In addition, the Chapter discusses the decision to use human capital theory and lifelong learning as a lens to understand the behaviour of the participants with a discussion on skill ecosystems introduced as an enhanced approach and framework to understand skill and skill development.

Chapter Three details the methodology and design that has guided the study. This research is based on experiences and stories from the three participant groups: state training providers, manufacturing management, and manufacturing production workers. My approach to this research lies firmly in an interpretivist paradigm with elements of a constructivist approach (Mackenzie & Knipe, 2006). Focus groups and one-on-one semi-structured interviews were chosen as qualitative data collection tools.

In Chapter Four, I present three of the five key findings from the focus group and one-on-one interviews. The emergent data produced was in response to the research question regarding how participants understand skill and what they consider to be the desired skills in the manufacturing workforce. These themes are: influence of the environment, shift from technical to employability skills,

and creating and ‘seizing’ opportunities to learn new skills. Chapter Five continues the presentation of the findings from the data, in relation to the opportunities for and constraints to their understandings of skill grouped into the final two themes: parity of esteem and challenges in developing skill.

Chapter Six synthesises and critically discusses the key findings in the dissertation linking the discussion of the themes to the literature and theoretical framework provided in Chapter Two. Chapter Seven brings together the most significant outcomes of the focus group and one-on-one semi-structured interviews and discusses their implications. It moves on to outline the study’s limitations and the recommendations for addressing understandings of skill in Oklahoma manufacturing. I also reflect here on recommendations for future research in this area and draw conclusions and implications for my own professional practice.

Chapter 2 - Literature Review

2.1 Introduction

For the last 30 years, skill in the workplace has been the subject of empirical research in the academic arenas of economics, politics, sociology, business and education (Attewell, 1990; Grugulis, 2007; Wheelehan, 2010; Lerman, 2014; Elliott et al., 2017; Livingston, 2017). Skill is generally regarded as multi-dimensional and complex, as Attewell (1990) comments: 'Like so many common sense concepts, skill proves on reflection to be a complex and ambiguous idea' (p. 422).

This Chapter falls into five sections. The first section critically reviews the growing body of literature on what is understood by skill, the meaning of which is not static (Elliott et al., 2017). The second section (section 2.3) focuses on the research on the skills employers require of their workforce. This finding is grouped into three core areas: soft skills and employability, critical thinking skills, and a theoretical foundation of skills. The third section (section 2.4) discusses two subjects. Firstly, it explores the costs and benefits of training and skill development for an employer in developing the individual worker's skill (Grugulis et al., 2006; Manuti et al., 2015; Cunningham & Villaseñor, 2016). Secondly, it discusses the emphasis in the literature on workplace learning (Lerman, 2014; Mueller & Wolter, 2011; Billett, 2015; Livingston, 2017). In the subsequent section (section 2.5), clarification is provided regarding skill policy in the US and there is a discussion of the language of skill embedded in policy (Cappelli, 2015). In the last section (2.6) I review human capital theory (HCT) (Schultz, 1961,1981; Becker, 1964), and then lifelong learning (LLL) within the context of US neoliberalism, and discuss its link to skill within manufacturing. Finally, I present the third element of my theoretical lens: the skill ecosystem approach.

These theories provide the lens through which to assess the constraints and opportunities that influence the discourse on skill in Oklahoma manufacturing. The reason why I have chosen to approach the question of skill from the perspective of HCT and LLL is that these approaches provide the lenses that seem to most comprehensively align with the recurring foundational presuppositions that are utilised, whether consciously or unconsciously, in the

discussion of skill. The skill ecosystem approach will be introduced as a lens on the data and as a better way for Oklahoma manufacturing to think about skill and how it can be developed. This approach, effectively adopted in other contexts around the world, would aid Oklahoma manufacturing by expanding industry's partnership with other entities to improve the skill's discourse.

In the context of Oklahoma manufacturing, there can be discerned a certain evolution and confusion of the meaning of the term skill among the key actors (state training providers, manufacturing managers, and production workers). At the same time, many manufacturers complain of an inability to obtain the right workers with the right skills for current and future jobs. It is against this backdrop that this study is focused on exploring how state training providers, manufacturing managers, and production workers (the "craftsmen") understand skill in the context of Oklahoma manufacturing. Over the past twenty years, the changing social and economic conditions in Oklahoma have impacted the dialogue around and practice of skill. With a shift to a "Right to Work State" in 2001, ownership of skill and the responsibility for its development in workers are argued to be shifting from the state to the manufacturer and the individual worker (Greer & Baird, 2003; King & Catlett-King, 2007). This shift has contributed to the confusion in the understanding and implementation of a skill discourse. While skill used to be considered a means to an end, in the last couple of years, interest in skill has risen socially, economically and politically due to issues of labour supply and demand (Cappelli, 2015; Warhurst et al., 2017). As I observed in my professional practice, when the supply of workers is constrained, increased attention is brought to the skills that each individual worker possesses.

It has been suggested that skill in the workplace as a topic of research is defined differently within the various academic contexts and that this perpetuates its complexity (Attewell, 1990; Elliott et al., 2017; Bryson, 2017). In addition, the skills employers value in their workers have been changing, with a shift from traditional technical skills to more emphasis being placed on employability skills (Grugulis et al., 2004; Little et al., 2006; Hurrell et al., 2013; Hart, 2015; Cunningham & Villasenor, 2016; Hurrell, 2016), critical thinking skills (Little et al., 2006; Wheelahan, 2010; Belkin, 2015; Hart, 2015; Hurrell, 2016), and a

need for a theoretical foundation of skills in manufacturing (Wheelahan, 2010; Young, 2016). This study is interested, firstly, in how manufacturers' concerns regarding productivity and the costs and benefits of workers' skill development influence how skill is defined, and, secondly, in the shift in the skills that are valued by industry (Keep & Mayhew, 2010; Muehlemann & Wolter, 2011; Gambin & Hogarth 2017; Lerman, 2018). Despite employers' changing preferences for certain skills, the influence and role of workplace learning in skill development is gaining research interest, focused in particular on informal learning (Hager,1998, 2004; Tynjälä, 2008; Eraut, 2011, 2014; Eliot et al., 2017; Livingston, 2017), and apprenticeships (Streeck, 2012; Muehlemann & Wolter, 2011; Billet, 2015; Bosch, 2017; Graf, 2017; Gambin & Hogarth, 2017; Lerman, 2017).

The significance of the study of skill has been underlined by policy initiatives both nationally and within the state of Oklahoma. The emphasis on workforce skill in the current policies provides the context for this study around the changing meaning of skill (US Congress, 2007; WIOA, 2016; Gambin & Hogarth, 2017). Studies of skill with a focus on manufacturing have implications for a broader policy agenda that aims to advance policies that support the skill development of the current and future workforce, as well as for the complex dialogue around the policy discourse of skill.

Running in parallel to the research and dialogue around skill situated in a neoliberal society are the recurring discussion on human capital theory (Schultz, 1961,1981; Becker, 1964; Putnam, 2000; Ng & Feldman, 2010; Livingston & Guile, 2012; Valiente, 2014; Dalziel, 2017) and the philosophical framework of lifelong learning (Faure et al., 1972; Olssen et al., 2004; Grace & Rocco, 2009; Biesta, 2011; Cappelli, 2012).

2.2 The meaning of skill

Sennett (2008), in his book "The Craftsman", writes about the struggles and evolution of the 'craftsman's' job and skill through history, with special focus on the introduction of machines during the industrial revolution and the resulting impact on skill in the workplace. The manufacturing industry is one in which many workers consider that skills are required to perform their job as a

craft. It is also an industry in which the required skills are impacted by technology advances (Davis et al., 2012; Rosenfeld, 2017; Tisch & Metternich, 2017). Sennett's arguments are valuable for situating our study:

> Social and economic conditions, however, often stand in the way of the craftsman's discipline and commitment: schools may fail to provide the tools to do good work, and workplaces may not truly value the aspiration for quality. And though craftsmanship can reward an individual with a sense of pride in work, this reward is not simple. The craftsman often faces conflicting objective standards of excellence; the desire to do something well for its own sake can be impaired by competitive pressure, by frustration, or by obsession (2008, p.9).

Sennett, in his writings, illustrates the changing role society and economics play in the provision of what he refers to as the 'tools' or the skill development that enable workers to perform their craft. Other researchers identify with Sennett when he claims that the focus of skills development has moved away from the value of craftsmanship to the value of meeting goals (Green, 2011; Orr & Gao, 2013; Unwin, 2017).

In Oklahoma, unemployment is at 3.2 percent (as discussed in Chapter One), GDP is growing, and at a current rate of 4.2 percent, a post-high-school education gap exists (WIOA, 2016), and manufacturing workers are retiring at an accelerated rate (Optis, 2016). These conditions have reinforced the perception that Oklahoma's workforce is lacking in the current and future skills required by industry and is almost in crisis mode. When delivering his State of the State speech, Oklahoma's governor, Stitt, emphasised the need as a state to 'strengthen the workforce' (Oklahoman, January, 2019). Governor Stitt acknowledged that the workforce needs to be 'strengthened' but fell short in discussing the impact of low unemployment on the potential supply of a skilled workforce. In times when labour pools are limited, industry experiences both a skills gap and a skills shortage (Osterman & Weaver, 2014; Cappelli, 2015). A skills gap, according to Cappelli, 'is the idea that widespread shortfalls have been found in the basic skills of future employees' (Cappelli, 2015, p.242), whereas, a skills shortage focuses on 'job-related skills' (p.242). In the literature, a skills shortage is also referred to as a skills mismatch (Leibert, 2013; Liu & Grusky, 2013; Cappelli, 2015). This skills shortage makes it all the

more crucial to understand what research is saying about skill and how these arguments can be applied to our context and understanding of skill within manufacturing in Oklahoma.

The core question of what constitutes a skill has been debated in research for the past century. Some definition of the term is often included in policy interventions in Oklahoma, the US, and globally (Green, 2011). With the development of the industrial economy and the focus of the last five decades on the knowledge economy (Drucker, 1969), renewed focus has been placed on understanding and defining skill. It has been suggested that the meaning of skill has not been static (Attewell, 1990; Elliott et al., 2017; Bryson, 2017). In contrast, other research (Bryson, 2017) states that the complexities in defining skill have also been challenged, as researchers' continued 'discussions of skill have experienced both a broadening and a narrowing of focus' (p.1). These discussions, in turn, are prejudiced by definitions of the term that are influenced by society and economics, coupled with the notion that skill cannot be separated from an individual's place and value in society (Putnam, 2000; Green, 2011).

Elliott et al. (2017), in their *Oxford Handbook of Skills and Training*, define skill within a workforce setting, drawing on literature from the disciplines of economics, educational psychology and sociology. Attewell (1990), Green (2011) and Payne (2017) have all used the perspectives on skill of these three disciplines. Each of these fields attaches different aspects to the meaning of skill, which in turn adds to the term's complexity and confusion (Payne, 2017). Payne states that skill is 'a slippery concept within the social sciences' (2017, p. 56). Therefore, I will examine how each of these disciplines defines skill.

Economists generally define skill on the basis of the definitions of Schultz (1961), Becker (1964) and Mincer (1974), who conceptualised it in terms of HCT. These authors, and other supporters of HCT, define skill as an individual's attributes. These attributes act as the vehicle for increasing a person's capital and worth. This capital is defined by Schultz as 'the knowledge and skills that people acquire through education and training' (1961). In section 2.5 of this Chapter, I will look at HCT in more depth. Drawing on the momentum in

industry and academia to define skill in terms of HCT, Drucker (1993), in his research on the knowledge economy, broadened the definition further. His research places increased value on skill as the result of increased knowledge and individual worth and performance. Human capital consists of the skills and knowledge the individual acquires from education and training opportunities, with the goal of increasing an individual's productivity in the workplace (Psacharopoulos & Woodhall, 1985; Ng & Feldman, 2010). In contrast, Grugulis & Stoyanova (2006) note that when skill is seen as a performance measure within industry, it is challenging to 'establish a link' (p.2). Developing this research further, Grugluis & Vincent (2009) argue that it becomes even more complicated when including 'soft skills' in the workplace skill dialogue. As noted by Hurrell et al. (2013), soft skills are often described as 'non-technical and not reliant on abstract reasoning, involving interpersonal and intrapersonal abilities to master performance' (2013, p.162). Grugulis & Vincent (2009) argue that defining 'soft skills' is complex due to the intangibility of the concept. Common examples of 'soft skills' within the literature are: problem-solving, team-work, motivation, and oral communication (Grugulis & Vincent, 2009; Dalziel, 2010; Hurrell, 2016).

Political rhetoric, government research and scholarly writings emphasise the importance of soft skills as the most valued skill sets sought today by employers (NACE, 2012; Collet et al., 2015; Hurrell, 2016; Humburg & Van der Velden, 2017). Employers and policy makers, both federal and state, understand skill in different ways; they define skill based on their own settings and are often blind to the biases and preconceptions they bring to their definitions. From reviewing the current discussion on skill, there is an evident change in the skill mix that employers appear to want their individual workers to display. Employers have shifted from an emphasis on technical skills to a focus on 'soft skills' (Grugulis & Vincent, 2009; Collet et al., 2015; Hurrell, 2016; Warhurst et al., 2017). Moreover, this underlines the shift towards including 'soft skills' within definitions of workplace skills, beyond the traditional definition of technical skills. In manufacturing, technical skills are traditionally referred to as practical abilities often attributed to mechanical skills. Some examples of technical skills in a manufacturing context are: CNC lathe operation, machine set-up, inspection, grinder operation, and computer/data entry (Norman et al., 2002, p.1483).

Recent research discusses a transition in language, from referring to 'soft skills' to 'employability skills'. The transition in how 'soft skills' are described has led to confusion, as Collet et al. (2015) note, due to a lack of shared language between key stakeholders, including academics, industry and the individual worker. In addition, Lloyd & Payne (2016) take umbrage at claims that 'soft skills' are skills, arguing that this categorisation devalues the concept of skill. Grugulis (2007) and Green (2011) define skill from an economist's perspective, placing the control of skill under the enterprise's responsibility, and ignoring the societal influences that shape and impact the skill of each individual as they play out their role in the social system of work (Grugulis, 2007, p.18; Green, 2011, p.7).

Among educational psychologists, research has centred on defining skill from two perspectives. First, it has focused on how skill is defined or connected to the skills required by the individual workers to perform their job. Second, it has focused on how the worker acquires the skills to perform their job (Payne, 2017, p.57). The discussion of skill in the educational psychologist field varies greatly across the world. In the UK, Payne cites Clarke & Winch (2006, p.262), who define 'a skilled worker' as:

> someone whose operational ability to carry out a particular task is recognized by the immediate employer but who is not necessarily formally trained or "qualified" with the potential to carry out a wider range of tasks than those immediately confronted (Payne, 2017, p.58).

This narrow definition of skill is reflective of the US context and Oklahoma, the location of my research. In this context, the education and training of the individual is focused primarily on work skills. In contrast, in the literature on the European and Australian contexts, educational psychologists, such as Brockman et al., (2011), provide a much broader definition of skill. This is similar to the approach of the Organization for Economic and Cooperative Development in their publication, *'Skills for Social Progress'*, wherein the definition of skill is broadened to include 'social and emotional skills-such as perseverance, self-esteem and sociability' (OECD, 2015, p.13).

Payne (2017) defined skill in two ways: first, as that which is 'required within the job' and, secondly, skill as 'a social construct' (Payne, 2017, p.56). Payne argues that Braverman (1974) and others who debunk Taylorism align with the belief that skill in the workplace cannot be separated from the complicating forces of an individual's autonomy and the organisation's control of skill. Other researchers state that skill cannot be separated from its location within the workplace when seeking a definition (Littler, 1982; Attewell, 1990).

Grugulis' belief that skill is part of a social system is expanded further by Grugulis & Stoyanova (2011).

> Essentially skill is part of a social system; and skilled and expert work is a product of the way different parts of this system relate to one another (2011, p.2).

As work in manufacturing becomes more complex in light of technological advances, Wheelahan's (2010) and Grugulis & Stoyanova's (2011) research provides valuable data and arguments for how skill should be defined. Wheelahan's research raises the issue of the need for an understanding of the role social systems and theoretical knowledge play in skill development (2010). For a discussion of Wheelahan's contributions to theoretical knowledge and skill development, see section 2.3.3.

'Management rhetoric accepts that skill development is the only acceptable route to prosperity. Management practice lags behind' (Grugulis & Stoyanova, 2011, p.1). If management truly believes in the importance of its workers' skill development, why do managers, as Grugulis & Stoyanova (2011) claim, fail to support skill development? Thus, this research study also seeks to explore whether the lag in management practices might be due to a lack of understanding of what skill is and not knowing what strategies are necessary for continued, sustained skill development in the workplace. Consequently, a key question that this study asks is: How do Oklahoma production workers, manufacturing managers, and state training providers understand skill?

2.3 Skills valued by employers

Regarding which skills employers seek in their employees, there was no overall consensus within the body of literature (see Grugulis et al., 2004; Little et al., 2006; Hurrell, 2016; Cunningham & Villasenor, 2016). There is confusion in the literature when it comes to defining skill and a lack of consensus when defining which skills are most valued by current workers (Payne, 2000; Green, 2011). Payne (2000) and Green (2011) conclude that the skills that are valued have changed as the economy has changed. For example, Green (2011) comments:

> Half a century ago skill was reserved in policy discourse for technical qualities, usually in craft and related occupations, and had a distinctly manual overtone. In the "knowledge economy" its meaning is a great deal broader (2011, p. 21).

The skills described often change and conflict. Bosch (2017), in discussing skill, concludes that the 'terrain' of skill is changing, which in turn is seen to influence the demand for specific skills from industry. As the labour supply is reduced, there is a shift to no longer defining a skilled worker in technical terms but rather in broader terms (Payne, 2009; Hurrell et al., 2013). From reviewing the literature, it emerged that three areas of preferred broader skills were more dominantly discussed: soft skills/employability, critical thinking, and the role of theory.

2.3.1 Employability skills

Cunningham & Villasenor (2016) note that the learning outcomes of education show that students are not taught the skills that labour markets need (p.103). They also insist that whilst employers value all skill sets in their employees, of greatest value to them today are socio-emotional skills, often referred to as employable skills (p.126) and higher-order cognitive skills. Grugulis et al., (2004), Little et al., (2006) and Hurrell (2016) stress that the skills sought by employers mainly relate to soft skills and employability skills rather than to hard skills, which are commonly referred to as technical skills (Laker & Powell, 2011). 'Soft skills' in literature are generally defined as:

> non-technical and not reliant on abstract reasoning, involving interpersonal and intrapersonal abilities to facilitate mastered performance in particular social contexts (Hurrell et al., 2013, p.162).

In discussions of 'employability', often included is a 'set of achievements, understandings and personal attributes that make individuals more likely to gain employment and be successful in their chosen occupations' (Little et al., 2006, p.2). These skills are commonly referred to as 'soft' and 'career' skills, and are aligned with Career and Technical Education (CTE) core goals and AAC&U advocacy. CTE is the US equivalent of Vocational Education and Training VET. In this dissertation, I will use VET interchangeably with CTE. Some literature differentiates between soft skills and employable skills. 'Employable skills' are defined as the skills that ensure an individual's employment beyond six months on the job (Padmini, 2012). Selvam (2012), referencing Knight & Yorke (2003), defines employable skills:

> As a set of skills, understandings and personal attributes that make graduates more likely to gain employment and be successful in their chosen occupations (2012, p.32).

What these differing definitions demonstrate is that there is a divide and disagreement between what policy, researchers, and education describe as the skills necessary for success within the workplace and what an individual worker and employer believes is required to be a successful employee (Hurrell et al., 2013; Collet et al., 2015). This confusion in the literature emphasises the need to have an understanding of what skills are valued and needed by employers in the workforce and what employees themselves see as necessary for success in the workplace.

2.3.2 Critical thinking skills

The Hart Report of Employers and Students, entitled *'Falling Short? College Learning and Career Success'*, concluded that only 23 percent of graduates were sufficiently prepared in critical thinking to make effective employees. The report states:

> When it comes to the types of skills and knowledge that employers feel are most important to workplace success, large majorities of employers do NOT feel that recent college graduates are well prepared. This is particularly the case for applying knowledge and skills in real-world settings, critical thinking skills, and written and oral communication skills—areas in which fewer than three in 10 employers think that recent college graduates are well prepared (2015, p.11).

'Critical Thinking', as defined by The Foundation for Critical Thinking (2018), is a self-directed, self-motivated, self-corrective activity that one engages in when reviewing one's own thinking about any subject in order to improve the quality of one's thinking. An individual becomes a more 'critical thinker' when she evaluates how she thinks and begins to identify and move away from her own egocentric or socio-centric patterns of thinking. A critical thinker is someone who is more self-aware of her own presuppositions or worldview which shapes how she perceives and evaluates information.

In response to the Hart Report, Debra Humphreys, vice president for policy and public engagement at AAC&U, was quoted in the Wall Street Journal as saying that employers place great importance on whether the employee '…can continue to learn over time and solve complex problems' (Belkin, 2015). One reason why the ability to solve complex problems is important to many employers is that the discipline-specialised knowledge a student gains through education will often be out of date not long after they start a job. The employee is expected by employers to continue to learn and solve problems as they grow, adding new knowledge in response to changing information and opportunities. This conclusion affirms the research of Wheelahan (2010) and also draws attention to the role that the individual worker plays in their own skills development.

Research contributes to the growing debate of what skills employers value in the individual worker, with some studies pointing to the area of critical thinking. Georgetown's 2014 Recovery Report '*Job Growth and Education Requirements through 2020*' (Carnevale et al., 2013) predicts that by 2020, the US will create 55 million new jobs, over 65 percent of which will require education past high school (p.2). In turn, 96 percent of these post-high-school jobs will require critical thinking (p.8). In 2011, the Accrediting Council for Independent Colleges and Schools (Bieda, 2012) surveyed 1,000 employers on the career readiness of graduates. The results of that survey showed that applicants performed below employers' expectations when it came to critical thinking (Bieda, 2012, p.9). A third report was published by The National Association of Colleges and Employers (NACE), the leading organization for higher education (HE) and employment in the US. In the report, entitled '*The Skills and Qualities*

Employers Want in Their Class of 2013 Recruits', the surveyed participants ranked critical thinking as one of the most desired qualities in a graduate (NACE, 2013).

As the Georgetown and NACE reports evidence, an ability to think critically is top of the list of attributes that graduates need to demonstrate to future employers. What these studies suggest is that the US has a growing need for employees who have gained from HE and vocational education the capabilities commonly associated with critical thinking.

2.3.3 The role of theoretical knowledge

In her book *Why Knowledge Matters in Curriculum: A Social Realist Argument* (2010), Wheelahan emphasises that 'workers need to be able to use theoretical knowledge in different ways and in different contexts as their work grows in complexity and difficulty' (p.2). Sociologists Bernstein (1971) and Wheelahan (2010) define 'theoretical knowledge' as that knowledge which allows the individual to think about what has not yet been thought and to 'imagine alternative futures' (Wheelahan, 2010, p. 2). In the case of the manufacturing sector, which is changing from being perceived as a low-skilled industry to a technologically advanced one, theoretical knowledge is assumed to be acquired in HE or VET education (Gaulden & Gottileib, 2017; Spencer, 2017, 2018). Wheelahan argues that as learning is continually redefined to focus on students being 'work-ready' (p.3), this moves the theoretical foundation for an individual's skill development away from mathematics for electricians, mechanics and engineers. Wheelahan's research stands in contrast to research conducted by Hager (2004), Tynjälä (2008) and Eraut (2011). It could also be argued that a gap in theoretical knowledge is acquired in VET. For example, machinists and CNC programmers experience decreased worker discretion and a consequent skill acquisition across the life course. Yet, HE graduates in engineering leave formal education with a better theoretical understanding, which leads to increased worker discretion in knowledge and skill acquisition (Eraut, 2011).

The relevant literature also suggests that some of the core factors shaping skill in practice are researchers' discussions and understandings of the role theory

and knowledge play in skill development (Young, 2006; Wheelahan, 2010). As jobs get more complex and there is an increased focus on digital skills, individuals and industry benefit from a focus on theoretical knowledge (Wheelahan, 2010; Arntz et al., 2017; Spencer, 2017, 2018). Aligning with the belief that skill includes knowledge, Wheelahan, referencing Young (2006), points out that 'many jobs also require knowledge involving theoretical ideas shared by a community of specialists' (2010, p.2) located within the academic disciplines. I would argue that this observation is important when applied to the manufacturing context of my research. Basic theories required in manufacturing operations, including measurement, gauging and pressure, are key for skill development. It is in the VET context and curriculum that the individual, when participating in vocational education's bridge to career, is exposed to theory and the subsequent work-based practice of testing and growing theoretical knowledge, which in turn develops skill (Wheelahan, 2010; Wheelahan & Moodie, 2017). Wheelahan and others argue that the VET curriculum is adding less theoretical knowledge to support the individual's learning, thereby weakening it. Could it also be argued that, with the increasing complexity of industry, faculty within VET have not been able to expand their theoretical knowledge base to keep abreast of the speed of change? This theoretical knowledge gap of VET instructors in turn impacts the learning and skill acquisition of each individual learner. More recently, this gap has been seen to be prevalent in the transfer of technological and digital skills and in the consequent impact on skill in the workplace (Tisch & Metternich, 2017).

2.3.4 Automation

Gerovitch (2003) defines automation as 'the conversion of a work process, a procedure, or equipment to automatic rather than human operation or control' (p.122). In the last decade, the impact of automation on manufacturing has grown with the global economy, stepping into a new realm of skill related to the next industrial revolution - Industry 4.0 (Hermann et al., 2016; Van Laar et al., 2017; Bonvillian et al., 2018; Deloitte, 2018). The term Industry 4.0 was first coined in 2011 by the German Government as one of its key industry initiatives. In the US, research in this area is often called Advanced Manufacturing and this term is used interchangeably with Smart Manufacturing (Davis et al., 2012). In the context of this research, Smart Manufacturing is generally described 'as the

integration of complex physical machinery and devices with networked sensors and software, used to predict, control and plan for better business and societal outcomes' (Hermann et al., 2016, p.3929).

As industry enters this new era of smart manufacturing influenced by the Internet of Things (IOT) and the changing skills required to adjust to the quick speed of change, educators, economists and sociologists are now discussing skill as it relates to the skill of automation (Van Laar et al., 2017). These experts want to question how skill is defined in regard to human skill in this new technological framework. In other words, they are focusing attention on the skill that is at play with robotics, data, IOT and the interrelated functions that impact and connect with human skills. These human skills are increasingly referred to as 'digital skills' (Frey et al., 2016; Spencer, 2017; Van Laar et al., 2017).

Research on automation and its impact on the skill of the workforce is often centred on two key areas of debate. First, the literature consistently claims that a skill shift has been seen with the integration of automation. The shift occurs from needing a low to medium skilled workforce in manufacturing to a growth in demand for high skills (Acemoglu & Restrepo, 2018; Krzywdzinski, 2017; Ra et al., 2019; Pew, 2014; Spencer, 2018). As described by Krzywdzinski (2017), when addressing the skill shift with the introduction of automation into automotive manufacturing in Germany and Central Eastern Europe, automation in manufacturing does bring challenges and a necessary shift in skills. What researchers cannot agree on, in this first area of debate, is how the impact of technology on production and processes will affect the 'nature' of the change (Krzywdzinski, 2017, p.248). Autor et al. (1998) and Brynjolfsson and McAfee (2018) argue that automation will require highly skilled workers with low-skilled worker jobs gradually disappearing. However, other research focuses on the impact of automation on the reduction of medium-skilled workers' jobs resulting in low-skilled workers performing the tasks that cannot be automated (Frey & Osborne, 2017).

The second area of debate in research around the integration of automation into manufacturing reflects discussion on what skills the high–skilled manufacturing

worker will need to possess in the age of automation. Industry reports suggest the skills that will be in highest demand from manufacturers will be technological skills, both basic digital skills and more advanced technology skills centered on programming (Spencer, 2016; Bughin et al., 2018; Nedelkoska & Quintini, 2018). In other words, there is a focus on the skills at play in robotics, data, the Internet of Things (IOT)and interrelated functions that impact and connect with human skills. These technology skills required for automation are increasingly referred to as 'digital skills' (Frey et al., 2016; Spencer, 2017; Van Laar et al., 2017). Researchers also predict a related demand for higher cognitive level skills, such as creativity (Frey & Osborne, 2017; Bughin et al., 2018; Ra et al., 2019).

What is agreed is that the integration of automation into work practices is increasing and as a result its impact on skill cannot be ignored (Bughin et al., 2018). How policy and practice are adapted and aligned to facilitate this impact and its transition for workers is imperative to government, industry and society. Another approach to understanding the impact of automation integration on skill is the skills ecosystem approach. In the following section I discuss that approach and explore how this theory could potentially offer a more effective approach to the skills problem in Oklahoma.

What I did not observe in the literature is any significant discussion around the interconnected skill of humans and machines via robotics and data analytics. These innovations will push the context and speed of skill acquisition to the extent that they will strain industry and VET in their attempts to keep up. This would be a topic worthy of further research. From the reviewed literature regarding the desired skills valued by employers, there was an evident gap in the research focusing on the question of what skills production workers themselves see as valuable for their employment. This study will address this gap in the research by including the views of all three actors (state training providers, manufacturing management, and production workers) when asking what skills are needed in Oklahoma's manufacturing workforce.

2.4 Skill development

This section will review the literature discussing the perceived opportunities for and constraints to the skill discourse. Two key areas were dominant within the findings and will be discussed in this section. First, within the literature, I saw an emphasis on topics related to the perceived risks of skill development, discussed in relation to the productivity gains and the relative costs and benefits of training and skill development for an employer in developing the individual worker's skills (Keep & Mayhew, 2010; Lerman, 2014; Cunningham & Villasenor, 2016; Manuti et al., 2017). Second, in a great number of studies, discussion focuses on the significance of work-based learning as a tool for skill development. Particular emphasis is placed on informal learning within the workplace and the adoption of apprenticeship programmes (Eraut, 2011; Billet, 2015; Manuti et al., 2015; Livingston, 2017).

2.4.1 Costs and benefits of training and skill development

Literature stresses the impact of an employer's cost-benefit analysis when developing the individual worker's skill cannot be ignored (Keep et al., 2006; Lerman, 2014, 2017; Cunningham & Villasenor, 2016; Manuti et al., 2017). When it comes to the education and training of the workforce and associated skill development, 'skill drives productivity, competitiveness and incomes' (Lerman, 2017, p.1).

Kemp & Mayhew (2010) write of the 'potential impact of skills on productivity' (p.539) and discuss the very often assumed connection between skill and productivity. They argue that government policy is so focused on the connection between investment in skills and economic output that skill development is not seen as a correlation in the practice of the workplace (Kemp & Mayhew, 2010, p. 541). However, investments in skill development by the government often lack buy-in from senior management and, therefore, subsequent implementation within the enterprise. Indeed, the literature shows that government discourse and policy for skill development often omit any linkage between investment in skills and benefits for the organisation (Muehlemann & Wolter, 2011; Gambin & Hogarth, 2017). In practice, most manufacturers weigh up the benefits and risks of investment in skill development.

Lerman (2017) argues that in a 'free society' (p.146) like the US, employers and individuals must decide on their investment in vocational training, and in particular in CVET. This argument can be applied to any work-based skill development. When conducting a cost-benefit analysis of training, employers often focus on the perceived risks of skill development, such as other employers 'poaching' individuals after they have been trained (Lerman, 2017, p.147). Another risk or barrier associated with investing in skill development, discussed by Klosters (2014), is the financial cost borne by the employer; if market conditions experience a downturn, employers see any investment as a financial loss. Muehlemann & Wolter (2011) argue that while employees may be poached once trained, it is less likely to happen if the training and skill developed is not certified. When skills are developed but not assessed, the trained workers are less desirable for employers who are seeking employees (p.581). More recent research into the opportunities and benefits of skill development for an employer has centred on apprenticeships (Mohrenweiser & Zwick, 2009; Lerman, 2014; Hanusek et al., 2017), the benefits of which are correlated to the employer's profits. The largest survey conducted comparing German and Swiss firms' apprenticeships showed that the benefits offset the investments for all industries with the exception of manufacturing (Mohrenweiser & Zwick, 2009). Leman (2018) has conducted extensive research into apprenticeships and the slow adoption of apprenticeships in the US compared to Europe. Discussing the relative advantages to the employer, he quotes Muehlemann & Wolter (2011):

> ... in a well-functioning apprenticeship training system, a large share of training firms can recoup their training investments by the end of the training period. As training firms often succeed in retaining the most suitable apprentices, offering apprenticeships is an attractive strategy to recruit their future skilled workforce (p.1).

The relatively lower profits derived from apprenticeships in manufacturing could be influenced by the increased manufacturing costs in terms of raw materials and the waste that is accumulated in training errors. In the US, data and research are sparse regarding the costs and benefits perceived by a manufacturing employer when providing apprenticeships and other workplace skill development initiatives (Reed et al., 2012). Reed et al., on behalf of Mathematica Policy Research, conducted a cost-benefit analysis of ten US states' apprenticeship programmes. Their research, which did not consider the

cost to employers, concluded that the 'social benefits of registered apprenticeships exceed social costs' (Reed et al., 2012, p. xiii). Social benefits reduce unemployment costs for the government, but for a manufacturer they bear the cost of putting in place an apprenticeship programme in the US model (Reed et al., 2012). The literature also points to a lack of knowledge among employers about skill development and the necessary resources available in the state provided by educational and private entities to help facilitate skill development. Consequently, employers are making poor investment choices about skill development (Snell, 2018).

Manufacturers are often faced with product demand with tight production turnaround schedules. In this fast-paced production environment and faced with high customer demands, it takes careful forward planning on the part of management to allow time for skill development. Research commissioned by the Manufacturing Institute and carried out by Deloitte shows that 12 percent of employers are routinely using overtime to meet production goals; this allows no time for skill development (Deloitte, 2014, p.9). As mentioned previously, this refers to developing both hard (technical) and soft skill. For many in modern manufacturing, skill development often takes place 'on the job' (OJT). Traditionally, such informal skills development has been called 'following Joe'. Research has shown that due to the production demands of manufacturing operations, the preferred management strategy is to prioritise meeting production goals over meeting skill development goals (Muehlemann & Wolter, 2011; Grugulis, Holmes & Mayhew, 2017).

2.4.2 Workplace learning and skill development

A very commonly discussed topic in the literature is the matter of informal learning and work-based learning (Eraut, 2011; Billet, 2015; Manuti et al., 2015; Livingston, 2017). Until the late 1990s, research into learning mainly centred on formal education and the life transition from school to work (Tynjälä, 2008; Dalziel, 2010). Currently, scholars in the field of workplace learning emphasise that continuous learning and skill development are important for both the individual and the workplace as they compete in ever changing global markets (Tynjälä, 2008; Keep & Mayhew, 2010). As a result, there has been a growth in research into workplace learning. Research contends that most individual

workers' skills are acquired informally at the workers' own discretion in the workplace (Billet, 2015; Livingston, 2017). But what is not acquired in the workplace, as one researcher notes, is the theoretical knowledge that allows the worker to adapt skill to new processes in manufacturing (Wheelahan, 2013). This 'gap' between theoretical knowledge and the individual worker's skill acquisition is a common component in the skills debate in Oklahoma manufacturing.

In this changing work environment, research shows that a gap exists between learning knowledge and skills in HE and VET and the school-to-work transition (Eraut, 2004). It is worth noting that in the US, VET is organised and implemented differently from state to state. These differences in organisation stem from the fact that only 5 percent of the budget is federally funded. I will look at this further in Chapter Five. Scholars differ in how they see this gap play-out within the workplace. Hager (2004) states that learning and skill, as defined in HE and VET education, are not transferable to the workplace and that the knowledge and skills required to do a job are most often acquired on the job.

Hager (2004) categorises the knowledge acquired in HE and VET into five areas: theoretical, methodological, practical skills and techniques, generic and general knowledge about the occupation. He argues that there is little evidence that these skills are being transferred to the workplace from the classroom or production lab. Instead, he argues, in many cases, they are developed in the workplace. In agreement with Hager and Eraut, Tynjälä cites other empirical studies which concluded that each individual learner surveyed found that they had developed more skill in the workplace in informal learning contexts than during their formal education (Strenstrom, 2006; Tynjälä et al., 2006; Tynjälä, 2008).

In his research, Livingston (2017) concludes that 'the labour force is continually engaged in informal learning, primarily learning by experience' (Elliott et al., 2017, p.295). This aligns with the OECD definition of informal learning:

> …learning resulting from daily activities related to work, family or leisure. It is not organised or structured in terms of objectives, time

> or learning support. Informal learning is in most cases unintentional from the learner's perspective (Dalziel, 2010, p.22).

Elliott et al. (2017) go beyond the OECD definition to point out that the individual is engaged in informal learning in the workplace, and they conclude that informal learning, like formal learning, is linked positively to job performance. These definitions highlight two key arguments within the literature. First, an emerging school of thought holds that theoretical knowledge acquired through education and developed through practical application in the workplace is imperative for successful workplace learning and skill development (Wheelahan, 2010; Billet, 2015). Second, increased attention should be given to the research on informal learning, as opposed to formal learning, its increased viability when exploring skill and how individuals learn in the workplace. As Tynjälä concludes, 'This requires close collaboration and partnership between education and work' (p.131).

Eraut (2004, 2011) conducted research into informal learning in the workplace and focused on the workplace learning of professionals, technicians and managers. Eraut's research concluded that 'in all the cases the majority of learning in the workplace itself was informal, and involved a combination of learning from other people and learning from personal experiences, often both together (Eraut, 2004, p.248). Further research by Eraut (2011) over a three-year period showed that 70 to 90 percent of his research group's learning occurred in the informal workplace setting. Learning from the challenges of the work itself and learning from other people were reported as being important by almost all of Eraut's respondents (2011, p.8). Although it is difficult to quantify what learning or skill development actually occurred, Eraut's research goes further in adding considerable weight to the conclusion that informal learning plays a major role in an individual's skill development. Jeske & Roßnagel (2016) note that managerial support and encouragement of skill development are the greatest predictors of success in informal learning.

Billett refers to the opportunities for learning and individual decision-making in the workplace as 'worker discretion' (2015, p.219). From his research, he concludes that individual workers had increased discretion based on their education level. Billett's quantitative research findings are worth highlighting,

as they suggest that one of the lowest levels of discretion is to be found in the manufacturing industry (p. 221). His research aligns with previous qualitative research on this issue by Livingston (2017). Livingston concludes that an individual's ability to use their skill is often aligned with the discretion they have in their job. He notes that less individual worker discretion is more apparent in working-class employees. This aligns with Billett (2015), since the majority of individual workers in manufacturing operations are frequently classified as working class and/or low-skilled. This argument is also supported by Unwin, who, referring to Sennett (2008), argues:

> Yet when employees no longer feel a sense of pride in their work or the work itself does not generate commitment, their motivation to participate in training or to share their knowledge and skills can quickly seep away (2017, p.222).

This conclusion also stands in agreement with Hager (2004) and Tynjälä (2008), who argue that most learning occurs in an informal work setting. Further research could look at the informal learning of manufacturing workers and the relationship between their levels of discretion to learn and perform their jobs and their skill development and individual autonomy.

A great deal of research has been produced in Europe and Australia that explores work-based learning focused on apprenticeships, with particular focus on a dual-apprenticeship model, which is relevant to this study (Muehlemann & Wolter, 2011; Bosch, 2017; Gambin & Hogarth, 2017; Lerman, 2017). In the US, relevant research is lacking on this topic; yet it could provide a valuable contribution to understanding and developing skill within US manufacturing. Discussing how European manufacturing companies transition the dual-apprenticeship model to the host country of the US, Fortwengel & Jackson (2016) observe that knowledge about apprenticeships is almost non-existent. Research also suggests that the transfer of apprenticeships to the US is constrained by the organisation of national and state training and skill providers. The US model is a 'liberal market model', similar to what Bosch refers to (2017, p.6). The set of skills required by the workforce is determined by the needs of industry, and the costs of the skill development are shouldered by the individual worker and/or company. Of particular relevance to the Oklahoma context is

Bosch's observation that the US has the remnants of an apprenticeship system and that US trade unions have lost the battle for social protection and skill development. Streeck (2012) suggests that it was the changing framework witnessed in the US in the 1980s, when unions lost control of workplace skills, that weakened or eliminated apprenticeship training (p.339). Furthermore, in the late 1990s and 2000s, as section 2.5 on policy will discuss, there were federal cuts to skills funding, and this was when Oklahoma passed the right-to-work (RTW) legislation. These two moves combined severely threatened workplace learning (particularly apprenticeships) (Greer & Baird, 2003; Devinatz, 2015).

These findings in the literature provide the historical context for the current difficulties in implementing national and state-wide apprenticeship programmes. While Fortwengel & Jackson (2016) discuss the difficulties of apprenticeship adoption in the US, the specific historical context of reduced federal funding and Oklahoma's right-to-work legislation also needs to be kept in view when looking at the constraints to apprenticeship programme adoption in Oklahoma (Greer & Baird, 2003). These measures have implications for the types of learning and obstacles to learning that individuals are exposed to and how they learn and acquire skills. The literature shows that there are many issues to consider when discussing skill within industry. This discussion regarding the difficulties of adopting apprenticeship programmes prompts the question: What are the barriers and drivers to shaping skill for the manufacturing workforce in Oklahoma?

2.5 The policy context of skill

State training providers, manufacturing managers, and production workers understand skill in differing ways. The conceptualisation of skill also varies with the size of an enterprise and is often influenced by policy. As my research is positioned in the US, before I examine how skill is discussed in the relevant skills policy discourse, it is necessary that I first identify how policy in this context is defined (Reed et al., 2012; National Skills Coalition, 2014).

2.5.1 Skill policy in the US context

Policy can be interpreted in many ways in an educational setting such as the training of workforce in manufacturing. Ball (2013) offers a plausible working definition:

> Policy is an enlightenment concept, it is about progress, it is about moving the inadequacies of the present to some future state of perfection where everything works well and works as it should (2013, p.7).

Policy is anything that brings purpose, proposals, programmes and sometimes decisions in the form of governmental acts. Education in the US as a policy is established in state constitutions as a right for all citizens. Subsequently, the purpose of federal education governance is primarily to advise and/or recommend, rather than to serve as a regulator or implementer of policy (US Department of Education).

It is also important when addressing the role of policy in the US to remember that policy is implemented by each state. This structure leads to many differences between states, with most programmes that are funded at a state level being driven by political and economic forces, both at the national and local levels. Each state is often a contributing partner in skill development and receives federal and state funding.

Most funding for education comes from state and local tax payers. At the state policy level, Oklahoma assigns responsibility for skill development via initiatives that involve stakeholders, such as the public workforce system, VET, Veteran Affairs, Native American Tribal agencies, and non-profits. Tribal projects are funded mainly through federal funds and casino revenues within the state. The Oklahoma Office of Workforce Development (OOWD) is the state body tasked with implementing the Federal, Workforce Innovative Opportunity Act (WIOA), designed with the purpose of increasing:

> the wealth of all Oklahomans through providing education and training for citizens to obtain quality employment. Governor Fallin's rationale is that coordinating strategic priorities and plans across education, training, and industry will increase the wealth of all Oklahomans by providing employment opportunities for workers and

> ready availability of highly skilled talent for business and industry. The initiative is built upon a coalition of businesses, educational institutions, state agencies, and other partners (WIOA, 2016, p.25).

Wealth is defined by the current Governor and State Government in the WIOA as wealth-generating occupations and policies that increase the likelihood of businesses and entrepreneurs prospering, which in turn increases state fiscal resources (p.25). This neoliberal approach aligns with HCT, which is discussed in section 2.6.2 of this Chapter. When situating this study in its context, I think it important to explain the State's workforce plan, as it has relevance to my research questions and positions them within an Oklahoma manufacturing context. Under the federal directive, the Workforce Innovation and Opportunity Act (WIOA) succeeded the Workforce Investment Act (WIA) in July 2015. This is the fourth iteration of the programme since its inception in 1960 (Heinrich, 2015). As part of the WIOA, the governor of each state must submit to the US Secretary of Labour a Unified State Plan that outlines a four-year workforce development strategy for the state's workforce development system. This national, publicly funded workforce system is a network of federal, state, regional, and local agencies and organisations that provide a range of employment, education, training, and related services and supports to help individuals secure jobs while providing businesses with the skilled workers they require. The target population that the WIOA was established to serve are low-income or unemployed youths and adults and dislocated adult workers (Spaulding, 2015). Its primary objective is to ensure that employers' requirements are matched with skilled individuals from these target population groups. Low-skilled and dislocated adult workers are often ideal candidates for entry and mid-level jobs in manufacturing. Another key priority of the current WIOA is to encourage state and local WIBs to better:

> ...align their workforce development activities with state and regional economic development plans, so as to ensure that the training and employment services offered are linked to expected industry growth, the related skill competencies required, and anticipated employment opportunities (Heinrich, 2015, p.15).

As mentioned in section 1.3.1 of this dissertation, the key priority of the State's system of developing workforce activities aligned to their economic development plans indicates the view that economic growth will occur with skill

development and that policy is driven by creating conditions that encourage growth in human capital via lifelong skill development. The implementation of the WIOA and the state plan is intended to promote a unified plan, drawn up by the Governor's office, across agencies with a shared understanding of employers' workforce needs. The workforce is overseen by the Secretary of Commerce and Workforce. It should be noted that each state administers its Unified Plan in its own way and supplements its plan with state funds, since federal funding for the WIOA has decreased (President's Budget, 2018). Holzer (2015) reports that the federal government currently spends about $5 billion a year on the WIOA, compared to $40 billion in 1980 under its predecessor - the Comprehensive Employment and Training Act (CETA). In the new US administration, President Trump's budget (referred to as the skinny budget) has proposed to apply a further 21 percent cut to the budget of the Department of Labour, whose office funds the WIOA, registered apprenticeships, and other programmes (White House Budget, 2018).

As the US population's life expectancy increases and the retirement age is raised, individuals are spending longer in the labour market, which in turn creates a need for work skills to be updated over an individual's lifecycle (Gambin & Hogarth, 2017). The question then becomes: who is responsible for the funding of this skill development? Discussing the UK national training system, Gambin & Hogarth report that the government delivers 'sub-optimal levels of skill development' (2017, p.633). A similar criticism can also be directed towards the US federal government. Its inability to deliver high-quality skill development places an increased burden on the state to do so from a policy perspective. In the US, when it comes to manufacturing, the responsibility for skill development often falls upon the employer and/or the individual, especially in non-unionised and right-to-work states like Oklahoma. State funds rarely exist to develop workplace skills in the transition from school-to-work and beyond. This skill development is not simply a question of economics. The literature points to a correlation between community and the ongoing skill development of the individual. In Oklahoma manufacturing, outside of the large metropolitan areas of Oklahoma's City and Tulsa, rural manufacturing communities are impacted greatly by the skill supply and their ability to equip employees with the required skills to navigate the speed of business change.

Gambin & Hogarth's research offers a valuable distinction between initial and continuing vocational education training systems (IVET and CVET). IVET is primarily funded by the state and the individual, whereas the costs of CVET are covered by the employer and/or the individual. The ways in which responsibility for ongoing skill development is assigned varies across the world; even within the US, there are differences between states, and even between counties within states. The core of Oklahoma's public education system consists of: the Oklahoma State Department of Education, which has primary responsibility for K-12 grades, Oklahoma State Regents of Higher Education, which oversees the state's higher education (HE), and the Oklahoma Department of Career and Technology Education (ODCTE). The ODCTE offers programmes and services in 29 autonomous technology centre districts operating on 58 campuses, 393 K-12 (early childhood to high school graduation) school districts, 16 Skills Centre campuses (including three juvenile facilities), and 31 Adult Basic Education service providers around the state of Oklahoma (ODCTE, 2018). These differences exist as a result of the different funding models promoted by the state's education policy. In Oklahoma, 70 percent of the funding for CVET is appropriated from property taxes, 25 percent comes from the state budget, and 5 percent is provided through federal funds. In the state budget funds, marginal financial resources exist for new and expanding manufacturers to offset skill development costs. These programmes of funds are obtained through an application process and focus on the skill development of new employees and offset an employer's costs for providing training. This program is called the Training and Industry Program (TIP). In times of balanced state budget, these tax and cash funds play a key role in offsetting skill development costs. As a result, if the local economy is weak, vocational budgets suffer. Each VET centre works closely with advisers from local industries to ensure students learn the skills needed to be valued members of the workforce.

As individuals are now spending more years in the workforce, the need to fund continuing education and training is of increased importance and attracting scholarly attention and debate (Gambin & Hogarth, 2017). Confusion exists between the state and employers as to who is responsible for the funding and development of continuing skill development. This confusion draws less

scholarly attention, with the conclusion appearing to be that it is 'more of the responsibility of the employee and employer' (Gambin & Hogarth, 2017, p. 654).

2.5.2 The language of skill in US policy discourse

As my research is focused on my practice and on the understanding of skill within the context of Oklahoma manufacturing, it is necessary to situate it within the national and state policy discourse around skill. Upon examining policy from the 1970s and 1980s, it is evident that the government was focused on assisting workers whose jobs had been affected by foreign trade. These individuals were given career relocation advice, health coverage, and training income support (Harper-Anderson, 2018). Against the backdrop of US governmental cuts in spending on the education and skills programmes of the late 1990s, policy institutes emerged that acted as policy advocates. In response, the National Skills Coalition was formed in 1998 with the objective of promoting US national and state policy for 'a vision of an America that grows its economy by investing in its people so that every worker and every industry has the skills to compete and prosper' (National Skills Coalition, 2014, p.1).

Discussing the change in skill policy discourse in the UK, Payne (2000) argues that the shift from a focus on traditional technical skills to a focus on service and 'soft' skills is the result of the transition from a traditional manufacturing economy to a service economy. The situation in the UK contrasts with the case of the US, where manufacturing accounts for 12 percent of the GDP and is growing. Unemployment rates and demand and supply all influence the policy discourse. While the discourse is focused mainly on the 'skills gap', in comparison to Europe, little mention is made of 'skill shortages' in US literature and policy (Cappelli, 2015). In the last five years, policy discourse has focused on solutions to the perceived 'skills gap' and is reflected in two main policy initiatives nationally and also within the State of Oklahoma: sector partnerships (Oklahoma Unified Plan, 2015) and work-based learning with an emphasis on apprenticeships (State of the Nation, 2017; Skills for Good Jobs, 2017).

Sector partnerships serve to convene employers with 'education, training, labour, and community-based organizations to address the local skill needs of a particular industry'. This policy initiative illustrates how the US differs from the

UK, as it pushes programmes and a broad skills agenda, rather than a defined strategy focused on specific skills (Payne, 2000). Although Oklahoma has enacted policy to support sector partnerships, it allocated no funding until 2019 (DeRenzis & Wilson, 2015). Oklahoma's sector strategy funding model aligns with Payne's (2015) observation that US skill policy has a broad skills agenda with no specific skill development. This is seen in the purpose statement contained in the request for proposals that the state released for sector partnerships: 'employer-driven sector partnerships and developing local, regional, and/or state-wide strategies' (OOWD, 2019, p.1).

2.6 Theoretical framework

In this section I set out the theoretical perspectives from which I draw to illuminate how my participants understand skill in manufacturing. This introduction provides a brief overview, from the available literature, of Oklahoma manufacturing in the current neoliberal context. Section 2.6.1 provides an explanation of what human capital theory (HCT) is and why it is central to my dissertation as a way of exploring and critiquing how skill is predominantly understood in the manufacturing sector, from the perspective of my participants. Similarly, in section 2.6.2, I discuss the origins of the concept of lifelong learning, the way it is often applied under neoliberalism, and its relevance for this study. In section 2.6.3 the skills ecosystem approach to skill is discussed as an alternative to a human capital approach, followed by a conclusion of this section.

The selection of the theoretical approaches for this dissertation is based on the interpretation of what seem to be appropriate perspectives for Oklahoma manufacturing in a neoliberal political economy, as understood by Harvey (2007).

> Neoliberalism is in the first instance a theory of political economic practices that proposes that human wellbeing can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong private property rights, free markets, and free trade (p.2).

Critical of neoliberalism, Olssen et al. argue that it provides an apparently 'positive conception of the state's role in creating the appropriate market by

providing the conditions, laws, and institutions necessary for its operation' (Olssen et al., 2004, p.136). Moreover, as both Olssen et al. (2004) and Harvey (2007) argue, while neoliberalism has traditionally focused on the economy, over the last fifteen years it has penetrated into education and training, and into research discussions around the development of skills and knowledge (Trowler, 2003). This penetration is very apparent in the US. A neoliberal approach to skill development puts pressure on citizens to be responsive to efforts to make them productive. It insists that market forces provide the stimulus for individual growth and self-determination. The state intervenes only when there are 'market distortions' or 'certain dysfunctions' (Olssen et al., 2004, p.137). Following these accounts, my study occurs in a neoliberal environment.

In the early stages of my study design I planned to use the Capabilities Approach as my theoretical framework (Sen, 1997; Nussbaum, 2006, 2014) and as a lens through which to consider perspectives of skill in manufacturing. During the past twenty-five years in the US and beyond, Sen and Nussbaum's Capabilities Approach have gained recognition with academics and are commonly cited in discussions on social justice in learning and education (Pogge, 2002). As Pogge notes, when Sen is explaining the Capabilities Approach, he is 'concerned not with what persons have or are, with their achievements or functioning, but rather with what they can have or be' (2010, p.168). Although this is highly relevant to the study of the individual in a community as it pertains to social justice in learning and education, this research study is focused on skill. With further research and reflection, I found it difficult to align Nussbaum's (2006, 2014) interpretation and application of the Capabilities Approach to my study focus. Nussbaum's approach to capabilities is based on a normative theory of justice and I would agree with Robeyn's critique (2006, 2016) that the Capabilities Approach can be somewhat 'elastic' (2006, p.70), leaving it open to differing interpretations. I came to the conclusion that I was trying to rework the Capabilities Approach to fit my research questions and the setting of Oklahoma manufacturing, and, in the process, I was undermining the strength and applications of this theory. I then sought to find other approaches that were more in line with Oklahoma manufacturing.

An important reason why HCT and LLL are used in this dissertation is not because I support elements of HCT but because Oklahoma policy (OOWD, 2016; State Chamber, 2018) and manufacturing reports (Optis, 2016 and Deloitte, 2018) centered on skill appear to suggest that policy makers and employers in manufacturing make decisions about skill primarily for economic benefits. In that respect the policies and practices in focus here are imbued with human capital and lifelong learning approaches as they conceptualise skill as a feature of working life that will advance the productivity of the company. Of course, the producers of manufacturing policy and reports understand skill in a way that is often distinct from how educationalists discuss the concept (Attewell, 1990; Bryson, 2017; Elliott et al, 2017). Oklahoma manufacturing employers and policies have an economic emphasis when approaching the subject of skill and conceptualisations that appear to be influenced by both HCT and LLL.

2.6.1 Human capital theory

In this section I explain what HCT is, provide a critical analysis, and explain why it became central to this dissertation as a way of exploring and critiquing how skill is predominantly understood in the Oklahoma manufacturing sector. Throughout this section I also theorise how the language of economic benefits centred on skill uses, if sometimes problematically, the discourses and guiding principles of HCT.

As most educational theorists note, HCT is based on an understanding that education and skill development are the key drivers of economic growth (Schultz, 1961; Becker, 1964; Bowles & Gintis, 1975; Ball, 2008; Valiente, 2014). Dalziel (2017), referencing the OECD, describes workforce skill as 'the global currency of the 21st century' (p.143). In the US, HCT 'treats education and training as an investment and emphasizes the direct impact of skill creation on productivity' (Olssen et al., 2004, p.147). In other words, according to HCT, education creates a "product" and this product has consequences that are productive for the individual as well as society. Of course, such a view can be and frequently has been criticised and I return to these criticisms later here.

Yorke, writing for the UK Higher Education Academy, describes the impact of HCT related to graduates in this way:

> The employability of graduates has become an aim that governments around the world have, to varying extents, imposed on national higher education systems. This interest in employability reflects an acceptance of human capital theory. Under human capital theory, the task of government is to foster conditions that encourage growth in the stock of human capital, since this is seen as vital to the performance of knowledge based economies in a globalized society (2006, p.3).

Yorke's comments on higher education can also be extended to vocational education. The growth of the US economy and manufacturing places the country in need of a more educated workforce, who will, in turn, make a positive contribution to the welfare of the nation. The government wishes to maintain its position as the major influence in the world economy. By funding the education of more individuals, the government is attempting to create more "human capital". The government expects that a surplus of "human capital" (that is, a highly educated workforce) will result in the US maintaining its position as a hegemonic, neoliberal global power (Olssen et al., 2004; Yorke, 2006; Balibar, 2019). This view is characteristic of the underlying assumptions held by many in manufacturing in the US and, in turn, in Oklahoma. The goal of education is to produce self-determining learners who can acquire the skills to make them competitive in the market place. The US sees investment in its human capital as the avenue to economic success for the nation and for the individual. When the individual displays strong human capital with a relevant employable skill set, they are less likely, this account suggests, to contribute to societal problems. The success of the individual in turn strengthens the social capital of their communities and nation (Putnam, 2000). Of course this is an account that has been widely criticised but, within a US manufacturing context, the term "human capital" has come to be used interchangeably with "workforce", "human resource" and "organisation development". As noted in section 2.2.1, human capital is described as the knowledge and skills an individual acquires throughout their life course from education, training and experience (Ng & Feldman, 2010).

However, there are several elements of HCT that have been critiqued. A fundamental problem with HCT is that it reframes education by making its primary goal the employment of the individual (Tan, 2014; Gillies, 2015; Klees, 2016). As Gillies (2015) suggests, this economization of education diminishes

what education ought to do for the individual. Education's charter should not be about 'constructing people as mechanical objects' (Gillies, 2015, p. 3) but should rather aim at providing knowledge that aids the learner in constructing a life that is personally advantageous outside of work and which contributes to the public good (Klees, 2016). In the same vein, Tan argues that HCT treats education as if it is a 'supplementary component of business and industry' (Tan, 2014, p. 429). In other words, HCT wants educators to see their task as producing individuals (as if they are a product) who are marketable to potential employers (Ball, 2010). This approach diminishes the role of education as a source for advancing the freedom of the individual to construct a meaningful and enjoyable existence regardless of whether they work or not with HCT valuing only the economic productivity potential of individuals.

A second important critique of HCT is that it lays the blame on individuals when they do not invest in their own human capital (Gillies, 2016; Klees, 2016). As a result, is an individual has educational or even skill shortcomings then the problem is with the individual: it is their fault. Since, following Gilles (2015) HCT primarily sees individuals' education as an investment and their employment as a return for that education, they are not viewed as people whose value amounts to more than their work. This focus, it is also pointed out, ignores and excuses the role that governments and policies play in maintaining barriers that impede or discourage individuals' efforts to gain skills for employment (Klees, 2016). No accountability is placed on the government or state and this is limiting and harmful to an individual who has no control over policy (Gillies, 2016). Lastly, one of the significant flaws of HCT is that it was created under the assumption that global economies would continue to grow and continue to need a high surplus of highly educated and skilled employees (Valiente, 2014). What human capital theorists did not anticipate, and this is critiqued by other theories such as the New Political Economy of Skills, is that the demand and supply of skills would not always balance (Livingston & Guile, 2012; Valiente, 2014). Valiente points out that governments and institutions whose pedagogical practices are guided by theories like human capital and knowledge economy must now take a different approach to simply creating more skilled workers. He suggests 'incentivizing the existing demand for skills and the creation of highly skilled and highly waged jobs' (Valiente, 2014, p.43).

This argument, developed for Valientes's European focus, can also be applied to the current US climate of 4.1 percent unemployment (Bureau of Labour Statistics, 2018). Higher education and vocational education have not attracted and subsequently trained enough workforce to ensure the human capital needs of US and Oklahoma manufacturing (see Chapter One). Educators and state policy makers need to be conscious of the fact that the students they are helping to train with the required skills may not gain employment because the government and market have not sufficiently incentivised demand for skills and created the jobs that these students want. Valiente adds that governments often do not 'achieve a good match between workers' skills and job requirements' (2014, p.43).

This is surely a valid criticism of HCT. In his 2014 critique of educators' acceptance of HCT, Valiente again notes the importance the theory places on acquiring marketable skills.

> In the age of human capital, the economic success of individuals and countries will depend on how extensively and effectively people invest in themselves and their skills. For human capital theorists peoples' skills are more central than ever to economic development and social welfare (Valiente, 2014, p.42).

Following the HCT perspective now, more than ever, vocational and higher education focus on employability skills in order to bring both economic prosperity and, some HCT proponents would claim, improvement to the social well-being of individuals. If vocational education and higher education fail to produce students who are employable, they are failing to provide one of their key services to students and to society as a whole or so the HCT argument goes.

As Gambin & Hogarth (2017) point out, HCT suggests that 'individuals and society more generally stand to derive economic benefits from making investments in people' (p. 658). It also assumes that individuals will make investments in the education and training that will give them the highest pecuniary returns on their human capital. Supporters of human capital theory believe that when an individual invests in their education, they will acquire skill (Shultz, 1961; Becker, 1964; Mincer, 1974). This educational investment in turn will increase an individual's productivity. In the US, as education becomes more

costly due to the cuts in state funding, the responsibility falls ever more on the individual.

Human capital theorists suggest that organisations develop resources internally only when investments in employee skills are justifiable in terms of future productivity (Becker, 1964; Tsang et al., 1991; Vallor, 2015). Human capital theory emphasises the cost of labour relative to the return on investment. These returns come in the form of gains in future productivity resulting from developing employees' skills and knowledge. Individuals own their human capital, while firms work hard to protect these skills and knowledge so they are not transferred to other businesses. Therefore, many businesses are reluctant to invest money in generic or job-specific skills unless the investments can be justified in terms of future productivity (Schultz 1961; Becker, 1976). Snell & Dean (1992) argue that 'the value of human capital can be influenced by a multitude of sources, such as a firm's strategy and technologies' (p. 35). What they mean is that an employee's potential to contribute by using new technologies has created advanced manufacturing, which in turn will transform today's manufacturer worker into knowledge worker, as opposed to a hands-on worker.

Through this critical overview of the strengths and flaws in HCT, I have sought to suggest why this theory is central to this dissertation. Because HCT's focus on skill as a contributing factor with regard to individual and organizational productivity is so influential in the US, it makes sense for an exploration of skill in Oklahoma manufacturing to dialogue with this approach. Ignoring HCT as a lens through which to view this conversation would handicap the dissertation because it aligns very well with the discourses of, and attitudes towards, skill amongst Oklahoma policy makers and manufacturing employers. Their approach to skill and skill development is dominated by an HCT approach. From the available reports on the Oklahoma manufacturing sector (Optis, 2016 and Deloitte, 2018) and policy (OOWD, 2016) employers seem to be asking: 'How can this worker help us to be competitive in the market?'. Furthermore, what employers are willing to invest in to develop their employees are in those skills, and often only those skills, which can be shown to increase job effectiveness, reduce costs and increase production (OOWD, 2016; Optis, 2016; Deloitte,

2018). A critical use of HCT, therefore, is central to this dissertation because it provides an opportunity to more clearly explore how employers are currently thinking about skill and how it appears to be influencing their behaviour in Oklahoma manufacturing.

2.6.2 Lifelong learning

The idea to adopt LLL as a lens emerged when looking at US skills policy and observing the shift that occurred in the 1980s under President Reagan. The US began to experience deregulation of government and a move for responsibility for skill from government to the individual (Harvey, 2007). Coupled with the shift in skill responsibility was the expansion of Oklahoma as a "Right to Work State" in 2001 (Greer & Baird, 2003; King & Catlett-King, 2007). Subsequently, limited funding for skill development resulted in an increased shift to focus on the individual as the key driver of their own skill development (Olssen, 2006; Yorke, 2006; Dalziel, 2017). It is against this backdrop that it is useful to use, in addition to HCT, the notion of LLL to help understand what was happening in Oklahoma manufacturing regarding skill as an individual's responsibility.

For many researchers, lifelong learning (LLL) is understood as all learning that takes place in an individual's lifetime, or, as it is often labelled, throughout the life course (Elder, 1994). Other researchers view LLL in broader terms and argue that it is best understood as a philosophy of education (Mocker & Spear, 1982). LLL's roots stem from a report *Learning to be: The world of education today and tomorrow*, published in 1972 by the International Commission on the Development of Education area of UNESCO - the United Nations' educational, scientific and cultural organisation - under the leadership of Edgar Faure. *Learning to be* (1972) assessed the past state of education and identified the assumptions that could impact the future of education. In the context of this research, which examines the understanding of and responsibility for the skills development of the individual worker, the report's last assumption is particularly worthy of note:

> Our last assumption is that only an over-all, lifelong education can produce the kind of complete man the need for whom is increasing with the continually more stringent constraints tearing the individual asunder. We should no longer assiduously acquire knowledge once and

> for all, but learn how to build up a continually evolving body of knowledge all through life—'learn to be' (Faure et al., 1972, p.vi).

Central within Faure et al's *Learning to Be,* according to supporters of its thesis, is that each individual has the right to realize their potential and destiny and each individual continues to learn throughout their lifetime. Lifelong learning, Biesta (2016) contends, is focused on learning that contributes to the overall personal good of the individual as an inherent part of their participation in a democratic environment. A widely accepted interpretation of Faure et al's report is that whilst it included what a learner might learn that could make an economic contribution, LLL's original focus was on education for the individual's personal good and in the hope of promoting democracy. Proponents of this interpretation, such as Biesta (2011) and Coffield (1999), argue that it became subjected to the influences of governmental and educational policies and practices so that education's prime function changed to serving economic growth. For these writers what appears to have happened to the original impetus of LLL is that its educational purposes have been realigned and redirected by some of its proponents so that it has come to share the same objectives as HCT, namely to impact primarily the economy.

Grace and Rocco (2009), on the other hand, in their work on John Ohliger, the celebrated US adult educator, endorse his description of Faure et al's report as 'dangerous', and his view that it would 'drive out an alternative conception of learning and knowledge', something which is essential to the freedom of each individual (p.58). Ohliger, they write, saw the focus of LLL as economic from the outset, constituting an attack on the individual and the whole life course.

Cappelli (2012), however, in agreement with Biesta (2011) and Coffield (1999, argues that since the late 1980s, LLL has evolved and consolidated around a strong economic focus. While acknowledging that LLL included learning for economic purposes, Cappelli (2012) also writes that LLL changed from having a humanist approach for personal development to emphasising economic achievement. The shift in learning has been from 'learning to be to learning to be productive employable' *(*Biesta, 2011, p.64*)*. When discussing how industry co-opted the concept of LLL, Cappelli notes, 'A qualified workforce with the necessary skills and competencies was central to arguments for lifelong

learning' (2012, loc 354). Here, at play again, is the economic pull of learning and human capital, as LLL is reframed. Connected to that pull is, as Ohliger (1981) and Coffield (1999) argue, the 'social control' of the individual in the activity of learning. Coffield further develops the idea of the economic forces at play in LLL, citing as another criticism of revised LLL the UK's strategy of using LLL centres as part of policies that transfer the responsibility for learning and employability to the individual. This interpretation could also be applied to the US context. For example, Walter Mondale, the chief political force behind the advancement of lifelong learning in the US and the establishment of The Mondale Lifelong Learning Act in 1976, best summarises the aim of the revised LLL at that time as follows:

> Lifelong Learning offers hope to those who are mired in stagnant or disadvantaged circumstances – the unemployed, the isolated elderly, women, minorities, youth, workers whose jobs are becoming obsolete. All of them can and should be brought into the mainstream of American life…..lifelong learning…is a necessary step toward making the lives of all American more rewarding and productive (Stewart, 1987, p.276).

Pertinent to this study's research question is the understanding that in discussions of the skill development and learning of the individual worker within Oklahoma manufacturing and how they obtain the skill to perform their job, these discussions can often be framed within the dialogue and discourse of LLL in policy and practice. Coffield (1999) illustrates that revised LLL strategies often transfer the responsibility for learning to the individual who does 'not have the power to remove the structural barriers which prevent them from learning' (1999, p.482). Coffield illustrates further that the individual can lose their sense of individual job security and 'employability' if the responsibility for learning is placed on them. Coffield goes on to state that the employer believes the main obstacle to success to be the 'poor education of the workforce' (1999, p.483). As Ohliger (1981) comments, 'We can dangle jobs and training like a carrot to entreat participants, but we cannot mandate learning' (1981, p.25). This discourse impacts each manufacturing company and individual worker. These concrete criticisms of the revised interpretation and practice of LLL need to be kept at the forefront of this study, which explores skill in Oklahoma manufacturing in light of the views expressed by state training providers,

manufacturing management, and individual production workers regarding learning and skill development.

In the current decade, LLL has evolved further, and due to the neoliberal economic forces still at play in US society, it is commonly defined as the 'process by which individuals consciously acquire formal or informal education throughout their life spans for personal development or career advancement' (Eric Thesaurus, 2016). In this definition of the purpose of LLL, the responsibility for providing opportunities for LLL is shared collectively by the market and the State. Critical scholars, like Bagnall (2009), take exception to this definition of LLL, arguing that LLL has developed into a 'mutant construct, inspired and driven by neoliberalism and its attendant instrumentalism and individualism' (p.278) with the individual having the responsibility to learn (Cappelli, 2012). Bagnall observes that there is a 'pluriformity of uses for the term' "LLL", which allows supporters of LLL to use it to 'massage public opinion and policy formulation to their desired ends' (2009, p.279). Biesta's (2011) critique of what he perceives as a revision of LLL since Faure et al's report is that it has been impacted by economization, a shifting of responsibility on to the individual as a shift from 'learning to be' to 'learning to be both productive and employable (p.172). This critique suggests that LLL's objectives are altered so that they are aligned with those of HCT. Grace's (2004) critique goes further, citing Jarvis (2000):

> The lifelong learning society has become part of the current economic and political discourse of global capitalism, which positions people as human resources to be developed through lifelong learning, or discarded and retrained if their job is redundant. (Grace, 2004, p. 398)

Although in its current expression LLL focuses on the individual, many researchers have interpreted Faure et al's initial vision of it as having larger social purposes including the promotion of social inclusion and the promotion of democracy. Biesta references Aspin & Chapman's (2001) claim that one of the three major agendas of LLL is to advance 'social inclusiveness and democratic understanding and activity' (Biesta, 2006, p. 173). Yet while the idea of 'social inclusiveness' and the closely related concept of 'social cohesion' in LLL, as it is specifically conveyed in the 1997 OECD report entitled *Lifelong Learning for All*,

might appear to be attractive and laudable goals, Biesta demurs that what this discourse often rejects is the assumption that learners expect others will be included into their own definition of inclusion (Biesta, p. 174). In other words, it is a pseudo 'inclusion' that privileges the learner's own position on 'inclusiveness'. And regarding the interpretation of Faure et al's purpose to promote democracy through LLL, two things are unclear. First, it is unclear why democracy should be regarded as having an intrinsic value that is served by education. Second it is unclear, Biesta (2006) points out, how the individual pursuit of fulfilment and development contributes to the broader attainment of a democratic society.

Taken together, these points indicate why LLL and HCT are helpful for this dissertation. These more recent descriptions of LLL help explain who Oklahoma manufacturing employers assume is responsible for the individual worker's skill development (Bagnall, 2009; Biesta, 2011; Cappelli, 2012), and clarify why employers in Oklahoma manufacturing currently operate under the assumption that the responsibility of skill development should be shouldered by the employee, in order to be productive and employable. These two approaches, HCT and LLL rest on neoliberal ideas, which underpin dominant conceptions of LLL and hence of skills (Lanzi, 2004). Whilst HCT and LLL helped explain the neoliberal imperative of employers, it was insufficient for illuminating the perspectives of the study's participants on their lived experiences of skill. In the next section I look to a skill ecosystem approach which, I argue, provides a different, and potentially more productive, lens on the meaning of skill and on skill development.

2.6.3 A skill ecosystem approach

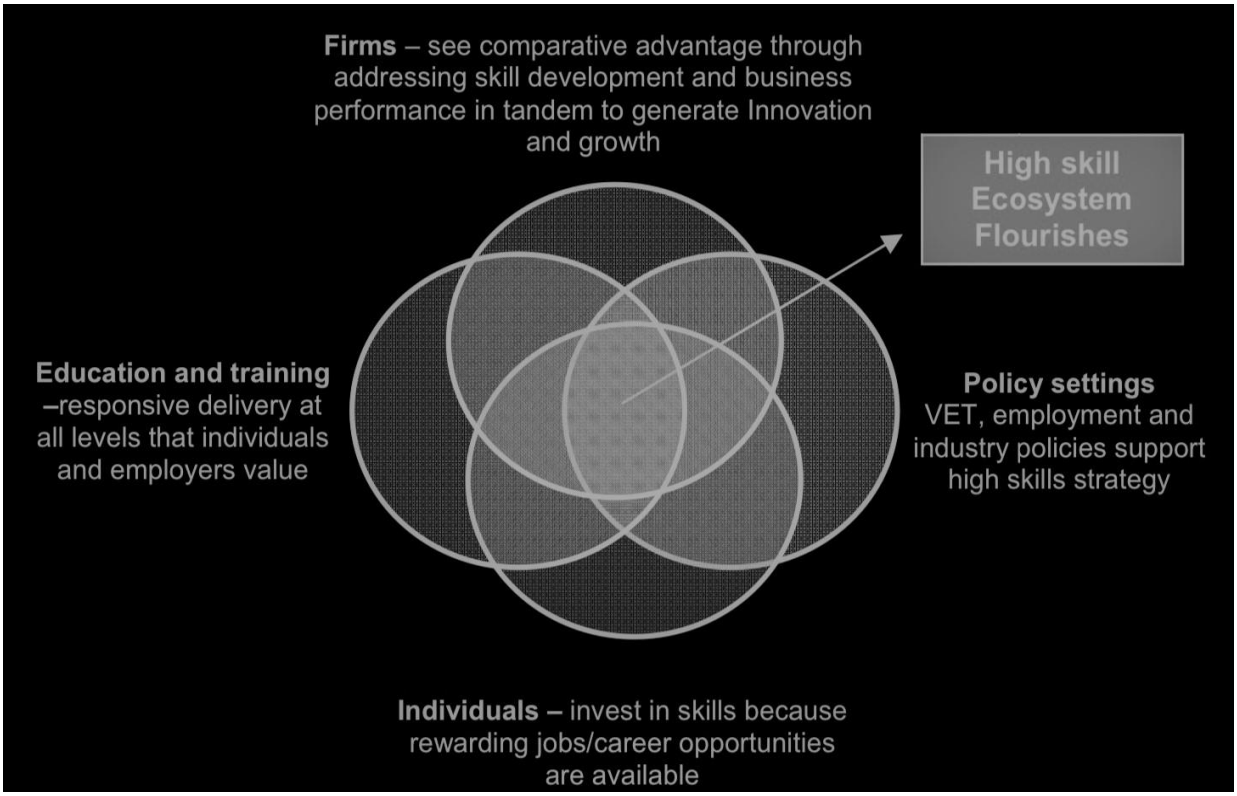
The skill ecosystem approach offers the possibility to frame a different strategic direction and policy on skill (Finegold & Soskice, 1988; Buchanan et al., 2001; Payne, 2008; Anderson & Warhurst, 2012). The concept of skill ecosystems was first introduced by Finegold and Soskice in 1988 (Payne, 2008). Finegold (1999) focused on what he calls a high-skill ecosystem as seen in California's high-technology and biosciences companies. He defines a high skill ecosystem (HSE) as 'a cluster of organizations (both firms and research institutions) employing manpower with advanced, specialized skills in a particular industry and/or

technology' (Finegold, 1999, p.61). Finegold (1999), discussing how to 'create and sustain' a skill ecosystem, suggests that four elements are needed in the framework. He describes those framework elements as a 'catalyst', a 'supportive host environment', 'fuel or nourishment', and 'a high degree of interdependence' (p.6). Buchanan further developed the study of skill ecosystems and, of particular relevance to this study, broadened its definition to: 'clusters of high, intermediate and low-level competencies in a particular region or industry shaped by interlocking networks of firms, markets and institutions' (Buchanan et al., 2001, p.11). Buchanan et al (2001; 2017) identified five strongly interwoven elements that characterise a functioning skill ecosystem: business settings and associated business models, institutional/policy frameworks, modes of engaging labour, the structure of jobs, as well as the level of skills and systems for their formation. Dalziel (2017) reporting on skill shortages in New Zealand and the introduction of regional skill ecosystems focused on 'employer-led channels at a regional level', (p.53) to address this problem, references Windsor and Alcorso's (2008) High Skill Ecosystem diagram (Figure 2.1). Although Windsor and Alcorso (2008) reference the high skill ecosystem, I would suggest this diagram also applies to a skill ecosystem which refers to any skill level.

Figure 2.1 illustrates the roles key stakeholders - firms, policy, education and individuals - can play in a skill ecosystem. As the diagram suggests, when all four stakeholders are working in partnership it is then that the skill ecosystem flourishes (Windsor & Alcorso, 2008; Dalziel, 2017).

Figure 2.1. Skill Ecosystem

Source: Windsor and Alcorso (2008, p.5).



The concept of skill ecosystems has gained further traction in Australia (Buchanan et al., 2001; Hall & Lansbury, 2006; Payne,2008), in Scotland (Buchanan et al., 2017) and within India's manufacturing industry (Chenoy et al., 2019). This wider interest in the concept of a skill ecosystem has been fuelled by governments and education being 'trapped in a low-skilled equilibrium' (Finegold, 1999, p. 60). A decade previously Finegold and Soskice had described Britain as being 'trapped' in this way. The country, they said, had:

> a self-reinforcing network of societal and state institutions which interact to stifle the demand for improvement in skill levels . . . [resulting in] the majority of enterprises staffed by poorly trained managers and workers produc[ing] low quality goods and services' (Finegold and Soskice, 1988, p.22).

The broader concept of skill ecosystems is useful for discussing skill (Anderson and Warhurst, 2012, p. 110). For this dissertation it offers an additional and

contrasting approach to HCT and LLL for understanding perceptions of skill and skill development. This is because, in a skill ecosystem approach, responsibility for skill is shifted away from primarily the individual worker to a dynamic ecosystem of strategic partners, collaborating on skill solutions within an industry or region (Payne, 2008; Buchanan et al., 2017; Chenoy et al., 2019).

2.7 Conclusion

This Chapter has reviewed the discussions on skill as applied to the workplace, and in particular to manufacturing. Skill is a complex, ambiguous and ever-changing term in meaning and application, as manufacturers are impacted by significant technological change. The impact of smart manufacturing and technology transfer on skill development in manufacturing is under-researched (Hermann et al., 2016). Researchers are also debating what employers understand as "desirable skills" in their employees. The research indicates that in industry, most skill development is occurring at the place of work in an informal setting (Eraut, 2004, 2011; Livingston, 2017). A gap exists in the individual worker's theoretical skill development (Wheelahan, 2010; 2017) and opportunities exist for the expansion of work-based learning (Elliott et al., 2017). Policies related to the funding of skill development are also discussed, as are the ways in which policy discourse in the US shapes workforce programmes. The overall conclusion to be drawn is that the language of skill in policy is focused on a "skills gap" and on solutions to address this gap (Cappelli, 2015; DeRenzis & Wilson, 2015). In addition, extant research indicates that management is rarely supportive of skill development in practice (Deloitte, 2015). The reviewed literature also suggests that HCT and LLL are flawed when applied to the developing of skill, as too much emphasis is placed on the individual's responsibility for skill development. Further, the literature shows that developing a culture of LLL within the workplace can provide a route to skill development that provides agency and empowerment to the individual worker. However, alternative interpretations would suggest that LLL is about serving the economy - not the individual. LLL promotes the idea that it is the individual worker who has to work out what they must learn for the employer. These complexities make it increasingly necessary that both industry/employers and individual workers be involved in research and participate in the process by

which policy decisions are made regarding skills development in Oklahoma's manufacturing workforce.

Deriving from the review of the literature discussed in this Chapter, the key questions addressed by this study are: How do Oklahoma production workers, manufacturing managers, and state training providers understand skill? From the perspectives of these three groups, what skills are perceived as necessary in Oklahoma's manufacturing workforce? What are the opportunities for and constraints to shaping skill for the manufacturing workforce? and Can Human Capital Theory and lifelong learning provide a framework within which to understand skill in Oklahoma manufacturing?

The review of literature has shown that for a US context, it was difficult to find qualitative research conducted in a manufacturing setting that addressed my research question from the perspectives of this study's chosen actors: state training providers, manufacturing managers, and production workers. Historically, research in both a manufacturing and business context has been influenced by economics and a positivist tradition, and is therefore more quantitative-driven. Bisman & Highfield (2012) note that within the discipline of accounting, peer-reviewed qualitative studies are often lacking, as are 'works which describe relevant research philosophies and provide guidance on how to deploy them' (Bisman & Highfield, 2012, p.4). I would also make a similar observation regarding my research area within manufacturing. In the US, as most research conducted around skill has followed a quantitative approach, comparisons for my research approach have been limited.

In the next Chapter, I will provide an overview of the methods and research approaches taken in my study. I will also discuss the challenges encountered during the research.

Chapter 3 - Methodology

3.1 Introduction

This Chapter discusses how the methodology employed in this research study was selected. First, it explains and justifies the research paradigm that guided my decision to follow a qualitative approach. Having justified my chosen paradigm and approach, I explain my positionality, and then outline the design process I followed, with a focus on my chosen methods: focus groups and one-on-one semi-structured interviews. Moving on, I describe the choices and issues regarding the field work site, sampling, participants, and ethical considerations. Section 3.6 addresses the study pilot, the technological influences, and the choices made in relation to collecting, recording, transcription and coding the data. The last section (3.7) is a reflection on my role as the interviewer and facilitator and on how this research has transformed my career.

The research methods employed were chosen to investigate the meaning of skill as understood by the three key participant groups who play a role in skill within Oklahoma manufacturing: state training providers, manufacturing managers, and production workers.

3.2 Research perspectives

This study involved an interpretivist paradigm with elements of a constructivist approach that was focused on gathering qualitative data. As a qualitative researcher, I am aligning myself with Schwandt (2001) and Carter & Little (2007), who define qualitative research as social research in which, as a researcher, you rely on 'text data rather than numerical data' (Carter & Little, 2007, p.1316). By gathering this data, I aim to find meaning in human interactions.

This choice of research approach was also influenced by a desire to place the participant's perspective at the centre of the research. Researchers have discussed how a qualitative approach places the researcher in the natural world (Marshall & Rossman, 2011; Creswell, 2014; Arthur et al., 2017). Others point to their confidence in qualitative data methodologies that aim to understand the researchers' and participants' 'world of experience' (Cohen & Manion, 1994, p.36). This is why I have chosen a qualitative approach that uses one-on-one

semi-structured interviews, together with focus groups, rather than a quantitative methodology, which is often preferred when conducting research in a manufacturing environment.

The ontology of research refers to the researcher's understanding of nature and the social world and 'therefore what can be known about it' (Guba & Lincoln, 1994, p.108). Gray (2004) refers to ontology within the social sciences as the 'study of being, that is, the study of existence' (2004, p.16). As each person views reality through their own lens, there are multiple realities at play in the social world. Hatch (2001) describes it well.

> While acknowledging that elements are often shared across social groups, constructivist science argues that multiple realities exist that are inherently unique because they are constructed by individuals who experience the world from their own vantage points (2001, p.15).

My own ontological approach to this research as a constructivist researcher followed Hatch (2001) and Guba and Lincoln (1994) who focus on the multiple realities constructed by individuals. This is amplified by Waring and Coe (2012, p. 16) who note that 'multiple realities are constructed by individuals' (Waring & Coe, 2012, pg. 16) and others who suggest that both participant and researcher construct their own subjective reality of knowledge, and, consequently, their worldview (Hatch, 2001; Merriam et al., 2002; Gray 2004).

While ontology is the understanding that the researcher brings to their research, epistemology, as Gray (2004) describes it, is the personal background brought by the researcher that helps them know what knowledge is 'legitimate and adequate' (p.16) for the world in which they live and work. Further, the epistemology, or 'theory of knowledge', as labelled by Carter & Little (2007), is subsequently shaped by the understanding that knowledge can be interpreted during the research in a more intimate setting with the participants of the study. It is transactional and subjective. As a researcher, it is important to be conscious of these assumptions about one's own ontology and epistemology when paired with one's professional practice, experiences, values and reflections, as they influence the choice of research design and analysis (Easterby-Smith et al., 1991). I was conscious that I was approaching my research through a constructivist approach, meaning that the participants and I

would be creating a subjective reality to describe the nature of skill and skill development in particular sectors of Oklahoma manufacturing. I was also assuming that the creation of this subjective reality would arise as the participants and I explored this topic in intimate group discussions. Kuhn's (1970) research into 'shared understandings' (also commonly labelled "paradigms") challenged the scientific method of research, which is prominent in its application in both the US education research community and manufacturing research. As Guba & Lincoln (1994) explain, paradigms are 'viewed as a set of basic beliefs' (1994, p.107) with ontology drawn from a questioning of the researcher's understanding of nature and the social world and 'therefore what can be known about it' (p.108). Gray (2004) refers to ontology within the social sciences as the 'study of being, that is, the study of existence' (2004, p.16). As each person views reality through their own lens, there are multiple realities at play in the social world. Hatch (2001) describes it best:

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Numerous researchers (Denzin & Lincoln, 1994; Mackenzie & Knipe, 2006; Marshall & Rossman, 2011) point out that each paradigm within a qualitative research approach rests on different assumptions. My research rests upon the

assumption that constructivists are positioned in empirical research as producers of data that focus on experience. This experience is informed by relativist ontology, as each participant personally and socially constructs their own reality within their lived experience. The interpretivist paradigm with elements of a constructivist approach fits with my approach as it centres on conducting research that values the individual's voice, experience and knowledge (Tierney & Lincoln, 1992, p.116). By adopting this lens, my aim is to derive meaningful constructs from the feedback and insights from each participant group contributing to the research in this small-scale study. Similar to Mackenzie & Knipe (2006), I see the interpretivist paradigm and constructivism as one and the same. The interpretivist paradigm fits with my approach as it is centred on conducting research that values the individual's voice, experience and knowledge (Guba & Linclon, 1994, p.116). The voice produces what Geertz (1975) refers to as the 'storied lives' (1975, p.6). This "voice" links to the focus of constructivism being on constructing reality from lived experiences. I would argue that those lived experiences are articulated through an active voice in qualitative research.

Coe (2017) stresses that 'groups of researchers adopt the whole paradigm as the one true way and defend it in opposition to any other set of views' (2017, p.5). As a result, I believe that with a qualitative approach to research, the topic being studied cannot and will not fit within a neat box of the kind a quantitative approach would require. Additionally, from a global perspective, Cawthorne, (2001) offers insights into the feasibility and reliability of applying a qualitative approach to research in a manufacturing environment. She claims that the quantitative approach seeks to deploy 'narrowly factual or structured questionnaires' (Cawthorne, 2001, pg.85). Cawthorne (2001), who spent 7 years working for the United Nations and Oxfam doing field research in manufacturing settings, offers key insights in her research that discuss arguments for supporting the use of conducting research which deploys a qualitative approach in my chosen industry of manufacturing. Cawthorne (2001) argues that it is in this world of experience that the qualitative researcher seeks to 'understand, interpret and report honestly the things people say and the things people do in all their messy complexity' (p.65). She further discusses how her experiences as a professional practitioner and academic conducting qualitative research has

produced relevant and practical data that is centred in manufacturing on questions of workforce. Qualitative data is relevant as it empowers the researcher 'to pick a route through complex social, political and economic realities' (Cawthorne, 2001, pg.85). That route is guided by the 'interaction' of the research participants who provide 'authentic information' that is not always obtained from deploying quantitative data methods (Cawthorne, 2001). Cawthorne's (2001) research context is similar to my research environment and her experiences affirm to me that the chosen participants would be willing to be part of the research process as active participants instead of filling out the typical survey which usually has a more restricted pool of data. Quantitative research design limits the voice of participants and restricts the aim of this research situated within their lived experiences.

Consequentially, this research will be better served by an interpretivist paradigm with elements of a constructivist approach and a qualitative research design. This study aims to uncover various understandings about the discourse of skill in Oklahoma manufacturing that only those participants working in the reality of this industry can appropriately interpret and attach meaning and value to. It is by looking through the lens of a constructivist researcher that I will be reflecting on the lived experiences around skill of those that influence, manage and work in the manufacturing industry: the state training provider, the manufacturing manager, and the production worker.

3.3 Professional perspective

My current role is director of workforce and community partnerships for the State of Oklahoma. The focus of my role is to facilitate workforce solutions among manufacturers, state agencies, education, economic development partners, and other groups to help ensure a skilled manufacturing sector in Oklahoma. The aim of this role is to give visibility to the Oklahoma Manufacturing Alliance (OMA) as a key player and provide a bridge with manufacturers as they recruit and develop the current and future manufacturing workforce in Oklahoma.

A main motivator for this study can be found in my professional context of working in manufacturing in Oklahoma and in my past and current professional

roles, in which I have been responsible for the training and development of the workforce. Over the past seven years, I have become concerned about what I hear in meetings with the senior management of manufacturers, who state that they do not have enough staff with the right skills for their manufacturing operations. When I meet with manufacturers and ask about their challenges for the next five years, skill development and staff retention are top of the list. When talking to manufacturers about how these challenges can be addressed, there is often confusion and a lack of understanding about skill and the framework within Oklahoma that could assist manufacturers.

It was my professional experiences and my reading of business publications and reports that spurred my interest in exploring the topic of skill from an academic perspective to create a bridge with the professional domain. The literature I refer to is reviewed in Chapter Two of this dissertation. In my work, I also began to observe that it was rare to see a manufacturer that wants to invest in its people to train employees to bridge the gap. They look to the state to promote learning and often shirk their financial and human responsibilities for developing their workers. I believe that by equipping individuals with the required skills to perform their jobs effectively, employers will in turn contribute to their enterprises and the communities in which they reside as engaged citizens. This is the point at which my professional career and my doctoral work intersected. When asked to choose a topic for my dissertation, I initially struggled, before recalling the challenges faced by my clients. In their confusion of how to train current and future staff with the necessary skills within their manufacturing operations, I saw a viable research problem. In isolation, manufacturers are struggling daily to understand skill.

Before moving on to discuss the participants, sampling, field work site and ethical considerations, I must explain my choice of research methods.

3.4 Research methods

In this section, I provide an overview of the research design process. Then, in the subsequent sections, I explain my choice of design approach and methods. The methods are referred to as the 'techniques for gathering evidence' (Harding, 1987, p.2). The choices of methods to deploy when gathering the

evidence or data are varied. As my chosen ontology is focused on the real world of the participants, I decided to use focus groups and semi-structured one-on-one interviews. This situated my research questions in the "real world" of the people who manage and participate in skill related to manufacturing (Garcia & Gluesing, 2013).

In my pilot study, I had chosen to collect data using only one research method: semi-structured interviews. From the experience of using only one research method and in conversation with my supervisor, I began to question why I was avoiding triangulation of data. As a way to improve my research, I became more convinced that certain researchers (Fielding & Fielding, 1986; Hatch, 2001; Leech & Onwuegbuzie, 2007; Nordin et al., 2014) were correct in arguing that when a researcher uses two research methods in their data collection, it leads to an increased opportunity for validity in the data secured. As Fielding & Fielding (1986, p. 23) and Hatch (2001) define it, this triangulation of data means locating yourself at the 'intersection' of at least two types of data.

Each method has its limitations for data collection. Therefore, in order to expand the amount of data that could be collected, I considered using an additional research method to help achieve that intersection of data. Potter & Hepburn (2005) critique the use of interviews in research, arguing that it limits the quality of data produced. As a result of my own research and on further reflection, I concurred with Potter & Hepburn's observation. To produce the triangulation of data in the research, I decided to deploy an additional research method. This choice prompted me to expand the methods deployed beyond semi-structured interviews to include focus groups. Early on in this EdD journey, I believed that focus groups presented two limitations as a core method of research: time constraints and the possibility of one participant monopolising the conversation within the focus group. Nevertheless, I chose to modify my research design and added focus groups as my first data collection point followed by semi-structured interviews. The aforementioned limitations were at the forefront of my mind when deciding how to structure my focus group, as I will discuss further in section 3.4.1. All of the research for this study was conducted in Oklahoma City, the capital city of the State of Oklahoma, US (see Figure 3.1). Oklahoma is a south central state, the 20th largest state in the

US, with a population of approximately 3.9 million (United States Census Bureau, 2016).

Figure 3.1. Oklahoma, US


Source: Google Images

In conclusion, those characteristics of focus groups that I once saw as limitations can in fact create an environment where the participants are able to interact and build upon each other's ideas to generate data that is relevant to my research question. Many researchers (Morgan, 1993; Krueger, 1994; Marshall & Rossman, 2011; Warr, 2005) stress that it is in an environment where participants can best interact and build upon each other's ideas that different data is produced.

3.4.1 Focus groups

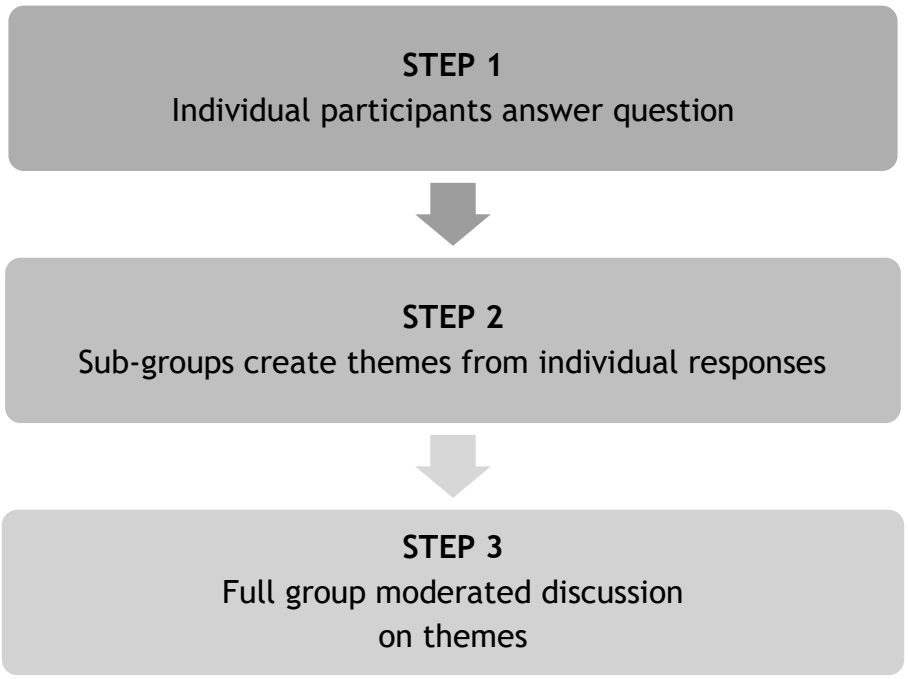
While focus groups can be defined in a variety of ways, they are generally understood as a group of people that researchers assemble to discuss and remark on a specific topic about which they have personal experience (Krueger, 1994; Powell et al., 1996; Harrell & Bradley, 2009; Gibbs, 2012). In a focus group, the contribution of the group as a whole is as important as the individual voice (Gibbs, 2012). This presents a challenge to facilitation, so it is imperative that the facilitator is well organised.

When asking questions about what is really happening within an Oklahoma manufacturing context, I need to also include the key voices of the participants (Erickson, 1986; Hatch, 2001). The participants for the focus groups and semi-structured interviews are discussed in section 3.5.3.

Deploying a facilitated focus group method allowed me to structure the session around the key questions which emerged from the literature review. This would in turn allow me to analyse the data for the key themes emerging from the findings and discussion Chapters of this dissertation - Chapters Four, Five and Six. Having initially decided to use semi-structured interviews as my primary research method, on further reflection of my research questions and my desire to explore the questions within a more facilitated interpretative environment where participants could gain from synergy with each other, I realised this was not the best approach. Therefore, I made the decision to start instead with the three focus groups, consisting of state training providers, manufacturing managers, and production workers. The participants for the one-on-one, semi-structured interviews were subsequently selected from each focus group, as discussed in section 3.5.3.

Originally, I had intended to conduct the focus groups using an entirely group-focused discussion-and-answer method. However, after discussion with my supervisor and reading Gibbs (2012), I decided to use a method that built upon each participant's input, so as to minimise the possibility of individuals monopolising the discussion. I refer to this format as the Facilitated Technique (Figure 3.2). I chose this method to counterbalance my concern that one individual may dominate a focus group discussion. Gibbs (2012) notes that what distinguishes focus groups is that they can be 'interactive, the group's opinion is at least as important as the individual opinion' (2012, p.186). This method of focus group facilitation allowed all participants, through their written responses, to individually reflect on the research questions. This represented Step One of the focus group discussion. In Step Two, the sub-groups discuss their prompted responses. This is done before the participants collectively discuss their responses as a complete focus group, which is what takes place in Step Three (Figure 3.2). This method allowed the researcher to feel confident that the conditions were appropriate to allow the perspectives or voices of the participants to be prominent in this qualitative research (Hatch, 2001; Hedges, 2012; Creswell, 2014).

Figure 3.2. Facilitated Technique – Focus Group Flow



As state training providers often dictate the big picture for the skills discourse, I opted to include this group as my first focus group, followed by manufacturing management, and, lastly, the manufacturing production workers. I was very surprised at the punctuality of all participants. All six participants arrived between 15 and 20 minutes early. As a result, we started five minutes ahead of schedule. I had decided on a 2:00 pm meeting time as I knew they would all have to travel by car to the location of the focus groups and they may choose to go home early rather than return to their place of work complete their workday. The facilitated technique is explained below.

<u>Step 1: answer the question individually on small post-it-notes</u>

I printed each question on an A4 piece of paper and displayed it on a desk easel for all of the participants to see clearly. The participants were then requested to answer the questions individually and list their responses on the various post-it notes. (See Appendix 3 for flow of focus group). To prepare for this activity, each participant had four stacks, each a different colour to represent the four questions.

Step 2: place individual responses on the large flip chart paper, then, as a sub-group, look for common themes.

Within each of the three different focus groups, participants were asked first to individually and randomly place their responses on their sub-group's flip-chart paper (a sampling of these can be seen in Appendix 7), and then, as a full focus group, to place everyone's responses into themes. It was fascinating to watch each sub-group at their flip chart paper pooling their individual responses together and discussing how they were looking for themes and connections in their responses. They also broke off into side conversations around the skills. I observed that most of the sub-groups tried to seek my input by asking what I thought. However, to maintain my neutrality, I turned the focus back on them as practitioners in the field in each of their areas of discipline: state training providers who influence policy and direction for the state, manufacturing managers who decide what skill programmes to implement, and individual production workers striving to carry out their jobs and meet employer expectations. I observed their interaction and referred back to it in the large group discussion.

Step 3: Full group moderated discussion on themes

The three steps in the focus group flow were repeated for each of the four questions. The challenging part of Step Three was timing. I wanted to make sure that all four questions were asked of each participant group during the entire focus group. With the state agency workers, I felt I could potentially go over time. So, for one of the questions, I integrated it into the full group discussion and omitted Steps 1 and 2.

This facilitated process whereby all of the participants provided their perspectives in Step 1 was a way to counteract any individual tendency to dominate the discussion. In the full group moderated discussion (Step 3), I intentionally addressed the opening question for each probe to different people in the group. My intention was to make sure that each participant would contribute to the discussion. I found that in both the manufacturing

management group and the production workers group, as the discussion drew to a close, it was harder to control the more verbal participants.

Synergy was created and most groups wished to keep talking and did so past the allocated 60 minutes. As a result, I had the personal professional outcome of one of the state training providers in charge of the WIOA asking me to facilitate a 10 county sector board to oversee skill initiatives for aerospace and medical manufacturing. This sector grant is part of the State WIOA that was explained in Chapter Two. Each focus group was planned to last for 60 minutes. I believe this schedule may also have contributed to an environment in which the participants in all three focus groups stayed back to talk with each other beyond the planned ending time of the discussion. They continued discussing Oklahoma manufacturing skills and the daily challenges of their jobs.

In their research, Morgan (1993) and Krueger (1994) note certain common myths regarding the use of focus groups, which include: focus groups are cheap and quick, focus groups require moderators with highly developed special skills, focus groups tend to produce conformity, and, lastly, focus groups must be validated by other methods (Morgan, 1993, p.6).

These myths stem from the popular use and knowledge of focus groups within a marketing context. Research shows that the use of focus groups has successfully developed beyond a marketing tool into education research. According to Fontana & Frey (1994), the usage of focus groups within research is now recognised as a valuable method of securing relevant data and has 'come out of the closet' (1994, p.21) in the research community. Gibbs (2012) counters the argument made by Morgan (1993) and Krueger (1994) that focus groups produce conformity. Gibbs suggests instead that focus groups can produce data that is derived from creating an environment where people can talk freely. As part of the focus group plan (see Appendix 3), open-ended questions were prepared (see Appendix 4).

3.4.2 Semi-structured interviews

As mentioned in the Chapter introduction, the second research method chosen to deploy within this study was semi-structured interviews. Scholars have argued

that this method helps in the gathering of pertinent data that flows well, allowing the researcher to examine the innate meanings embedded in the responses of the participants chosen from the focus groups (Hatch, 2001; Cassell, 2005). I wanted to employ an interview method that is not often used within the research field of manufacturing. I knew that a semi-structured interview would provide me with the structure but also the flexibility I needed as the interviewer to adjust to my different populations. Cawthorne (2001), whose research is also focused on manufacturing, reflecting on her experiences as a researcher, notes that semi-structured interviews are a desirable research method for manufacturing as they focus on the individual worker. Cassell (2005), who writes on the use of interview in a management context, comments that the use of interviews in environments similar to the one in this study is 'under-represented' (2005, p.168). Semi-structured interviews also provide 'the depth of information' and are often 'the best method to resolve seemingly conflicting information' (Harrell & Bradley, 2009, p.10; Rabionet, 2011). As my semi-structured interviews took place after the focus groups, this gave me an opportunity to probe any intriguing and conflicting information that was presented during the focus group discussions.

The advantage of semi-structured interviews over other styles of interviews may be counterbalanced by the fact that although a voice is given to each participant and research study writes about their insights, researchers are often focused on the processes and not the solutions to the participants' problem. In this research, that problem is the confusion over the understanding of skill in Oklahoma manufacturing. The decision to use semi-structured interviews also aligned with my interpretivist paradigm with elements of a constructivist approach, whereby I depended on the chosen research participants' 'views of the situation study' (Mojtahed et al., 2014, p.88). The participants and the researcher are "co-creators" of the understandings and data produced from the research.

After conducting the focus groups, I selected two participants from each of the population groups of the focus groups to participate in the semi-structured interviews. The interviews were planned to last 45 minutes each. All but one of them took place at each participant's place of work. A2, from the state training

provider participant group, preferred to meet at my place of work. I booked a meeting room and the interview was conducted in this secure location.

I encountered some difficulty in deciding who to choose from among the focus group participants for the follow-up one-on-one interviews. Sunstein & Chiseri-Strater (2007) discuss ways of sorting through data from focus group research so as to identify which participants would be valuable for further probing during the one-on-one interviews. I chose the six individuals based on the input they shared within the focus groups, which prompted my interest in probing their thoughts deeper in order to obtain valuable perspectives. On reflection, I believe that as the production workers' interviews were conducted after their work shift (because this was the request of the VP of manufacturing), these workers may have felt more rushed, especially since I observed that manufacturing production workers W5 and W6 were becoming tired 25 minutes into the interviews. My intent was always to allow them to 'freely present their life situations in their own words' (Kvale, 2006, p.481). I believe this intent was not compromised and my research objective was achieved; however, the interviews lasted 30 minutes, instead of the planned 45 minutes. One future area of research could be to look at the correlation between an interviewee's flexibility with their work schedule and how it correlates to the amount of data produced in interviews.

3.5 Sampling Procedures

3.5.1 Field work site and sampling method

The state training providers and manufacturing management focus groups were conducted at my place of work. At the time of the research, I was working at the Metro Technology Centre, one of the 29 VET campuses in the state. The centre permitted me to use a dedicated secure air-conditioned training room to conduct the focus groups over a period of two weeks. The manufacturing production workers focus group was conducted at the manufacturing facility during the last hour of their morning shift: 6:30 am to 3:00 pm. Due to compliance issues relating to the removal of hourly staff from their place of work, I believed I would have more opportunity to include this participant group if I travelled to their place of work to conduct these particular focus groups.

The VP of manufacturing accommodated this request and secured a meeting room at their facility.

I had a list of planned questions (Appendix 4) that I sought to cover in the course of the 60-minute focus group. Before the session, I had placed flip charts with lists of question numbers around the room to facilitate breaking the large group into two groups of three for Step 2 of the focus group process (see Figure 3.2).

To help create a comfortable field work site, it was decided that each group meet at 2:00 pm in the afternoon. Apart from the state training providers, my other two participant groups would have been at work from 6:30 am that morning. Therefore, I provided healthy refreshments, including water, given the hot climate.

3.5.2 Sampling

When deciding on the population sampling for my two research methods (focus groups and semi-structured interviews), I chose to use non-probability sampling. I was fully aware of the distinctive characteristics of non-probability sampling, 'that subjective judgement plays a role in selection of the sample' (Tansey, 2007, p.14). Non-probability sampling contrasts with probability sampling, where samples are randomly selected. Tansey (2007) lists the advantages of non-probability sampling, amongst which is the inclusion of important participants. Yet, he cautions that there is potential for 'greater scope of bias' (2007, p.13). According to Ritchie & Lewis (2003), utilising non-probability sampling helps the researcher explore their research question more purposefully. It is also important to remember that 'if we do a good job of sampling, it will help us learn what we want to know' Maiesl & Persell, 1996, p.11). Uprichard (2013) cautions the researcher to be conscious of bias issues when using this sampling technique. While it provides the researcher with greater control of the selection process, the trade-off is that such sampling techniques severely limit the potential to generalise from the findings of the sample to the wider population. However, I draw on Arthur et al's point below.

> Within the qualitative tradition some have argued that it is not appropriate for researchers to make generalised claims about the applicability of their work to other contexts. (Arthur et al, 2017, p.52).

Arthur et al (2017) further draws from Lincoln and Guba (1985) who write that the only generalizations to be made from qualitative research is that there are no generalizations. Thus, the choice of non-probability sampling aligned with my research objectives and the choice of three participant groups and I make no claims for generalisability.

Most of the literature which discusses focus group size suggests including four or more participants (Mason, 1993; Krueger, 1994; Gibbs, 2012; Creswell, 2014). This recommendation contrasts with a quantitative approach which typically uses a large sample size. I believed that by choosing six participants for each focus group, then selecting two interviewees from each population group, I would best facilitate an intimate dialogue in the research environment.

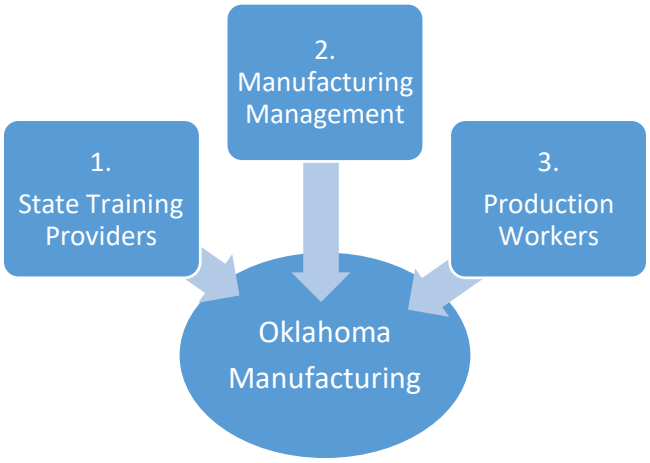
3.5.3 Recruitment and context for sample

As a practitioner within the sector of manufacturing with an emphasis on education and training, I have the opportunity to sit on and facilitate workforce committees within the State of Oklahoma. Discussion of skills at a state level is often dominated by educators from K-12, VET and higher education and by state training providers funded through the US Department of Labour and Education and Training division. While some employers do in fact sit on these committees, they rarely attend; they see them as a waste of time and feel they achieve little impact and change with regard to the skill challenges within their workforce. Having been a manager of training and development within a manufacturing setting and having had responsibility for the learning of workers, I too felt frustrated by the fact that state training providers often have no practical knowledge of the constraints and struggles managers deal with when creating learning opportunities. As mentioned in the literature review (Chapter Two), the costs of creating learning opportunities for key decision makers often outweigh the benefits. In other words, or more specifically, policy makers and agency staff have not had to acquire manufacturing skills as they have not worked in manufacturing; as a result, there is often a disconnect between policy and skill implementation.

As the purpose of my research was to investigate skills in Oklahoma manufacturing, it was necessary to look at the participants who play key roles in

this area. I grouped these participants into three groups, as indicated in Figure 3.3 and explained below.

Figure 3.3. Participant Groups



1. State training providers: This category included participants involved in education and workforce. They were drawn from workforce agencies, VET and government-funded STEM agencies. Coordinators work in the field addressing skill and workforce development for all industries, but with a specific focus on manufacturing. As I interact with these employees on workforce committees, I solicited participation in person at the committee meetings from coordinators and from the other participants over the phone. I then followed-up with emails to gain their commitment for participation and sent calendar invites for logistical purposes. These six participants are responsible for policy implementation and education and workforce training and skill development in Oklahoma, with a scope of action that includes the manufacturing industry.

2. Manufacturing management in the State of Oklahoma: Six managers were chosen from a variety of manufacturing sectors. The managers represented sectors of energy, plastics, renewable energy, steel and home products. I made phone calls and personal visits to manufacturing facilities to ask managers if they would be willing to participate in the research. I explained the location of the focus group as this would require travel time. In addition, I explained that the research would require about three hours of their time away from their

place of work for the focus group and possibly one hour for the one-on-one interview as I would travel to them. All managers asked were very willing to participate and grateful to be asked for input. The operations varied in size, but all were senior management level decision makers within their organisations. They varied in job responsibilities, from human resources to manufacturing operations (see Appendix 5 for participant coding). The cameos in Appendix 6 describe in slightly more detail the actual work of each participant.

3. Manufacturing production workers: These six individuals were chosen from one manufacturing operation with under 500 employees in the machinery sector in Oklahoma City. For production workers who are non-salaried staff their participation could only be secured if a manger or VP of the operation agreed for them to take time away from the operation. Therefore, I contacted the VP to ask for his cooperation. He signed a consent form to allow the requested six to eight production workers from the manufacturing operation to participate in the study. Their job responsibilities included machinist, welder, electrical technician, industrial maintenance, and manufacturing operations (Appendix 6, cameos, describe in slightly more detail the actual duties of each worker). The VP chose six production workers and all of them turned up on the day to participate in the focus group, and each of them also signed individual consent forms. The copy of the consent form is located in Appendix 2. As mentioned earlier, due to legal issues around travel for non-salaried employees I travelled to their place of work to conduct both the focus group and one-on-one interviews.

State training providers and some manufacturing managers with responsibility for human resources are active participants in state groups that examine workforce issues. These two groups are the practitioners often perceived to be closest to the dialogue within the state in relation to skill and can act as agents of change within their organisations. From my professional experience of working in industry with the responsibility for skill development, I am convinced that the greatest knowledge about skill within a manufacturing environment comes from manufacturing operational management. Therefore, it was my aim to include within the manufacturing management population a group of

manufacturing operational managers balanced with human resource professionals.

In addition, those who are often missing from the discussion are the manufacturing production workers. The individuals outside of management, who do their job day in, day out, who onboard new employees, and who conduct OJT are often unrepresented in an organisation when others are mapping and addressing questions around skill within a manufacturing environment. This factor played a key role in my decision to include manufacturing production workers within my research. Appendix 6 provides participant cameos.

3.5.4 Ethical considerations

As Ashley (2012) notes, research has shown that when looking at your research design, it is necessary to give conscious thought to ethical concerns. In the planning phase, I had two major ethical concerns. First, would participants from the state training provider participant group indirectly see each other as competitors and thus not share their perspectives? Or would they feel that their input would be shared outside of the group? Although, within the state, the training providers had the same goal of equipping the workforce with the correct skills to match industry needs, they were receiving funding from different sources and so their ultimate goals within each of their strategic areas could be seen as competitive. At the beginning of each focus group, it was verbally stated that all information within the group was to be kept confidential. This ethical compliance aligns with ethics review and approval process for my study that was submitted to the College of Social Sciences Research Ethics Committee at the University of Glasgow.

Second, I was concerned that the manufacturing production workers' perspectives from the focus group would be sought from me by the management of their manufacturing operation. I had explained to the senior management of the manufacturing company that any information shared within the focus groups and interviews was confidential and that, in my dissertation, all participants were protected by anonymity within the transcript (see Figure 3.4). At the forefront of my ethical responsibilities to my participants was the need to

preserve the conditions that would ensure they would not be 'harmed through the initiative of the research' (Mero-Jaffe, 2011, p.241).

After the production workers focus group, I received an email from the VP of manufacturing from my target manufacturer asking me to meet with him to give him a high-level overview of any comments that would be valuable for him to be aware of concerning his manufacturing operation. I felt it important to follow up and meet with him in person to explain again the ethical parameters of my research and to reiterate that all information is shared confidentially and reported with anonymity using pseudonyms. In our meeting, he also shared his concern that his organisation would be represented negatively in my paper. I brought a copy of the consent letter he had written me for my ethical approval, reminding him that nothing from my research can be shared until completion, and that even after that time, no-one will be aware of the exact people interviewed or of the institutions and companies they represent. In addition, as a researcher, I am bound by my ethical approval not to share his identity nor that of his company nor of any participant. Moreover, on completion of my research, as outlined in my ethical approval, all recordings and transcriptions will be destroyed. This explanation appeared to ease his concerns and he stated that he looked forward to reading my dissertation findings once I had completed my EdD.

3.6 Data management and analysis

3.6.1 Piloting the study instruments

It was necessary to conduct a pilot study to test my chosen methods and instruments: the focus group and the one-on-one semi-structured interviews. I chose to conduct the pilot research at my place of work. Ashley (2012) and Turner (2010) note that when conducting a pilot study, it gives the researcher an opportunity to try out the research methods and instruments and make changes if needed. Ashley (2012) adds that it is also important to conduct the research in as similar conditions as possible to those of the main research study. Turner (2010) argues that when choosing participants for the pilot, it is best to choose individuals who bear similarities to the chosen sampling for the main research study. As I have relatively easier access to the manufacturing managers than to members of the other groups, I decided to conduct my pilot with this

participant group. The pilot participants were not included in the main research study.

The participants in the pilot study included six manufacturing managers and four human resource managers in Oklahoma. From this group, I chose one participant to test the one-on-one structured interview.

Following the pilot and the testing of the instruments, I had to make slight modifications in two areas. First, in the focus group 'Step 1- individual participants answer questions', I realised that I was not clear enough in my directions, as the participants started writing several responses to the prompt on one post-it-note. When I noticed what was happening, I redirected the participants to use one post-it-note for each response. The second modification was again connected to the focus groups and to how my instructions possibly lacked sufficient direction. Connected to 'Step 2- sub-groups create themes from individual responses', I had to be clearer that the participants were required to place their individual post-it-notes on the flip chart and then, as a group, sort them into what they saw as logical themes.

After the pilot, I added more directional verbiage to my instruction sheet (see Appendix 3) to address both necessary instrument modifications.

3.6.2 Collecting and recording data

Acknowledging that my participants have very busy schedules and not wanting to inconvenience them further, I was conscious of the need to reduce the potential for equipment failure. As Easton et al. (2000) note, 'Equipment failure, whether or not it is related to human error or ignorance, might mean having to cancel an interview' (p.704). This may have been my only chance to conduct research for these participants. To mitigate the risk of equipment failure, I placed two recording devices in the centre of the table, situated in the centre of the room. I used a Sony voice recorder (my preferred recording device) and the audio recorder built into my iPad mini. The iPad mini was primarily used as a backup in case I had any problems with my Sony voice recorder. In all six interviews and three focus groups, the Sony recorder functioned very effectively, so I deleted my second recordings once I had

captured the data from the Sony recording device. Once I had obtained approval (written and then verbal) from all of the participants in the room, I checked the recording devices were operational. It was at that point that I turned on the recording devices to pick up the discussion. I was very pleased with the quality of the recording. To help with the transcribing of a focus group that included six participants and myself, I had each participant in the room identify themselves at the beginning of the interview. I used this tactic to help me formulate a participant coding table (see Figure 3.4), in which each individual was assigned a participant pseudonym. This strategy guided me through the transcription process. These pseudonyms are used throughout the design process and findings analysis.

3.6.3 Transcription

As a professional practitioner working full-time in this field, managing time commitments between EdD work and my professional work and faced with the time-consuming task of having to transcribe over 10 hours of focus group and semi-structured interviews recordings, I had originally planned to use a professional transcription service, as I had done so in my pilot with good results. In this study, I switched to carrying out my own transcription. This decision was influenced by discussions with peers and from reading research by scholars (Lapadat, 2000; Forbat & Henderson, 2005; Mero-Jaffe, 2011), who argue for the benefits of personal transcription in helping the analysis of data via coding. These scholars note that the transcription process has received little attention in the literature with a qualitative research focus. Mero-Jaffe (2011) discusses the five actors that can influence the quality of the final transcript: 'the researcher, the interviewer, the transcriber, the interviewee, and the equipment and place of transcription' (p.232). In making the decision to become the transcriber and the interviewer, I was taking on three of these roles: the researcher, the interview, and the transcriber. It could be argued that this decision could carry its own bias (Tilley, 2003) and that this bias could further be accentuated by transcription fatigue (Poland, 1995). Conscious of the effect tiredness can have on bias and realising that I work best in the morning, after discussion with my superior, I was permitted to transcribe at work in the mornings. I also arrived at work an hour earlier to make myself available if I was needed during normal business hours (7:30 am to 4:30 pm). Easton et al. (2000)

note that researchers have to be aware of the potential for transcription errors. The authors go on to suggest that the researcher should ideally be the interviewer and transcriber, which stands in contrast with Tilley's (2003) concern about bias.

Although it took me over 14 days to complete the transcriptions, the benefits gained from the process outweighed the time commitment. I found it easier to code because when I typed, codes were "jumping out" at me. Being present during the focus groups and interviews made it easier for me to transcribe the focus groups and to detect which people in the group were talking, and thereby attribute comments to the correct participant. I was, however, presented with one challenge. My final group - the manufacturing production workers - had similar accents, which made transcription more time-consuming. Having to listen multiple times to ensure accuracy added to the transcription time. The similarity in accents required me to go back over my recording several times. I found that the visual representation of the post-it notes on the flipchart paper (see Appendix 7) helped me make sure that I attributed the right statements to the right group in the room, which again added to transcription accuracy.

3.6.4 Data management and coding

The last decade has seen a growth in the availability of data management tools. These systems are known as Qualitative Data Analysis Software (QDAS). The plethora of tools a researcher can choose from means that when selecting she must carefully consider her criteria. What, in the first place, are the benefits of using a QDAS? What then should be the goal of the tool that will be employed? How can the researcher ensure their own appropriate transparency while using the tool in their collection of data? In this section, I will address these questions as I describe the process I used in choosing a data management tool and how I utilized that tool.

With regards to the general benefits of using a QDAS, qualitative researchers Garcia & Gluesing (2013), who conduct research into organisational technology change, summarise the benefits of QDAS as follows:

> Certainly the ability to collect more qualitative data and analyse them more efficiently provides international change researchers with

> the time needed to scrutinize large amounts of data, potentially uncovering new phenomena and process elements (2013, p.15).

Yet, despite what many would see as apparent benefits of using a QDAS, as Paulus et al. (2017) note, there is scepticism among qualitative researchers regarding the use and functionality of data analysis software in qualitative research. This scepticism is grounded in the belief that software behaviour, rather than method behaviour, will dominate the analysis. What is interesting is the parallel between people's scepticism of the Internet of Things and industrial Internet of Things, which I discuss in Chapters One and Two, and the scepticism prevalent within academia regarding the use of data analysis, which is in turn influenced by the Internet of Things.

Despite the scepticism, I made the decision after testing several systems in my pilot study to utilize NVivo 9 data analysis software, for several reasons. NVivo is formulated to help the researcher to easily organise and analyse unstructured information so that individuals and institutions can ultimately make better decisions. It is a tool that provides a workspace to help a researcher at every stage of the data management process, 'from organizing your material, through to analysis, and then sharing and reporting' (NVivo, 2018). When needing to share and transfer data, NVivo9 makes the operation seamless. The decision to use NVivo was based on its functionality and also on the fact that it was the preferred data analysis software of the University of Glasgow's Department of Education.

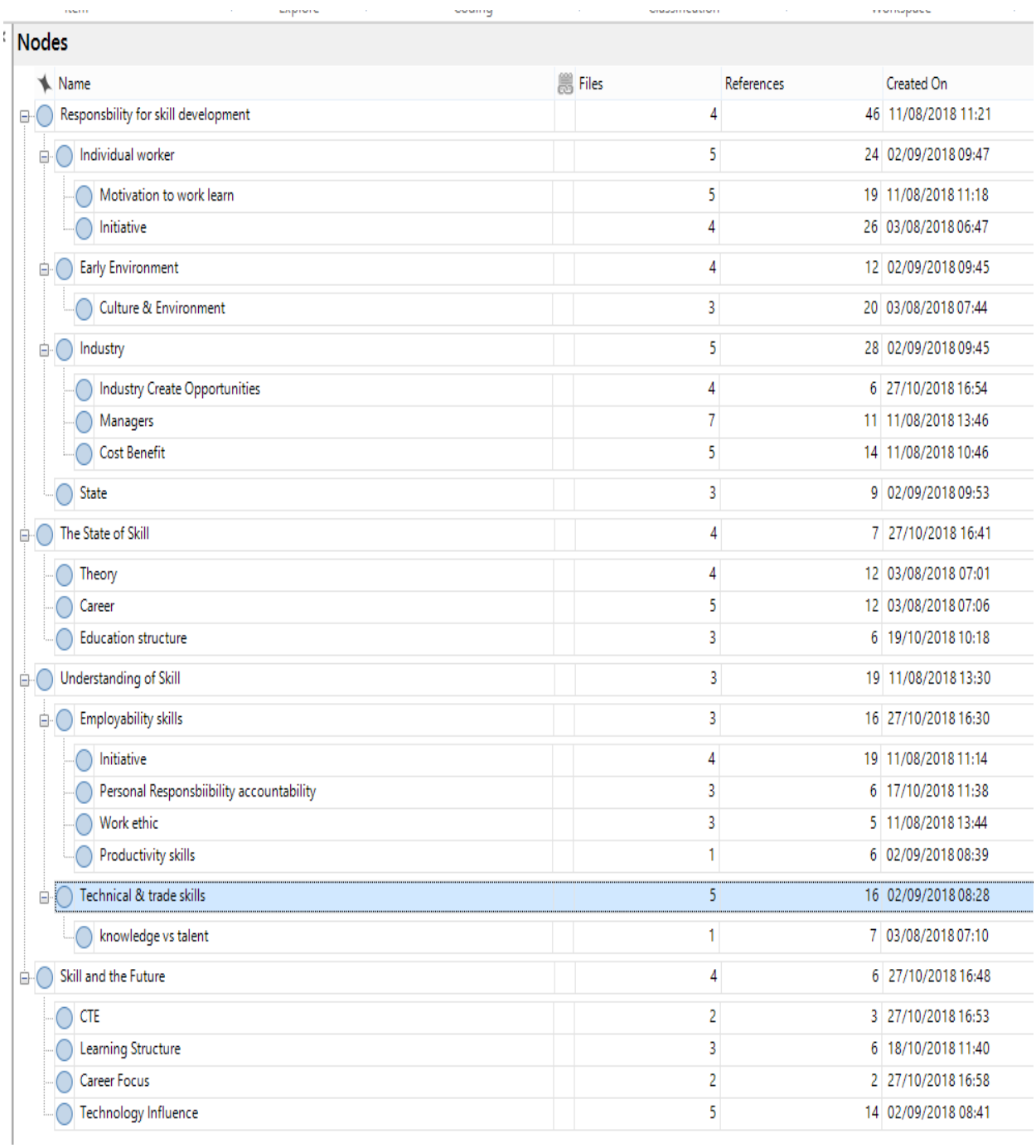
Paulus et al. (2017) analysed an extensive list of the literature reviews of researchers conducting empirical research. What they discovered was that the authors provided 'minimal levels of reporting' (p. 37) regarding data analysis. It was found that the authors of such studies provide very general one-sentence statements, such as 'the data was analysed using' or 'NVivo9 software was used for coding and analysis' (Paulus et al., p. 37). In some instances, researchers did in fact go beyond such simple descriptions of the software and analysed the data. As technology advances and QDAS become more sophisticated, it will be imperative for researchers to adapt to the increased functionality and accuracy of such software analysis tools.

How then was my QDAS employed to analyze the data of this research? I had two central functional uses of NVivo: first, as a tool to organize my electronic transcripts, and secondly, as a visual analysis tool. Having transcribed my one-to-one and focus group interviews, I then uploaded the transcripts to NVivo and carried out some very simple visual analyses, mind-maps and word analyses. I printed and kept always visible the word analyses and word frequency pages generated by NVivo from my transcripts. I found this visual representation of key words in the data helpful when looking for themes within the data. An example of a mind-map generated is in Appendix 9. Drawing from grounded theory, I then conducted line-by-line coding on my paper transcripts (Charmaz, 2008, 2015), ensuring that I engaged with the data to be able to recognise the participants' 'tacit knowledge, meaning and action' (Charmaz, 2015, p.1615). An example of a coded excerpt of transcript can be found in Appendix 10. I then entered into NVivo the codes generated from the analysis of the focus group and one-on-one interview data and used these as the coding words in NVivo. Figure 3.4 (next page) shows the representation of the codes frequency generated from the transcripts.

I found NVivo offered strong functionality and speed as a data analysis tool, resonating with the strengths of QDAS for the qualitative researcher as discussed by Paulus et al., (2017). This data depository of my research also enabled me to highlight text that provided 'narrative' connected to the emergent themes which I could reference and pull into my findings Chapters (Le Blanc, 2017, p.791).

Thorne (2000) states that qualitative data analysis is the most complex and mysterious of all of the phases of a qualitative project and the one that receives the least thoughtful discussion in the literature (2000, p. 68). Of the variety of methods available for analysing and making sense of the data, I chose to use two: QDAS and the traditional approach of manually going through the data to source my codes and themes from the transcripts. I searched for commonalities using NVivo and then cross-referenced them with the coding and word frequencies that were generated by NVivo. I then compared the latter with the NVivo coded (nodes) results before deriving my final sense of the data.

Figure 3.4. Representation of Codes Frequency Generated from Transcripts.



Nodes

Name	Files	References	Created On
Responsbility for skill development	4	46	11/08/2018 11:21
Individual worker	5	24	02/09/2018 09:47
Motivation to work learn	5	19	11/08/2018 11:18
Initiative	4	26	03/08/2018 06:47
Early Environment	4	12	02/09/2018 09:45
Culture & Environment	3	20	03/08/2018 07:44
Industry	5	28	02/09/2018 09:45
Industry Create Opportunities	4	6	27/10/2018 16:54
Managers	7	11	11/08/2018 13:46
Cost Benefit	5	14	11/08/2018 10:46
State	3	9	02/09/2018 09:53
The State of Skill	4	7	27/10/2018 16:41
Theory	4	12	03/08/2018 07:01
Career	5	12	03/08/2018 07:06
Education structure	3	6	19/10/2018 10:18
Understanding of Skill	3	19	11/08/2018 13:30
Employability skills	3	16	27/10/2018 16:30
Initiative	4	19	11/08/2018 11:14
Personal Responsbiibility accountability	3	6	17/10/2018 11:38
Work ethic	3	5	11/08/2018 13:44
Productivity skills	1	6	02/09/2018 08:39
Technical & trade skills	5	16	02/09/2018 08:28
knowledge vs talent	1	7	03/08/2018 07:10
Skill and the Future	4	6	27/10/2018 16:48
CTE	2	3	27/10/2018 16:53
Learning Structure	3	6	18/10/2018 11:40
Career Focus	2	2	27/10/2018 16:58
Technology Influence	5	14	02/09/2018 08:41

According to Paulus et al., (2017) QDAS makes data analysis more 'transparent' if you trust the researcher and trust the software (2017, p.36). Unfortunately, little research can be found investigating how researchers utilise software analysis tools (Paulus et al., 2017; Robins & Eisen, 2017). Moreover, little research exists exploring how a researcher's bias can surface when wishing to

make sure that the coding that they have manually produced matches the coding generated by NVivo or other QDAS software.

From my coding, themes were derived that formed the organizational structure for the findings. As I wished to clarify my themes and sub-themes in a more visual way, I created a matrix (see Appendix 8) and a visual of themes using Word Smart Art, as displayed in Chapters Four and Five, Figures 4.1 and 5.1. These visuals guided me in my findings analysis as I was able to refer back to the NVivo results and the transcripts. This was a process that took numerous attempts, as I tried to draw clarity from the data in a way that accurately represented the participants' views in relation to the research questions. I ended up with five main themes and fourteen subthemes.

3.7 Reflection on the process

Reflecting on the methods and the research process has convinced me of the openness of the participants in this study, yet also their fragility as individuals. I felt a huge responsibility as the receiver of the data generated. This data was passionate and raw. The honest comments provided by the participants were an indication of how important the topic of skill in Oklahoma manufacturing was to each of them. To be transparent, I initially approached the research process as an academic task. However, after listening to the participants' narratives, and then facilitating and transcribing the focus group discussions and interviews, I felt more of a responsibility as the person who had gained this intimate knowledge of the participants' experiences, frustrations and hopes. I began to feel a deeper sense of personal responsibility for presenting their perspectives in a way that was as true as possible to their experiences. I believe that this change in my attitude to the research process has enriched my analysis of the data and findings, particularly in the recommendations section. As a practitioner in the arena of skill in Oklahoma manufacturing, I could potentially be an agent to affect change for the participant groups of this study.

3.8 Conclusion

This chapter provided an overview of and justification for the empirical, qualitative methodological approach followed in this study. I decided to follow an interpretivist paradigm with elements of a constructivist approach to my

research as this would best reflect the world in which the study participants worked. Having discussed research perspectives, I then moved on to my research methods and my reasons for choosing to use focus groups and one-on-one semi-structured interviews to gain the participants' perspectives on the researched topic. The semi-structured interviews were used as a follow-up to delve further into the key perspectives uncovered in the focus group data. The chapter then discussed the importance of the field work site, sampling, participant groups and ethical considerations. Next, I moved on to a discussion of data management and analysis, describing the software and procedures I deployed. The final section of the Chapter focused on my refection of the data collection and analysis process.

The next three Chapters, Chapters Four and Five are a presentation of the findings, followed by Chapter Six, which provides a discussion of the findings through the lens of HCT and a LLL approach.

Chapter 4 - Findings – Part One

4.1 Introduction

In this Chapter and the one that follows, I present the findings, analysis and a brief discussion of the data from both the focus groups and semi-structured interviews, as explained in the last Chapter. The particular focus of this Chapter is to address the research question: What does skill mean for one group of state training providers, manufacturing managers, and production workers in Oklahoma manufacturing.

As noted in the review of literature in Chapter Two, Payne sees skill as a 'slippery concept within the social sciences' (2017, p. 56). Some researchers define it as an individual's attributes (Schultz, 1961; Becker, 1964; Mincer, 1974). Others connect skill directly to an individual's productivity in the workplace (Psacharopoulos & Woodhall, 1985; Ng & Fledman, 2010). A similar "slipperiness" in the understanding of skill can also be seen in the findings of key actors in Oklahoma manufacturing, since the concept gets linked with several broad topics or themes focused on an individual worker's performance on the job.

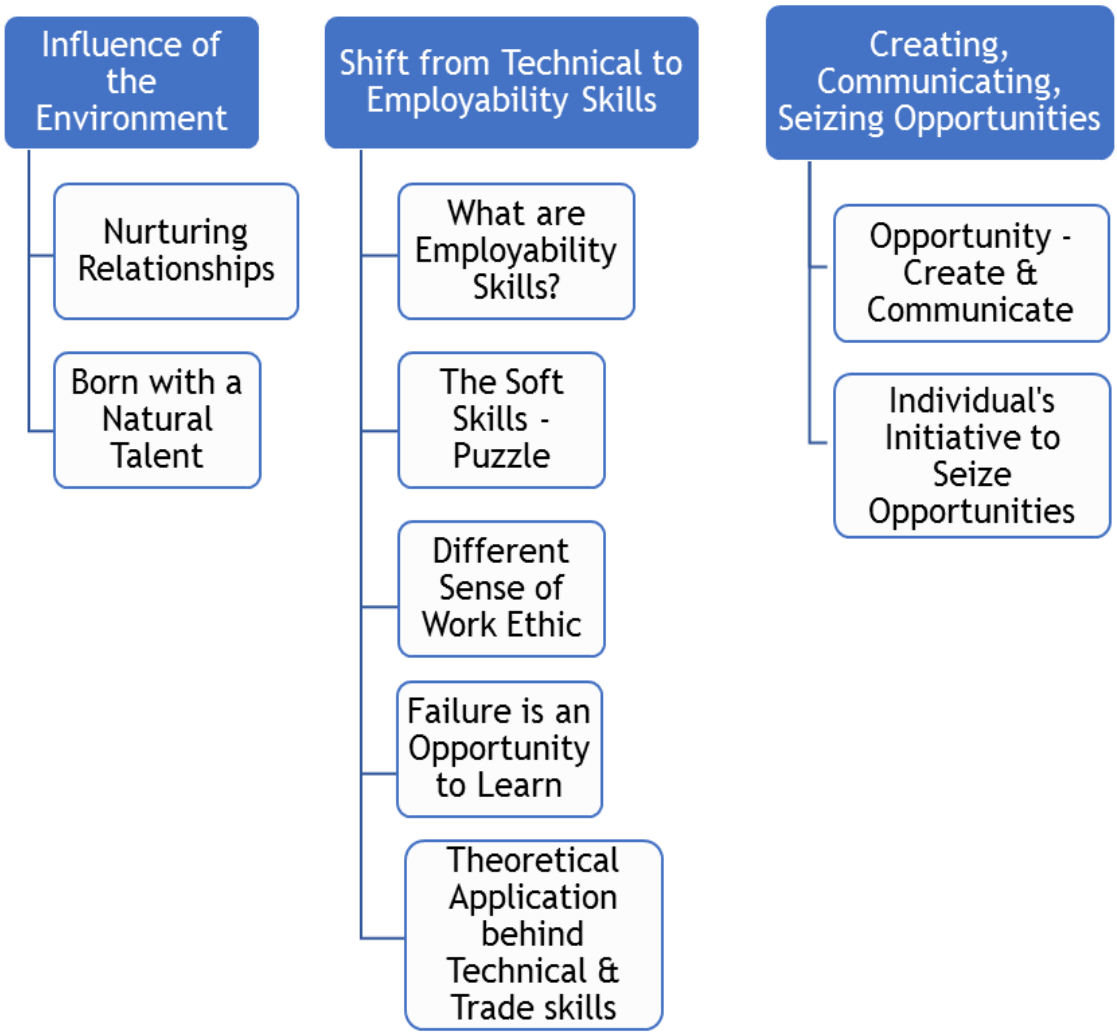
The analysis of the findings from both research methods deployed will be presented in accordance with the five themes generated from an analysis of the focus groups and semi-structured one-on-one interviews. As illustrated in Appendix 8 (Main themes and sub-themes) those themes are: influence of the environment, shift from technical to employability skills, creating and 'seizing' opportunities to learn new skills, parity of esteem and challenges in developing skill. Each of the themes consists of various sub-themes. The sub-themes identified from the data are the ones that most closely align with the research questions and can highlight the most pertinent data for providing valuable perspectives for analysis.

Having organised the themes and sub-themes, data was collected from the participants that represented and supported their accounts/dialogue. In this Chapter, I present and discuss the themes relating to the influence of environment, the participants' dialogue around the shift from technical to employability skills, and the discussion focusing on creating, communicating and

'seizing' opportunities to learn a new skill. I have grouped these three themes together as they reflect findings from the participants that pertain to factors that influence the three key actors' understanding of skill.

Chapter Five will centre on the findings concerning the challenges to understanding skill according to the study's participants. In both findings Chapters, I have reported quotes from the participants, as such richness of data can illustrate the emergent themes from the participants' dialogue. The diagram below depicts the three themes and nine sub-themes pertaining to the findings in the data from all focus groups and one-on-one interviews.

Figure 4.1. Themes and Sub-themes Part One



4.2 Influence of the environment on skill

In this section, the first theme from Figure 4.1 relates to the participants' discussion of how the environment one lives and works in is a major contributing factor to an individual's understanding and practice of skill. The study participants' reflections on the influence of the environment have been grouped under two sub-themes: first, the role that nurturing relationships in the home and the workplace plays in our understanding of skill, and second, the belief that some participants had that an individual was born with a natural talent for the trades.

4.2.1 Nurturing relationships

A6, aged 25 and the youngest participant in the study, in the state training providers' focus group summarised clearly the role nurturing relationships play in an individual's skill development:

> *Obviously parents play a major role in developing their children. Starting from a very young age until eighteen and often past that. School systems whether that be primary all the way through high school helping kids develop the skills and help them find what they want to do is going to be instrumental in what their outcome is and obviously the company once they are there helping them develop the workplace skills …….I think you have to have all of these and if you lose one of those legs it tends to be pretty noticeable.*

This explanation reveals how important nurturing relationships through the life course is for an individual; when one of these relationships is missing, the absence of that relationship disrupts an individual's development and subsequent skill development. A6 noted that parents play a major role in nurturing skill. The manufacturing manager's focus group also discussed the key role that relationships at home play in impacting skill development when the family unit is eroding. M4, looking around the room at the flipcharts which displayed all the responses posted by each group (Appendix 7), commented on a personal observation from the visual representation:

> *It's interesting and personal to me that the parent is probably the most frequently cited one up there, and yet parenting is a diminishing success factor.*

His comment that parenting is '*a diminishing success factor'* drew the attention of M6 and M1, who stressed their agreement that that the environment an individual grows up in is '*fundamental*' to the development of skill:

> *M6: the core stuff comes from the environment you grew up in. It's fundamental. From my perspective it is very hard to go back and correct that.*
>
> *M1: You are a product of your environment, positive or negative.*

The production workers also agreed with some of the positive impacts of environment. The early environment can create experiences that expose a young person to observing and taking part in elements of manufacturing processes. W6 reflected on his personal experiences of growing up on a farm and spending his spare time watching his grandfather weld. When I prompted W6 to expand on this reflection, W6 then went on to explain his experiences of spending time with a neighbour's child. For the last five years, the child would watch him weld. W6 started including the child and invited him over to his shop when he was welding so that the child could watch and learn.

> *Every time he sees me out there, "hey can I work with that" "Can I grind that with you, can I…" Now he's building a trailer for the AG teacher in his AG class ….. more often that's the only way he's going to learn.*

W6's account of his childhood experience and of the ways in which he fulfils that nurturing role for kids in his neighbourhood demonstrates his desire to nurture others as he himself was nurtured. W3 expands on this point and commented that he believed the factor that is most responsible for skill development for each individual is '*the environment where you are at'*. The early environment that an individual grows up in and the experiences they are exposed to were felt by many of the participants to be vital to skill development. They expressed agreement that parents, grandparents, neighbours and early environment laid the foundation for future skill development and were most responsible for nurturing the development of skill in an individual's life course (Elder, 1994).

From the data, it became clear that nurturing relationships played a vital role in understanding and communicating the 'opportunity' for skill development in the

workplace. It was apparent in the data emerging from the discussions that managers play a crucial part in skill development, as motivators, as 'nurturers' of learning, and as the individuals within the organisation that are most likely to create the opportunity for the skill development of their individual workers. The participants that had experience of managing individuals within a manufacturing operation, the participants who were managed, and the state training providers all saw this role as pivotal. M5 became highly animated and wanted to share his thoughts that came from his personal experiences as a manager. He believed that '*it is good managers that develop skill in people*'. I asked M5 to expand on what he meant by '*good managers*'. He commented:

> *I think good managers desire for their people to improve…well, for themselves to improve and consequently they desire for their people that are working with them to improve as well. So I think they're going to be looking for opportunities to help them get better.*

M5 was reflecting on the role of a manager in relation to skill development and demonstrated his own drive to manage those that report to him. His account underlines a view that managers should be thinking strategically about skill development for the organisation and look outside of their own narrow individual focus. Additionally, '*good managers*' desire to help their individual workers improve. Helping a worker to improve is achieved by creating opportunities for them to learn. A manager is likely to be more aware of the gaps in a worker's skill and, as a result, be able to suggest areas for skill development. The sub-theme of the manager's role in nurturing opportunities for learning and skill development in manufacturing was also implied by A6 when commenting on the role of the good manager:

> *Hey, you're doing really well at this and maybe we should look at doing some additional training to help you grow the skill, or we need somebody to be able to weld in this department and you seem like a good candidate, let's see if that's a good opportunity for you.*

From A6's experience as a production worker, he sees managers as the catalyst for engaging and nurturing individual workers and communicating the opportunities for developing skill in the manufacturing operation. A contradictory point of view was expressed by W5 in the focus group. W5 had been recently promoted to a team leader, having started as an entry-level

production worker. He shared his personal journey, which illustrated the importance of self-motivation in his career in manufacturing:

> *I had to have the initiative myself to want to grow, and learn, and understand each piece of the business and how I can impact it, how I can improve it, and how I can contribute to it.*

After W5 commented in the focus group that he had to create his opportunity, I prompted him to explain further in his one-one interview. He said that management created the opportunity and in a way they were nurturing him, but, ultimately, he was responsible for 'seizing' it:

> *I think it came from me and the management gave me the opportunity.*

W5's observations capture how he sees the individual worker's initiative as being important, but that the opportunities that managers lay before a worker are contributing factors to success and promotion.

In the manufacturing manager's focus group, it was mentioned that good managers have the ability to share knowledge and create learning opportunities for their workers. M4, a senior manager in human resources, felt it important to add clarification on the key attributes displayed by effective managers that nurture skill in their workers. This is how M4 expanded on the point:

> *Good ones are learners themselves. They understand that knowledge sharing is the key. And so they freely share knowledge with their employees. Good managers, they're thought leaders, they're thinking us into the future of how do we improve our organisation, improve our work environment and all this stuff.*

M5 agreed with M4's comments that good managers are often learners themselves and further commented that:

> *Managers should be thinking strategically about skill development as a business process.*

The contrast between the views of M4 and M5 brings into question the motivation for managers to nurture skill in their workers. Are they motivated primarily by business goals, focused on economic outcomes, or are they

motivated to nurture others for their individual growth, or is it a combination of both goals, and some other goal still? Research shows that most learning in manufacturing occurs in the informal setting during the course of the workday, but that it consists of strategic 'informal learning and skill development' (Manuti et al., 2015). Often informally referred to as "following Joe", but professionally as "on-the-job-training", in such skill development it is the manager who can nurture or hinder the learning environment.

A1, in summarising his group's individual responses, stated that nurturing skill development in the manufacturing industry of Oklahoma is a '*shared responsibility*', but he was uncertain of whose responsibility within a company it would be to provide skill development. He commented:

> It's shared responsibility frankly. I think the individual has a certain amount of responsibility to do that. I think the company…I don't know whose responsibility.

These accounts show that having a home and workplace environment that provides nurturing relationships for an individual are important contributing factors to that individual developing skill pre-employment. Also, once they are employed, they seek opportunities for continued nurturing and growth as a productive worker.

4.2.2 Born with a natural talent

W6, who has spent his life in and around welding, related his life experiences in welding and implied that welding, a key manufacturing skill set, is a talent that an individual is born with. He was drawing on his experiences of growing up in rural Oklahoma and commented that:

> *There is a natural talent for welding.*

Building on this idea of a '*natural talent*', a conversation developed between W3, W5 and W6 within the production workers' focus group. They discussed welding as a 'natural talent', which to them was a skill that is necessary and developed naturally in the workplace:

W3: You could have the knowledge but not be able to do it.

W5: Or it could be the other way. You could have the talent but not the knowledge. You could be really educated and intelligent.

W6: In 8th grade I welded a front loader on a tractor for our town, a small town…they still use that tractor today and I was never taught how to do that.

In the one-on-one interview, I asked W6 to expand on his comments and observations drawn from his own experiences of growing up in a family who had a tradition of welding.

So if I was to use myself as an example, it was my granddad and my best friend's grandpa that watching them, I was just able to do it. Nobody ever actually taught me how to do it. I just watched them and one day I was out in the garage doing it, and then I was able to weld.

The production workers' comments indicate that the environment was key in instilling in them the skills they would need for a career in manufacturing. Although W6 saw the skill as a '*natural talent'*, he did contradict himself somewhat when he recounted that he had learnt his skill of welding by watching his grandpa and friend while on the farm in his youth. W3 expands on these observations and states that an individual is '*born with it'*, but that it is the 'environment where you are at' and what you are exposed to that develops the skill. Others in the production workers participant group agreed with W6, and commented that, for them, it was clear that:

W3: Some are born with it…the environment where you are at

W5: Yes some are born with it. It's how they are raised or they get it like he says passed on from heritage or family.

These reflections on environment creating talent demonstrate a correlation with the literature reviewed that discusses informal learning in the workplace with particular emphasis on apprenticeship. Although the production workers spoke about how they believed they were born with natural talent, when probed, they explained how from a young age they had watched relatives weld. They developed skill, or what they refer to as a '*natural talent'*, by watching in this informal learning environment.

4.3 Shift from technical to employability skills

It is agreed within industry, education and government that a problem exists with skill, and in particular the supply of current and potential workers with the correct skills for the job (Cappelli, 2015). What is disputed is what is meant by skill within a manufacturing environment. In other words, there are differences in determining what skills employers wish to see in the workers they are choosing to hire and what skills they believe are needed by the current workforce to align with current and future operational goals. Only when it is determined through research and dialogue what is meant by skill in this context can the correct skills employers require from their current and future workforce be identified.

The research participants in this study were asked how they would define skill within their context of manufacturing. From the analysis of the findings relating to how the three participant groups defined and interpreted skill, it became apparent that the lack of skilled workers was influencing the conversation around defining the term skill. The following theme emerged: shift from technical to employability skill, centring on participants distinguishing two distinct classifications: 1) employability skills, and 2) technical and trade skills, focused on workers having a manufacturing theoretical foundation.

4.3.1 What are employability skills

When it came to the participants defining skill, I was surprised that less emphasis was placed on technical skill, as manufacturing is a very technically focused industry. In the current shortage of workforce in Oklahoma, it was remarked that technical skills are the last skill an employer is looking for when hiring a new worker. This point is emphasised in A5's comment:

> *I'll train them in what I need them to do. I don't care if they have the technical skill that somebody gave them.*

Since employers do not have a surplus of potential candidates from which to hire, hiring someone with employability skills was considered more challenging than hiring someone with the necessary technical skills. A2 commented that managers often say: '*I can teach them how to do the job*', but what was more difficult was teaching the employability skills. The employability skills which

participants listed as being most important were: soft skills, work ethic, and initiative. In the next section, soft skills are outlined, followed by a discussion of work ethic in section 4.3.3, and then an examination of initiative in section 4.4, which also details the findings within the theme of creating, community and '*seizing*' opportunities to learn.

4.3.2 The soft skills 'puzzle'

A2, who has a broad range of experience, as an educator and consultant, of advising manufacturers in relation to the skill development of their employees, stressed the importance of soft skills over technical skills and went on to list some of the soft skills he would hear manufacturers consider essential. Referring to what they saw as necessary for a manufacturing worker to be employable, he said:

> *When it comes to skills, when you simply look at the technical skills, that's only a piece of the puzzle in fact you have got in manufacturing. Manufacturers who often tell you, "I can teach them how to do the job, I have a hard time showing them how to turn up to work on time." How to do this and how to do that, those skills were teamwork, communication, and the ability to improve. All of those are soft skills that employers are looking for and that kind of go above and beyond technical skills.*

A4, a state educator approaching retirement, expanded in detail with a clear description of what he saw, from his experience, as the level of preferred order of employability skills (described as soft skills) desired by manufacturers:

> *In fact with any employer, the first thing they are going to say is the soft skills. They are wanting someone who is going to show up, someone who will take responsibility, someone who will look good to my customers, someone who is not going to embarrass me…*

A4 expanded beyond employability skills and offered the additional skills he believed an employer would love to see an employee possess:

> *I want someone who has the productivity skills. Tell me they are going to run my machines, they have all of the soft skills, they can read and write and do all the math, make my parts then I would feel I had died and gone to heaven.*

A4's impassioned comment: '*I would feel I had died and gone to heaven*' illustrates how rare it was for him to see someone who had all the necessary technical and employability skills for successful employment. It could also be interpreted that he was expressing his exasperation that industry possibly has too high an expectation of each individual worker. He has also seen during his career a flip in the skills that industry desires in a worker. In the past, these would have been technical skills. The passion of his voice and the words he uses highlight the rarity of seeing a worker with sufficient technical and employability skills. It explains why he included 'soft skills' as a defining skill set in his understanding of what is desired by manufacturers.

M3, an experienced human resources professional, explained that the main reason she 'separates' (sacks) employees is because they lack soft skills:

> *I'm not separating with someone because of their competency, it's other things rather than technical skills sets. You see we can train for the other skill sets. I don't know if we do a good job in the state of helping people to have those kinds of soft skills. They are lacking in soft skills.*

The participant's comments emphasise the attention that is being given to soft skills in the workplace by management. They are desirable skills, as M3 reflected, and when an individual is lacking in soft skills, that deficit is usually the reason for separation from a company.

4.3.3 'Different sense of work ethic'

Participants in all three population groups commented on work ethic as being a key skill of employability. Although it could be challenged that work ethic is more an attribute than a skill, since this study is reporting findings from the research data, I will keep the participants' inclusion of work ethic as a skill. They focused their reflections on work ethic around the core areas of time-keeping and honesty. M1's comments focused on his experience that he can teach anyone the technical skills. However, when it comes to the specific work ethic of time-keeping, he noted:

> *But to me, I can teach anyone how to weld in a very short amount of time, but I can't show them how to turn up at work on time.*

A3, who had worked in industry as a business owner for thirty years and then as a state training provider for the last 20 years, commented on a recent personal experience with one of her manufacturing clients. With the introduction of smart manufacturing and production monitoring with data boards and cameras, manufacturers can observe their operations over the 24 hours of operation. She recalled a conversation with one of her clients who explained how he had woken up during the night and decided to check on his operation remotely from his home:

> *On some screens employees including the supervisor were just playing around, he thought maybe they were on break. 15, 20 minutes later they are still all playing around. Nothing is being produced, he can see that too. So he had to drive at night from his home into the manufacturing facility and come down on his employees and really get firm.*

This account relates a very relevant example of the lack of work ethic that manufacturing managers observe in their workers. This owner drove at night to his manufacturing facility and gave 'firm' warnings to his staff and reminded them that they could be watched at any time. This experience introduces valuable information relating to future technology in the workplace. A3 interpreted this lack of work as 'stealing from the employer', although others would interpret what the owner did as spying on the workforce and evidence of his failure to engage workers in their work by making them feel part of the enterprise. A3 went on to comment:

> *If they aren't going to do what they are hired to do without someone sitting there and we're going to see more remote supervision with the robotics coming in, there is going to be opportunity for lack of productivity due to poor work ethic.*

Her impassioned comments went further. She inferred that the cause of decline in work ethic in the workplace is caused at school: '*Our public schools are a complete lack of discipline.'* A5 had a completely different perspective. Drawing on his own personal experience with two recently graduated children and being new to the manufacturing workforce, he commented that workers desire flexibility in their schedules:

> *They get more work done on those computers than I can ever think about getting done in an eight-hour workday. I understand, but they are fast and they are really good on that stuff. Now on a factory floor it isn't going to work.*

A5 did however wish to clarify that '*it depends on the level of staff, education and position*'. Manufacturing management needs to look at the different levels of the workforce, whether it is entry level, mid-level or senior level, and think through the issue of work ethic and the impact of using the technology available to monitor the operation. But A5 did not see that a desire for flexibility reflected a lack of work ethic, and alluded to the idea that possibly it is manufacturers that have to change. Yet he did understand that on the factory floor, it would be more difficult to implement a flexible work policy due to the highly organised manufacturing production schedules.

4.3.4 'Failure is an opportunity to learn'

M6, a senior manufacturing manager of a global operation, has had a lengthy career in recruiting and building teams. He explained that his experience taught him that when, in a job interview, a potential employee demonstrates signs of personal responsibility/accountability, the individual worker has a greater success of employability – to M6, this is the key skill for success. M6 noted two questions that he asks in every interview to sort out the candidates. From his experience, he has observed over the years that of the interviewees, '*75% fail*' the second question:

> *One, is tell me something you were successful at and the second one, tell me where you failed?...In the conversation for the second one, when you're telling me where you failed, if you're taking responsibility and say, yes, we had a group with this problem and this is what I could have done to do better, I'll hire those people all day long.*

M6's 40 years in manufacturing clarified for him that when asking an individual to comment on examples of their failures in life, their responses to his question provided evidence that they did or did not assume personal responsibility for their actions. His experience taught him that individuals who cast the responsibility for the failure onto the shoulders of other team members most likely continue this behaviour and are not employable workers. M1, another

experienced manager, reflected on the themes of personal responsibility and accountability further when talking about his experience of using predictive interviews in the hiring process. Predictive interviewing is a process of interviewing that looks at past experience as an indication of future performance (McDaniel et al., 1994).

> *Past performance predicts future success …People are honest and you may hear something you don't want to hear but they are telling you their experiences. But to me, failure is an opportunity to learn. Forget about the failure, never forget the lesson.*

These quotes demonstrate how the seasoned managers clearly appreciate an individual who takes responsibility for their actions. M1 and M6 interpret personal responsibility/accountability as a sign that an individual will be an employable worker - a view agreed on by the manufacturing managers' focus group as a whole.

4.3.5 The theoretical application behind technical and trade skills

A1, commented on what technical and trade skills employers tell him they are looking for in their manufacturing workforce. He listed the requirements as more entry-level technical, or, as he described them, '*basic skills*', which he defined in his commentary as:

> *For the most part, that's… and they talk about really low-level technical skills, because it appears that most of the industry is proprietary, and they don't have an issue with teaching them their methodologies. But they want somebody to have a basic set of skills, and they talk about basic math skills, reading a ruler.*

The findings show that manufacturing managers and state training providers, on the basis of their observations of manufacturing, found that when manufactures look for 'employability skills' in their workforce, they prioritise employability skills over technical skills. Manufacturers believe they can teach the technical skills and that they have a good history of doing so. Moreover, they felt that those employability skills came from the individual workers' early environment. Nevertheless, the study participants' narratives also reveal that technical skills are still desired by manufacturers in Oklahoma, as an individual must possess a theoretical foundation of knowledge.

The participants repeatedly referred to theoretical foundation of manufacturing theories and their application within the manufacturing operation. They discussed what skills they observed in new graduates and current workers, noting that what was often missing was a theoretical foundation necessary to work in manufacturing. Their comments also centred on the importance of theory, stressing that it should have a practical application to industry in students' education both in VET and HE. M3, who was a training manager for ten years before moving into human resources, commented on her experience of training in a manufacturing operation. It led her to believe that there was a gap in the education curriculum, as there was no component that allowed students to apply the theory. As M3 commented:

> *I think education is more general and theoretical. When I was a trainer for a company, I was trying to focus on the application of what they are learning, so maybe going a couple of more steps and saying this is what you learnt and now this is how you apply it in what you are doing.*

M1 in agreement with M3 commented:

> *Yes, teach them the work and how to work. They know how to do the math or the sciences and they don't understand the work.*

His comments illustrate again that workers may know manufacturing theory - that is, the application of theoretical knowledge in manufacturing contexts - but they lack an understanding of how to apply it within the manufacturing operation. W2, a production worker who spent most of his career in the electrical side of manufacturing production in several states around the US, echoed the manufacturing managers' comments about theory. However, he gave an example of how electrical theory can be applied practically in the workplace:

> *You take that theory and apply it to a practical purpose. Like an electronic technician. There is a lot of theory about electron flow and you learn to read schematics but you need to learn how to read schematics into a wiring box.*

I asked the production workers to give me an example of what basic theories are beneficial to know to work productively in manufacturing. W5, who was recently promoted to a team lead and had been educated post-high school as a machinist,

commented on the top theories he thought helped workers to be successful in manufacturing:

> *So it was obviously in the machining…being able to use precision measuring instruments, being able to read a blueprint. And not just a blueprint, but geometric dimensioning and tolerance, the GD and T. Being able to understand that and then understanding how the machines work.*

In contrast, M2, an adjunct engineering lecturer, explained some of the changes he is observing in VET and especially in HE students:

> *Whereas a CTE (VET) graduate doesn't necessarily always have the right technical skills, I know in the university we are growing apart from industry as the graduates are more research-focused and not as practical. When they get into a factory and they are asked to do a time study, they then begin to think this is something I'm really going to have to think about.*

M2's comments indicate that HE students compared to VET students demonstrated more knowledge of the application of theoretical knowledge in manufacturing context but were lacking in the application of theory within industry, and may even not wish to understand its application. M2's comment *'I know in the university we are growing apart from industry'* acknowledges the need to look at avenues that can bridge the divide between education and industry to correct skill development problems.

The participants' narratives confirm that the definition of technical skills in the context of Oklahoma manufacturing is the application of theoretical knowledge. These technical trade skills can be more specifically defined as the theoretical foundation of manufacturing knowledge and the practical application of that theory in the workplace. The practical application of theory was referred to as '*understanding how to do the work'*. The participants' narratives also revealed that VET and HE students were lacking in theoretical knowledge and its practical application, which they considered to be a skill.

The manufacturing managers and production workers had first-hand experience of hiring and working with VET and HE graduates. Their observations in the data provide evidence that a 'gap' exists in terms of the application of theoretical

knowledge to a manufacturing setting in both VET and HE graduates. As M6, commenting on VET and HE graduates, noted:

> *I find that at all different levels when they come out of school we will spend a good year trying to teach engineers how to apply what they have learned. Right down the line.*

This is not an isolated finding. Other participants commented: *'They don't understand the work'*, implying that workers who have received technical skill training often lack the theoretical foundation and understanding of why they perform a technical task, and when presented with a problem, they have difficulty working out solutions. This skill is not consistently being developed in new graduates in VET and HE, as historically expected by industry. Therefore, manufacturers are having to look for ways to bridge that theoretical 'gap' in knowledge and skill application.

4.4 Creating, communicating and 'seizing' opportunities to learn new skills

A key theme that emerged from the findings from all three participant groups in relation to the discussion of who should be responsible for skill centred on the creation, communicating and 'seizing' of opportunities to learn a skill. All participant groups deemed that the responsibility for skill development ultimately lay with the individual worker. The sub-themes that emerged focused on the importance of individual initiative and the motivation or desire to learn. Also, when opportunities to learn are created by management, they need to be communicated appropriately within the organisation, with the ultimate responsibility resting with the individual to 'seize' that opportunity.

4.4.1 Opportunity – create and communicate

Some researchers argue that LLL perpetuates a view that devalues the individual worker, in that they are seen as a commodity to train and in which to develop skills with the purpose of meeting business objectives (Coffield, 1999). I was conscious of this perspective throughout my study, as I was too of the participants' assumption that the US is a free society in which each individual has a choice in their skill development. The production workers in this study could potentially be the individuals oppressed by the control of LLL and

subsequently of HCT. The manufacturing managers' reflections could be an indication of their collective governance of the individual workers.

The manufacturing managers felt that it is ultimately the responsibility of the manufacturing organisation to create the opportunities to learn new skills. M4's comments on the matter met with agreement from others in the group:

> *The employer is responsible for creating the opportunity and the individual is responsible for seizing the opportunity.*

M4 thought it important that the group recognise that, as manufacturers, they should create opportunities for skill development, but, as managers, they needed to acknowledge that they often lacked the ability to structure or create those opportunities within the manufacturing operation. In this regard, he stated:

> *[Managers] all allude to that but we don't address what type of skill and how frequently.*

M4's comments show his belief that while they may agree that, as managers, they should create opportunities to learn, the reality from his experience is they do not know what skill to train for and how frequently to do so. In the one-on-one interview with M4, I probed his comment from the focus group where he alluded to the organisation not addressing skill. He expanded further:

> *If we had a better relationship with education, I think that would just open up people's minds. My company already told me I can go be the head of manufacturing and they can get me to this point. I'm going to need some education to get from that point to my final goal. But what I find is that kind of shuts people's thinking down (and mine) because they don't know what it is, where is it, who can pay for it.*

M4's reflections on his personal journey of skill development are reflective of his experiences as a manufacturer in Oklahoma. Manufacturers may see it as their responsibility to create opportunities for skill development, but they do not have good relationships with education and, as organisations, they do not have an understanding of how to structure and deliver their skill development programmes.

The production workers commented that if a good company is a good one, it will invest in its people. They added that it was the manufacturer's responsibility to create opportunities to learn. However, what stood out was the conversation that followed, which focused on what happens after skill development has occurred. They alluded to the fact that the company expects the worker to stay in employment for a certain amount of time:

> *W4: Almost like a learning contract.*
>
> *W6: We will pay for your education as long as your education benefits us.*
>
> *W5: It has to benefit the company.*

As mentioned previously, the participants in their narratives saw that the individual should take on the responsibility for skill development by using their initiative to learn (see section 4.4.2). M5 commented that although an individual should be responsible for their skill development, which his focus group agreed with, what he felt the group was ignoring was the communication of those opportunities:

> *We haven't talked about the weakness that we aren't always aware of what is all out there and what skills are required, and that we don't communicate these effectively within the organisation*

M6 agreed with M5's observation, commenting that they have to put all '*material out in the open'* regarding opportunities to learn a new skill. The suggestion that there should be materials provided without any accompanying conversations focused on a skill development plan indicates that the managers depend on their workforce to use their own initiative. This impression is further strengthened by M6's account:

> *Most people aren't driving this, but at least if you stick material out in the open where they can see it...some will gravitate towards it. Very few, but the ones that do are the employees you will want to have at the end of the day.*

Manufacturing managers see communicating opportunities to learn as simply '*[sticking] material out in the open'*. This opinion points to their lack of understanding about how to strategically plan and structure skill development

for their workforce. Discussion about new skills has to take place in a wider context even than the company.

In the group discussion, most of the findings focused on skill development at the place of work and on the organisation's role in creating 'opportunities' for skill development. The participants were particularly clear that while it was the organisation's responsibility to create opportunities for learning, their experience had shown that the opportunity was not necessarily extended or communicated to all people in the organisation. In some of the family-owned businesses, there is a value placed on skill development and on the ways in which this development can help the individual not only in their manufacturing operation but also in their career progression. This philosophy is a cultural one for a company and is often based on the owner's conviction. W2 commented on his experience of a former employer incentivising night classes to study for a degree. If you scored an 'A' grade, the company would refund you 100% of the tuition costs. He commented on the owner who:

> *…encouraged everyone to go to school as that was free money. One of the owners came out at a team meeting and said you're walking away from free money, we are giving you an education and if something ever happens, you are taking that education with you.*

This is a conscious decision of employers and company owners to invest in CVET, which contradicts Lerman (2014). Lerman claims in his research that the reason companies do not invest in their employees by creating CVET and skill opportunities is the perceived risk of 'poaching' by other companies. The fact that this point never emerged in the data for this study as an obstacle to skill development might be seen as a regional positive characteristic of family-owned manufacturing businesses in Oklahoma

Critics of LLL often point to the discourse in which the needs of the individual worker regarding learning and skill development are ignored if the needs of the state or organisation do not line up. This power over the individual emerges in Burchell et al's., (1991) writings on 'governmentality'. M6 stated that when his company offered workers financial reimbursement for the skill development they obtained during their own time away from work, he could:

> *…count on one hand five people who took the opportunity when it was offered and funded.*

What M6 learnt was that it was not hugely successful to incentivise opportunities for skill development by offering only a simple financial reimbursement for training outside of work time. So, he designed a larger financial compensation and advancement structure based on the skill development levels, which he referred to as his '*skills matrix*' (see Chapter Four, section 4.4.2). M6's skill matrix gave individual workers a route to 'seize' the opportunities for skill development. The matrix was also seen as a way to advance through the global manufacturing organisation and a means of taking all of '*the controversy between people away*'.

Within the data, an example of an employer governing the individual was seen in A3's narrative of management watching production staff remotely (section 4.2.1). This example gives a broader perspective of how an individual worker is being governed by the advances in technology. Although not mentioned, a future area of research could explore how the implementation of remote monitoring can enhance or limit the informal acquisition of skill in the workplace. As the environment shifts and with the influences of smart manufacturing, it will become important for the individual to become the motivator of skill development.

4.4.2 The individuals' 'initiative' to 'seize' opportunities

Although initiative was cited as being the most desired skill in an individual worker, the manufacturing management participant group commented that from their extensive experience in the field, '*initiative*' is a skill that they observe is only present in a small percentage of their workforce. This comment itself might place unrealistic expectations on the individual worker to be the initiator of their education and skill development.

Commenting on initiative, M6 made the statement:

> *You can't teach initiative, you can't teach passion.*

Here, M6 is observing that from his own experiences, initiative seems to be something inherent to an individual. Agreeing that initiative is something that cannot be taught, W3 comments:

> *It is, but I consider myself old school. Like you say I don't deserve anything unless I went out after it myself.*

By referring to himself as '*old school'*, W3 indicates that he sees a change in today's new workforce and that he feels that anything he gets in life is dependent on him. It might be inferred that he views today's worker as displaying a greater sense of entitlement. He may also be expressing his frustration and possibly anger about the individual workers, particularly millennials, entering the workforce. He went on to state:

> *You know you have to motivate and show initiative yourself. You get what you want out of life by going for it. If you don't take the risk, sit on the couch and play Xbox or PlayStation and expect me to hand it to you, well you're going to get a cold slap in the face.*

These comments about younger people also relate to what M2 is observing in HE engineering students. M2 reflected on a personal example of when he was an adjunct engineering teacher:

> *I was with a class of 30 students, junior level engineering students. The first question I asked was: How many have been in a manufacturing facility? Only two raised it. So I thought that wishing the two years you would have made the initiative and go tour a facility and know what kind of tools and methods and skill sets is required.*

M2 expressed the belief that students want everything handed to them and demonstrate little initiative. A1 mentioned that what he has been seeing in new workers is a lack of initiative and that they appear to be expressing a particular attitude of:

> *This is my job. This is the only job I do. I don't need to learn anything else.*

Expanding upon the discussion of initiative in agreement with the notion that the individual is responsible for their own skill development, M5 challenges the

previously stated beliefs that the individual worker is not always aware of what skill are required to do a job or what opportunities are available for skill development. He describes it as a '*weakness*' to hold '*people accountable for what they don't understand*':

> *We haven't talked about the weakness that we aren't always aware of what is all out there and what skills are required. So you can't make people accountable for what they don't understand. I think they bear some responsibility for continuing to seek out opportunities.*

In relation to initiative, the production workers discussed the idea of apathy, which is seen as the opposite of initiative. It appears that these comments show their personal frustrations with the individuals they work with who show little, or no, initiative. Primarily, the participants had in mind '*millennials*', whom they view as lacking initiative and representing a very real problem for the manufacturing workforce. It should be noted that half of the production workers interviewed in this study are millennials. W1 went on to comment:

> *The individual has to be responsible for yourself. The only thing you are owed is what you work for. We owe you nothing because you're alive.*

The participants ultimately assigned responsibility for skill development to the individual. A worker shows they are acting responsibly when they display initiative. However, the tone of the comments expressed by the participants reveals a frustration about the lack of '*initiative*' displayed by their co-workers. W1 and W2 believe that the individual is responsible for their own actions. From the discussion of responsibility for skill development connected to individual initiative, there was an emergent theme: the individual displaying a desire or 'motivation' to want to learn. A6 explained this point well when stating that the individual worker:

> *…has to want to develop the skills. They have to have a desire that they want to develop the skills.*

The production workers emphasised this point further on in the discussion on initiative, stressing that the individual worker demonstrated their motivation to learn. As W6 reflected:

> *I think it comes from within. If you want something you have to go get it, and if I wanted to weld I had to do everything I could to be the best at what I wanted to do…You have to want to learn what you need to be good at it.*

W6's commentary on the need for the individual to have the motivation to learn new skill was very impassioned. It shows his determination to succeed in his journey to become what he calls '*the best of what I wanted*', and underlines his belief that the motivation comes from within. He further emphasises the importance of individual skill development in learning when commenting:

> *So you can have the best teacher out there, but if you don't want to learn it you're not going to. So as new technology comes out, they should want to have that knowledge and they should reach out to get that knowledge for themselves.*

Here, he is emphasising his conviction that the individual has to be continually learning and has to demonstrate a desire to learn. As a follow-up, I probed further in the one-on-one interview into W6's comments and asked him to explain his comments about the individual needing to demonstrate a desire to reach out to get the knowledge themselves. In response, W6 commented that it was individual self-motivation that leads to a desire to learn. He illustrated this point by sharing his personal experiences. He commented that his primary motivator was his family.

> *So but from there it's up to the individual to retain that knowledge and it's also up to the individual to want to go to that training. Mine was my family. I always wanted to give my family the most I could give them. And sitting idle is not going to do that. So if I'm good at one task, I'm only good at one task, that one task can only take me so far. I have to adapt to other tasks. And adapting to other tasks is what lets me provide more and more for my family.*

W6 identifies his family as his primary motivation to learn and develop skill. His motivation to learn and advance was to provide financially for his family. It could also be argued that his motivator to provide financially is also a fundamental desire for self-worth and acceptability. In relation to money as a motivator for learning within manufacturing, M6 illustrated an example of a skills matrix system tied to financial compensation with which he has enjoyed great success as a manager. In this system, the ownership of learning is left to

the individual, who drives the learning and subsequent development of their skill:

> *The ones that had the initiative and drive were chasing it, but everything was out in the open. If you were satisfied doing this then that's ok. It took out all of the controversy between people. If you want it, here it is, you drive it. You have to drive it yourself, that takes us back to the individual…individual has to own it.*

The theme of the individual's motivation to learn was illustrated further by W5 in the one-on-one interview, when he wanted to reflect on his personal story of his skill progression within the manufacturing sector. As a machinist, he wanted to learn more, and to facilitate that learning within the workplace, he would stay after his shift ended and ask an engineer if he could watch and learn. He would ask the engineers:

> *Hey, there is an empty desk right there, can I jump on it and start teaching myself some stuff myself? And that is what I did with a lot of things. I just told myself: I can do this, let me try to do this. I can do this, let me help you out. Kind of developed and improved myself.*

W5's personal account demonstrates his sense of initiative and motivation to learn, which he refers to as '*…initiative, motivation and a little bit of pride… or self-worth'*. W5 is a great example of a manufacturing success story. Although he was unclear as a teen about his career direction, he did realise that he was practically inclined. In high school, he enrolled in a concurrent avionics course that was offered in connection with his local VET. He realised early on his limitations with electrical theory, and rather than fail the programme, he felt the need to make a change. To gather advice on his choices for other programmes, he went to a school counsellor for help. The fact that he sought help was an example of initiative. The school counsellor suggested machining, which has opened up many opportunities for him to 'seize' in his career. His strong work ethic and sense of initiative have led him to look for new ways to learn in the manufacturing operation and resulted in a promotion to supervisor level.

Tensions did emerge in the findings regarding the question of who should be responsible for skill development in manufacturing. The production workers

were vocal about their responsibility for developing their own skill once employed in manufacturing. This point was underlined by W6's comments. They saw that the individual worker had to demonstrate a sense of initiative. Their narratives indicated that they believed the way initiative is shown is by a worker '*seizing*' opportunities to learn and to develop their abilities. They attributed the development of initiative to the impact of an individual's early environment, as this shapes people to be responsible for their own learning. Some of the harsher comments made by production workers suggested a degree of unknowing control and governance exerted by the employer in regard to their skill development.

All three participant groups essentially viewed skill development as a shared responsibility between what they referred to as the '*community*' (see section 4.3). This community includes parents and family, the school system, the company and the individual. For the core content regarding whom the participants considered to be responsible for skill development, see Appendix 7.

4.4 Summary of findings

The first key finding to emerge from this data regarded the participants' understanding of what manufacturers mean when they talk about wanting workers with the right skill. The majority of the participants believed that manufacturers sought employees with the necessary abilities to be productive workers. The participants repeatedly identified the skill manufacturers desired as consisting of: '*employability skills*', a basic theoretical understanding of manufacturing, and experience using their skill in a relevant or comparable industry.

A second key finding that should be highlighted relates to the understanding of '*employability skills*'. The majority of the participants stated that the '*employability skills*' manufacturers want to see in their workforce is the skill of initiative. The data presented illustrates that manufacturing managers see initiative at play when a worker demonstrates a desire to learn new skill by '*seizing*' opportunities to learn. The production workers went further, stating that a worker demonstrates initiative by taking responsibility for their own learning of skill. A frequent comment among the participants was that too

often those employees who failed to show initiative to learn were looked upon by manufacturers and peers as insufficiently skilled to be highly productive or not amenable to learning the new technical skills required by employers.

A third key finding was that participants sensed a disengagement between education and industry to address certain skill development that would be valued by employers. Manufacturing managers saw the need for partnering strategically with education to assist them as they grow in their understanding of how to develop skills of their employees and to identify the necessary skills for their workforce. Here we see potentially the embryonic beginnings of the recognition of the need for a skill ecosystem.

The last key finding to emerge related to how skill are learned. Many of the participants believed that the sufficiently skilled worker comes to learn the skill desired by manufacturers through informal learning experiences that occur in their community and at the place of work. Production workers commented about how certain people acquired employable and/or technical skills by observing others informally who were exercising those skill. The participants also observed that certain workers were able to learn skill on the job, without any formal training offered by employers; they merely needed to observe and replicate skill that were demonstrated by highly valued employees and in a workplace environment where a manager practised discretion by creating a workplace of learning.

4.5 Discussion

The goal of HCT is to produce self-determined learners who can make themselves competitive (Harvey, 2007). These findings illustrate the effects of an individualised approach to skill, but also suggest that some study participants are moving away from that approach to ideas that are more conducive to the creation of a skill ecosystem. Specifically, they are moving towards an approach that identifies the levels of skills and the systems and partnerships that work to develop these skills. There is already in place a potential for building a structure of jobs (Buchanan, 2017) through the informally connected family-owned manufacturing businesses in Oklahoma. This view aligns with Buchanan et al.,

(2017) who discuss that 'regional or sectoral social formations' (p.1) are formed to address workforce issues and are known as skill ecosystems.

In addition, the approach of HCT does not seem to be working. For example, when participant A4 comments '*I would feel I had died and gone to heaven'*, referring to how he would feel if he was to see a worker who is employment-ready with the necessary technical and employable skills, he is illustrating both HCT and an LLL approach. His sarcasm indicates he perceives skill as specific abilities that would contribute to productivity and the economic progress of his employer and that his experience has been that he rarely sees them in employees. If HCT was working, then workers would have had the internal motivation to gain the skills that employers seek. It could also be suggested that a skill ecosystem approach that aligns input from industry into the desired skills in their workforce with education partnerships could correct this problem. The US is seen as having a 'fragmented system of workforce development' (Buchanan et al., 2017, p.454) of which skill development is a part. To address this fragmented structure, an effective skill ecosystem in this context would adopt the suggestion of Dalziel (2015) who states that an ecosystem that should be sought is one that includes the input from 'students, employers and faculties' (p.63).

What we do see in the findings, when participants are discussing the 'opportunity' to learn, is that the manufacturing managers and state training providers in this study acknowledge the need to partner within their community with education and other strategic partners that could assist with industry specific skill development. When M2 says *'I know in the university we are growing apart from industry'*, and M4 states '*if we had a better relationship with education*' they are both illustrating a key feature of the skill ecosystem approach, the need to form an avenue for strategic partnerships. M3's complaint *'I think education is more general and theoretical'* evidence the failure of a strategic approach that brings the various elements together for effective skill development. M3's observation on the failings of education demonstrates how a skill ecosystem approach could support companies because education would include more emphasis on practices of application rather than theoretical knowledge. M6's comment that he had to '*teach engineers how to*

apply what they have learned' also gives further emphasis to the importance of the introduction of a skill ecosystem approach that aligns industry and education working in collaboration. Leveraging education and other strategic partners brings the experts together when deploying a skill ecosystem approach. These avenues are what a skill ecosystem seeks to produce by bringing together education and industry to strategically create skill development programs (Anderson & Warhurst,2012). Strategic partnerships between education, industry and policy makers are key elements of a skills ecosystem (Dalziel, 2015; Buchanan et al., 2017).

On a separate topic, W2's affirming comment that a company's owner once said to an employee regarding opportunities to gain additional skills development that would be reimbursed by the company , '*and if something ever happens, you are taking that education with you*' is also suggestive that this participant already has an informal but potentially important appreciation for the development of a regional skills ecosystem (Buchanan, 2017). They may already perceive that skill development of an employee in one company who then is '*poached*' by another employer still contributes to the overall regional skills ecosystem.

The findings are in alignment with Grugulis et al., (2004), Little et al., (2006) and Hurrell (2016) and they acknowledge that employability skills, with the emphasis on initiative and a desire to learn, are the most desired skill. These study participants go further by concluding that, formal and informal education is not producing them. It could also be argued, based on this study's findings, that HCT and its application in an educational environment is flawed, as most employability skills are developed in the early environment and primarily by family.

The belief prevalent among the manufacturing managers that the organisation is responsible for creating opportunities for skill development contradicts the relevant literature (Hager, 2004; Tynjälä, 2008) which discusses how most skill is developed in the informal learning environment of the workplace. What this study's findings show is that the participants recognise the existence of informal learning, but they feel that manufacturing managers need to do a better job of

creating opportunities for skill development and communicating these opportunities to workers. The opportunities that were felt to be lacking in the organisations are reflective of a more formal approach to skill development. This might align with lifelong learning, and the view that the individual must always be building up their knowledge and skill throughout their life course (Faure et al., 1972).

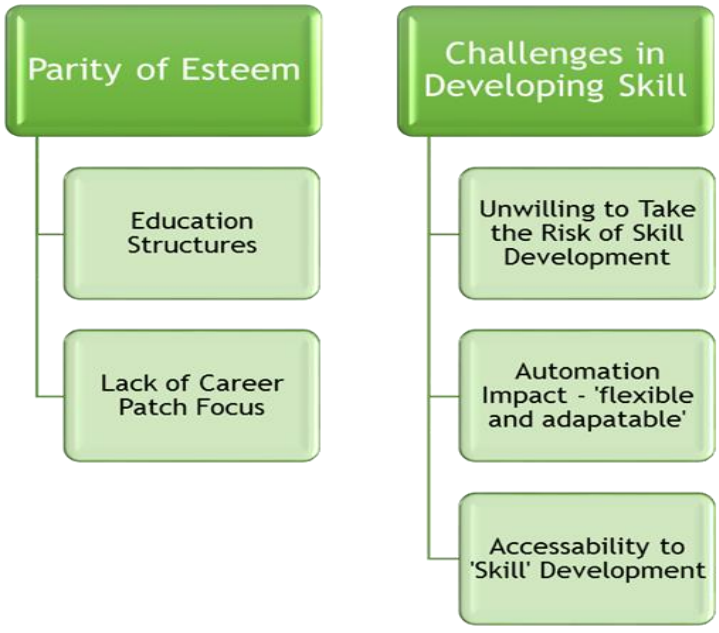
Chapter 5 – Findings – Part Two

5.1 Introduction

It was pointed out in the review of literature in Chapter Two that workers have to be able to use theoretical knowledge in new ways and new contexts because their work is likely to grow in complexity and difficulty (Wheelahan, p. 2). It was also noted that researchers have stressed that manufacturing, in particular, is changing from operating as an industry that primarily hires low-skilled workers to one whose workers will be engaged with advanced technology (Spencer, 2018; Gaulden and Gottileib, 2017). What literature indicates is that there will be a necessity for those in manufacturing to develop new skill as advanced technology will demand new skills from current and potential workers. Developing these new skills, however, have their own impediments. How key actors in Oklahoma manufacturing view those barriers will be addressed in this Chapter.

In the last Chapter, the participants' understanding of skill was examined in the context of Oklahoma manufacturing. In this Chapter, I continue the presentation of the findings of the focus group and interview data, presenting a review of what the participants perceived to be obstacles to understanding skill. Their responses are organised into two main themes: parity of esteem and challenges to understanding and developing skill.

Figure 5.1. Themes and Sub-themes Part Two



Each theme and sub-theme derived from the coding generated using Nvivo to select, separate and sort the data (Paulus et al., 2017). Following on from this, I manually organised the codes into sub-themes and represented them in Word Art, as represented in Figure 5.1.

5.2 Parity of esteem

The participants' discussions centred on the structure of education prior to- and during employment in Oklahoma and how it has impacted the understanding of skill in Oklahoma manufacturing. From the data generated in the focus groups and one-on-one interviews, two key sub-themes will be analysed in relation to the state of skill in Oklahoma manufacturing. The first sub-theme gathers together the data and perspectives of the research participants regarding how they see the current and past structure of education in the state with a focus on funding HE over VET. The second sub-theme, entitled 'lack of career path focus', gathers the participants' perspectives of their own experiences as students in manufacturing skill development during their careers. In addition, it also gathers their perspectives of other students' and workers' paths in education for manufacturing skill development. This theme has been labelled 'parity of esteem', since the findings show that the participants saw a lack of parity in how education and industry present skill and the opportunity for a career path in manufacturing.

5.2.1 Education structures

When the discussion moved on to current experiences of training their workforces with new skill, M4 was very keen to comment on his experience. M4 has a broad career experience in human resources. After working in a variety of industries, he transitioned to work in manufacturing four years previously. After moving to Oklahoma, he reached out to education providers to seek partnerships to train his staff and recruit students to his manufacturing operation. This reflects his ability to discern the differences between US states in education and recruitment practices for different industries. M4 commented that it was a challenging process for him after he began working in Oklahoma manufacturing. He spent time calling education providers from K-12, VET and HE in order to arrange a meeting with them. M4 describes his experience as having to '*fight his way in*'. These experiences illustrated to him the confusion and lack of structure

in the education/workforce structure as it related to employers in the manufacturing industry pre-employment and during employment:

> *I started thinking, "Why am I doing this? I mean, why do I feel like I have to do this? Why isn't someone chasing me, as opposed to me chasing them?" And when I started to meet just teachers and administrators and learn about certain programmes that were in place, and, of course, I had these thoughts all along. Why did I have to chase down that information? Why didn't that information come to me somehow so that I would be aware of it?*

This journey of trying to understand and seeking help from education on how to equip his staff with the required skills was confusing for M4 and represented a major obstacle to equipping his workforce with the required skills. M4's behaviour as a manufacturing manager suggests his desire to address the skills problem of his workforce by forming strategic partnerships with education partners. He also noted that most manufacturers are disconnected from education as they do not have the time to leave their operation and seek out answers. He commented:

> *Ultimately, I discovered that as I started to make inroads into each of these different levels within education, none of them were interested in working with one another.*

The observation that different levels of education do not want to work together was echoed by W6, in the production workers focus group. W6 was educated as a welder in high school at a concurrent programme between VET and his high school. His noted that all levels of education simply want to make money:

> *Although the education system is way too siloed and the two-year system wants to make money and four-year schools want to do the same.*

The siloing of the education structure is in reference to the divisions of K-12, VET and HE.

M4 elaborated on the education structure problem he had described in the focus group, commenting that the funding structure of education within the state is the catalyst for the structural problems:

> *Two-year schools work on behalf of two-year schools. Four-year schools work on behalf of four-year schools. Tech programmes work on behalf of tech programmes. It's like they're fighting with each other over students. So if we're going to let funding drive the decisions that educators are making about how to connect with industry, I think we're going to keep missing the mark.*

In the follow-up one-on-one interview, I probed this line of commentary with M4, asking him to explain what he meant by his comments about education divisions working against each other and '*missing the mark'*. Reflecting on his comments about '*missing the mark'*, he explained that he was referring to education's inability to serve industry, adding:

> *They don't have the ability to organise themselves around the kind of campaign that it would take to educate industry about their existence.*

It was also observed by the state training providers that more attention is given to HE, than to VET education in the state. This aligns with a viewpoint commonly held in the UK, where labour problems in technical occupations are often considered to be a result of less clear organisation of VET compared to HE (New Statesman, 2017). In section 2.3.1, I discussed the policy context of skill in Oklahoma, with the emphasis on state and local funding. Gambin & Hogarth (2017) describe the UK's funding of skill development as 'sub-optimal' (p.633). This observation regarding a shortfall in funding for skill development parallel this study's findings in that the limited state funding made available for school-to-work transitions and workplace training is rarely seen by manufacturers. TIP funds are available for new employee skill development, but these are very limited within the VET budget. Fiscal year 2019 saw $1 million made available in the form of TIP funds (OK Career Tech Statistics). As a result, manufacturers either have to fund skill development themselves or rely on the individual worker to acquire and fund the acquisition of skill.

5.2.2 Lack of career path focus in education and industry

Two sub-themes emerging in relation to what the participants saw as a core obstacle to skill development in the one area of manufacturing of this study were, firstly, a lack of manufacturing awareness on the part of educators and industry when advising students on what careers to pursue in manufacturing.

Secondly was a growing mismatch between VET's educational content and the industry needs of the state. M4 reflected on his personal experiences as a high school graduate and, more recently, as the parent of two recently graduated students.

> *There is just a lack of awareness … I don't think the teachers and administrators are influential enough. Certainly going back to my day and even before that which seems to continue today. They don't seem to be able to advise kids on where to go after high school.*

M1 was passionate when explaining that he felt his high school did not provide direction regarding the opportunities available for high school students. He recounted:

> *My counsellor was terrible. I knew what I wanted to do, I just wanted to weld. Today everyone wants to go to college. I think they used to divide us but couldn't tell us. Here is a guy that's good with his hands not his brain and here's a guy good with his brain not his hands. You end up in that rung and they hope you become a productive citizen.*

The state training providers also reflected on the work of counsellors and teachers in K-12, with A1 commenting:

> *So a real lack of career focus on all of education.*

In contrast, W5 commented on his positive experience of a high school counsellor and how he was redirected to a career that matched his interests and skill. He was struggling with the theory content of an aeronautical course that he was taking concurrently between high school and VET and feeling that he was not in the right programme. He decided to share this frustration with a school counsellor, who asked him what he wanted to do. He explained that he wanted to do something engineering-related, so the counsellor offered the following advice:

> *"Maybe you should try machining. That's a good programme." So I went and I took the machining programme. And I fell in love with it*

and I could feel it's something I could relate to, it's hands on. And even then it was kind of move-at-your-own-pace type course.

These contrasting experiences with school counsellors illustrate the important role a counsellor can play in the development of skill in an individual worker by educating and directing individuals to programmes that are of interest to them and matching their skills and abilities. A3 thought it important to contextualise the discussion regarding exposure to trades within the historical structural changes of education in the State of Oklahoma. Her long experience of education in the state was valuable for situating the discussion, and she reflected on her personal experience of education in the 1950s and 1960s:

I'm not so sure we did ourselves a service when we took all of the trades out of every public school. When I was growing up we had carpentry, sheet metal all of those jobs. The kids at least got an alternative idea as to what is available to them out there and got them directed towards something they could actually make a living with. Today they are being denied that opportunity and I just don't know it was the right thing to do to create the VoTech system and consolidate as a result of cost.

Some of the state training provider participants were not aware of this change. Others who also work in the system strongly agreed with A3's assessment. A1, who was in agreement with A3's reflection on the history of Oklahoma education system, added that when VET was established 30 years previously as a separate entity, this took it out of K-12 school. A1 has a rich 40-year career working in state training providers that prepare youths and adults for employment. A1's observation centred on his personal experience of attending high school in Oklahoma in the 1950s, when he and many of his friends took trade classes. He thought the education system was better when trades were taught in the K-12 schools. Commonly known trade classes include: welding, machining and carpentry. He felt that students were exposed to more career options earlier on in their schooling when they undertook practical coursework, commenting:

The fact that they were enrolled in there doesn't mean that they necessarily ended up in that trade, but they were exposed to more careers, I think, and more work, at least working with their hands.

It is important to note that the State of Oklahoma is one of the few that follows this model of having a separate VET system. Most states have a system where

trade skill education is imbedded within high schools. The removal of VET from K-12 could be seen as evidence of a lack of parity of esteem between HE and VET, as the focus of K-12 education is on college preparation, rather than on vocational preparation.

The manufacturing managers felt that they were failing as businesses by not offering a clear skill and career path progression for their workforce. They saw that funding was often provided by an employer for subsidising degrees. But M6's observation indicates that he does not think anyone is driving career progression for non-degreed workers. He commented on his personal experience of offering advice to individuals that want to progress in their skill development:

> *I have a sense over the years and I have talked to someone who has tried to get ahead and popped into my office and said I would like to do this, this and this. I have said you will need these kinds of skills. They don't know where to go and get them. Most people aren't driving this.*

In response to M6, M3 commented that he needed to show them '*that career progression*'. In further elaboration of these comments, M1 added:

> *Career progression, right, and at the same time you're going to need these skills and here's where you can go get them.*

M6, reflecting on his experience of managing a manufacturing operation, observed that when '*you lay out the career path, they will go there*'. He stressed that it is the motivated workers displaying 'initiative' that will take advantage of the career succession plan within industry. However, most manufacturers were not aware of how to offer career progression opportunities to their workforce and the seasoned managers in the group were not adopting this practice. M5's account very clearly illustrates the frustration with what he describes as a '*mismatch*' between opportunities available and the need for a pipeline of workers educated with the skills needed by industry. He goes on to question, as M4 had done previously, whether it is hard for students to find open opportunities in education matched to a career path, or '*rungs*', as M5 calls them.

> *There is a mismatch between opportunities available in the state with industry and what opportunities are available vocationally. You may be able to get educated in one rung but that doesn't necessarily wind up being where the jobs are in the state. That is one piece of it and also not a lot of great ways for students to understand what the opportunities are.*

Continuing this discussion, the participants went on to list what they saw as the reasons for the lack of career knowledge and focus. A1 spoke of the restricted focus of the state's education over the previous 20 years:

> *The only opportunity for young people is a college focus, they have not identified the required trades that you don't need a degree for.*

As a nation, the US has pushed the college agenda and service industry agenda. This has contributed to fewer people going into technical trades and subsequently manufacturing (Balfanz et al., 2013). As A3 commented, *'It's all about the numbers and pushing kids to college'*. She continued her point, adding:

> *I think we have got to change the attitude of everyone. You are worthless unless you go to college. I think that has to change immediately. That goes back to our leadership as they continue to push this. When you go to events with the governor, what do they talk about? Higher education. Do they mention the trades? No.*

The findings also point to the fact that manufacturers are noticing a growing mismatch between the programmes offered by VET and HE and the specific career needs of industry. This mismatch shows a disconnect between VET and HE in the in the participants; areas (some exceptions were noted) and their programme planning. The participants felt this planning should be guided by industry needs and by future jobs and skills. Contrasting with these perspectives, A3 argued that the problem is due to industry being:

> *so busy with their day to day operation they don't have a realisation of how important it is to get involved in the educational system.*

She balanced this point by noting from her experience that it is also:

> *…hard for a lot of the education. If we don't have the input from industry then they develop education programmes not meeting industry needs.*

Given the speed of change in industry and the difficulty for industry to align with the skill needed to adjust to these changes, the manufacturing managers pointed out that the state's educators within their regional area were insufficiently prepared (both in VET and HE) to train students in the required skills and pass them through the system. As M3 commented:

> *The educators could easily say: "You have to toe the line here and you have to pass the test in order to progress." The students get moved forward continuously.*

It was also observed that a gap exists between CVET or as it is referred to in Oklahoma, Business and Industry Division and manufacturers in working towards the common goal of developing a workforce equipped with the right skills. The participants in the study included individuals with experience of working in both arenas: as providers of skill and also as decision makers trying to acquire the necessary skills for their workforce. M5, a manufacturing manager, illustrated in his narrative an example of recently graduated engineers who he has employed:

> *I find that at all different levels, when they come out of school, we will spend a good year trying to teach engineers how to apply what they have learned. Right down the line.*

It was suggested that the cause could be that education is too siloed, and given the funding system, every educational structure is competing with the others, instead of working together. To counteract these mismatches and siloing, it was suggested that sitting on education advisory committees would be a good way to align industry with education.

The educational goal of HCT is to produce a 'product' (Becker, 1993; Keep et al., 2016), and that product is a skilled worker. This theory explains why the participants' would presume that since HE is not graduating students with the right skills and giving them the job skill sets needed by industry, Oklahoma's education system is falling short in offering clear career paths. It was also

perceived by the participants that, once employed, individual workers do not consistently see a progression in their skill development tied to their career.

5.3 Challenges in developing skill

5.3.1 'Unwilling to take the risk' of skill development

The production workers and state training providers cited the costs of training as factors that prevent manufacturers from developing skill in their workers. However, a reluctance to pay for training was not found to be a salient point emerging from the manufacturing managers' discussion on responsibility for skill development. W6 reflected upon what he perceived as a constraint of skill development:

> *It's a positive if you're structured enough and can get it done in the company. The majority of people in my department need training but trying to balance the workload with the training and the amount of time it takes to train is the negative aspect of it.*

The cost of investing funds in skill development was connected to the risks and benefits that could be gained from investing elsewhere. For instance, the benefits of investing in new equipment were seen as greater than those accruing to investments in the skill development of individual workers. Having observed manufacturers, A6 commented:

> *I think usually the companies have the funds, but they're limited and unwilling to take the risk of putting it into training when there's other pieces of equipment they may need or whatever.*

A5 expanded on A6's observation, adding that this reluctance to spend money on developing skills depends on the size of the employer:

> *There is a cost to it and it depends on the size of the employer and the cost. It's hard to quantify how much they are losing.*

In agreement with A5, A2 developed this theme further, commenting that it is not that a manufacturer does not understand the decisions they are making in regard to skill development and adjusting production schedules. For A5, his experience showed that leaderships held differing opinions on how to manage their resources. He summarised the problem as being:

> *…the lack of desire to pull people off the line to take care of anything that is required apart from by regulation.*

In their discussion, the state training provider participant group stated that industry was not willing to invest in skill development that has a particular emphasis on training as this would require taking individual workers out of the production environment. A6 cited comments heard from workers following their experiences of training and the feedback manufacturers received from individual workers when attending training courses:

> *I didn't get anything out of it and now the employer is ticked. That is way worse. As good training can be you have to show the employer what the outcome of that training will be. There has to be something they can walk away with.*

A6 noted that if manufacturers see no immediate benefits, management will not invest in time or money for skill development. However, he did offer a solution:

> *quantify the outcomes with a focus on return on investment (ROI), and/or hold a conversation on how it will benefit the manufacturer.*

A3, who had many years of experience training and developing the skill of her own staff, saw as a main obstacle to skill development the inability of manufacturers to engage in skill development. She also notes that they would only do it when they saw that it benefitted them, and, even then, by investing in just a couple of employees who A3 describes as '*proven*' employees. As A3 observed:

> *Unless they have an employee and they want to upgrade a skill and send them to some sort of school because the employee is a good employee and we need for that employee to do more. They might pull someone off to get specialised training, to get that done. That is a proven employee.*

The participants' perspectives regarding the risks associated with industry investing in training show a correlation with the findings of Muehlemann & Wolter (2011) and Grugulis, Holmes & Mayhew (2017), who concluded that production is preferred over skill development in the manufacturing sector. Interestingly, the state training providers believed that manufacturers know exactly what they are doing when they prioritise production schedules over skill

development. Moreover, when they are more aware of how skill development benefits their operation, they are more likely to adjust production schedules accordingly. These are the comments of advisors to industry – not of the manufacturing managers themselves. In the one-on-one interview with M5, I probed him about manufacturers not stopping production for training. His response suggested that the manufacturing organisation was lacking when it came to providing a clear skills structure and having the necessary capacity. He stated:

> *It's the capacity of the manufacturing team as well. I mean, I don't know that we have enough margin anywhere for anybody to really do that… just because we're so busy getting the product out.*

5.3.2 Automation impact – 'flexible and adaptable'

One salient and recurring theme within the focus group discussions related to the skills development needed so that manufacturing could adapt to changing technology. It is evident from the findings that they perceived that the skills needed by manufacturing are changing in response to the automation advances of Industry 4.0 (Autor et al., 1998; Hermann et al., 2016; Krzywdzinski, 2017; Brynjolfsson and McAfee, 2018; Bughin et al., 2018). In their discussions, there was a greater sense of urgency among the state training providers and manufacturing managers regarding the changing skills and the unpreparedness of the state and industry to address those changes.

The impact of automation on the skills needed by the workforce was a key focus in the focus group discussions of the challenges to skill development. M4's stressed his concern for the future workforce as regards this automation transformation:

> *The skill is different than anything, I believe, that we've ever talked about before. It's easy to talk about math and being punctual, life skills and some of those fundamental academic skills. But yeah, when you think about the automation that will be running the processes of tomorrow, that's pretty unbelievable…it makes me concerned for people who haven't spent some time working on growing those skills.*

Although M4 is concerned for the future of the workforce, he lays responsibility for developing the skill needed to facilitate automation on the shoulders of the individual worker who needs to '*grow their skills*'. He also believes that automation is the US's answer to its labour supply issues. He adds:

> *Unfortunately, the pace of voluntary turnover is so great across America that you don't really have to worry about laying people off. All you do is you put in automation, you move people to other roles, and you let attrition right-size the size of your staff.*

In the manufacturing managers' focus group, when talking about the challenges they face, M5 commented that it was hard to get away from being fairly people-dependent. This means, he concludes, that they will have to get their people to be more '*flexible and adaptable*'. A contrasting experience was described by M5 of how his manufacturing operation is adapting to digital technologies and automation. In the one-on-one interview with M5, a VP of manufacturing, I probed his comment further and asked him to expand on what he meant by '*flexible and adaptable*'. M5 explained that the context for his comment was his team's experimentation with introducing automation in the form of robotics to their manufacturing operation. When it came to the skill needed within his workforce, he commented:

> *I think a lot of what we have now is kind of home-grown. But that's an area where we did a good job. And we sort of created that margin by pulling people around and saying, "This is your job now. We're going to give you opportunities to learn."*

M5 did note in the one-on-one interview that when it comes to automation and the introduction of other smart technology within manufacturing, many workers '*really struggle*' with change, adding:

> *Our machinists I think in a lot of cases really struggle with seeing new things maybe as more of a threat rather than something to welcome and learn from…it could be partly how the whole idea was presented initially.*

He reflected that part of the transition problems could be down to how management presented the changes to workers.

The findings from this study on automation point to the need for organisations and individuals to be *'flexible and adaptable'*. This suggests that as robots, cobots and other technology are implemented in the manufacturing operation, the manufacturer must strategically create an environment in which individual workers can learn the new technology. Indeed, M5 reflected on his experience when his manufacturing company invested in robots and cobots and gave a few individual workers the opportunity to teach themselves how to adapt this new technology to their operation and learn the necessary skills not only to operate but also to service the new technology. M5's solution was *'home-grown'* skill development, or, what is often referred to as "informal learning". He created the environment, provided the tools, and left the experimental team to the task of adapting and growing their own skill to learn how to run and maintain an autonomous operation. With this strategic approach, the business was making a financial investment in its workers' skill development.

The manufacturing managers in the study expressed their 'concern' for the workforce and the skills that would be needed in future manufacturing operations. In their narratives, there was the clear indication that their 'concern' was with workers who had not learned the new skills for automation, not with their responsibility to create opportunities for the workforce to learn these new skills.

W6 expressed his personal belief that skill development was the individual's responsibility, particularly when it came to new automation technologies:

> *So as new technology comes out they should want to have that knowledge and they should reach out to get that knowledge for themselves. Robotic welders can weld at twice the speed that a human person can weld but a human person still has to set it up.*

Recognising how the automating of welding is going to impact his trade, W6 stresses again his belief that it is up to the individual worker to take responsibility for their skill development and show the attitude: *'I'll learn that so that I can set that robotic welder up'*. Therefore, the managers felt that it was the individual worker who should bear the responsibility for developing the skills of the future to work with and alongside automation. This belief was echoed by the other two participant groups. The production workers placed all

of the responsibility on the shoulders of the individual workers to respond to automation technology. As W6 commented, they should 'reach out to get that knowledge themselves'. Hence he and his peers see themselves as responsible for acquiring the skills needed to adapt to automation within their manufacturing facility. This comment reflects HCT's view that workers pursue knowledge for their own capital (Schultz 1961; Becker, 1976).

Concern was also shared by the state training providers regarding the types of skills that would be needed by the workforce to transition to automation within a manufacturing operation. A5 commented:

> *When you get to the futuristic point everything changes, right? You don't get the person running the machine, you get a person programming the machine.*

All the state training providers in their focus group agreed by acknowledging, 'so then the skill changes'. Although they fell short in expanding on defining these skills, it could be interpreted that a high-skill level will be needed in order to program and maintain the machines (robots). This aligns with the discussion on automation and skills in the literature where an increase of automation and robotics requires new jobs with higher skills (Elliott, 2017; Krzywdzinski, 2017; Ra et al., 2019; Rumsey et al., 2019).

5.3.3 Accessibility to skill development

In the focus groups discussions of who is responsible for skill development and the role of industry, the findings centred on the opportunity for skill development, and specifically on who creates opportunities to learn a new skill, who communicates it, and who 'seizes' it? In the production workers' focus group, W6's comments reflected his belief that:

> *The employer is responsible for creating the opportunity and the individual is responsible for seizing the opportunity.*

A6, the youngest participant, agreed that the employer should create the opportunity for the workforce to learn new skills; but he goes further, stressing that this opportunity should only be extended to the '*good employee'* with potential:

> *The company should accept the responsibility of identifying those great ones and growing them, providing opportunities, paying them for further education, motivating them to do better and to do more.*

In response to A6's comment, there was a certain degree of disagreement with his direction; but it could be observed that here there may have been a generational divide or differing management approaches regarding where responsibility is assigned to create opportunity for skill development in the workplace. As A5 commented:

> *If you have a guy running a machining centre, that is all you need. Unless you want to go train him supervisory training and all that. But typically I have seen companies work around that, we offer all of that stuff after hours and we pay for it. They do it on their own time. It had to be a shared sacrifice. That is very common with larger companies.*

A5's comments indicate a belief that the employer should pay for the skill development needed within their operation, but it should be done after normal production hours and during the individual workers' unpaid time.

M5, referring to the opportunity that a manufacturer creates for skill development, notes that it is a more difficult investment to make compared to purchasing manufacturing equipment. He explained that a company can find it complicated to understand how to create and put into place a system to grow the necessary skills:

> *The people development was probably, I mean, organisationally, the harder investment to make. So we've got a good track record of doing that there. I'm not sure we have a plan for continually developing people in those skill sets. I mean, I guess my sense is that we're hoping that maybe that just sort of happens somewhat organically, which is probably not a good strategy.*

The data from the production workers' focus group indicate that they felt responsibility for creating opportunities for skill development lay with the employer, and that only the good companies invest in their workers. W1, drawing on his personal experience of having worked for several manufacturers around the US, stated:

> *A good company is going to invest within its employees. Because it's going to bring out the best of their employees and that's what's going to make them successful.*

W5 built on W1's comments, stressing that the opportunities created by the employer should centre on the employees' skill sets, so that the gaps in their learning could be identified and bridged.

> *I think it should be the company's responsibility to identify the areas where they need the stronger skill sets and put programmes in place to develop their employees. I think even if you have gone to technical school or college the real life hands on stuff isn't there and it's the company's job is to identify those and put stuff in place to help.*

It was evident in the transcripts that all the participants had an opinion on the role of industry in creating opportunity for skill development. They saw the need for companies to understand how to communicate that opportunity to their workers. In section 4.4.1., M6 argued that simply 'sticking' or placing information about opportunities to develop skill out in the open for employees to look at would result in those that want it (or the motivated few) gravitating towards it. What this suggests is that M6 was not taking responsibility as a manager, but placing the responsibility on the individual worker. In contrast to M6's view, M4, the seasoned human resource professional, stressed that it is the organisation's responsibility to communicate the opportunities to individual workers, and illustrated in his narrative how he communicates opportunities at his manufacturing operation:

> *What we do is we try to show them what's possible here, and that either feels good to them or it doesn't. If it doesn't, they need to go find out what's possible elsewhere. But what's possible here in terms of the various types of roles that you can get into and what are the skillsets that are utilised in those roles.*

M4's reflections suggest a view that if there are no suitable opportunities for skill development, the individual worker should move on to another job or company. M4 went further, expressing what he believed was a weakness organisationally in his process of communicating opportunity for skill development at his manufacturing operation:

> *If we had a better relationship with education, I think that would just open up people's minds.*

He believed that industry needs to have better relationships with education as that would open up people's minds to what options are out there to assist manufacturers in skill development. A further finding that emerged in the manufacturing management focus group is related to the idea of incentivising the opportunity to learn. The participants acknowledged that their organisations were often neglectful of current employees. As A1 observed at his own manufacturing facility:

> *I mean, they often want to incentivise someone new. And they talk about bringing in new folks. But they don't seem to want to ensure that the ones that are here can remain successful.*

W2 shared an example of a manufacturer who encouraged all of its workers to go to school for any skill development. This owner incentivised learning by refunding 100 percent of the tuition costs if you the workers obtained an 'A' grade in their class. He described how this experience and the comments of the company owner had stuck with him throughout his career:

> *One of the owners came out at a team meeting and said you're walking away from free money we are giving you an education and if something ever happens you are taking that education with you.*

W2 illustrates an example of a manufacturer who saw it as his responsibility to educate his workforce for the future and to give them options. If his manufacturing business ceased to operate, they would still have skills and credentials to transfer to another job.

5.4 Chapter summary

This Chapter has presented the participants' data from focus groups and one-on-one interviews in support of the research questions of this study. Using the theoretical lens of human capital theory and the lifelong learning approach, the data was analysed to comprehend how the three key actors (state training providers, manufacturing management, and production workers) understand skill within the context of Oklahoma manufacturing.

The participants were in agreement that Oklahoma's education structure was a contributing factor to the current skills shortage in the manufacturing industry. Both the manufacturing managers and the state training providers focused on how the separation of VET from K-12 had led to less focus on vocational trades and more focus on college. This in turn generated a lack of parity of esteem in how career options are presented to students. The participants felt strongly that this lack of parity was a wrong move as it had led to fewer people going into manufacturing and other trades. M4 does share his strategic plan of reaching out to education partners to address his skills problem. The manufacturing managers suggested that since all branches of education are chasing the same state funding, they do not work together to address skills issues within the state. The manufacturing managers and production workers emphasised this lack of structure in regard to skill development, as well as the absence of a career ladder linked to a skill matrix in manufacturing operations. According to the production workers, their experience showed that while a skills matrix existed for workers on a college track, it was lacking for lower-skilled positions, who had no clear path to skill and career progression.

Moving on to the challenges in developing skill, the core findings from the participants' contributions emerged from the manufacturers' comments, specifically those managers who were unwilling to take what they perceived as a risk to permit their workers time away from production for skill development. In addition, it was acknowledged that automation will impact the skill needs of the workforce with a need for the worker to be '*flexible and adaptable'* to automation. A shift to a need for high-skills in the workforce was needed if a manufacturer was to implement automation to its operation.

5.5 Discussion

Human capital theory (HCT) is founded on the belief that the individual's acquisition of skill increases their capital as a worker, thereby endowing them with increased worth to themselves. Most of the study's manufacturing managers considered the individual workers to be the ones responsible for and in control of their learning and subsequent skill development in relation to new technology. This prevailing view is evidence of the hold that neoliberal ideas have on the community and work practices. An HCT approach to skill

development encourages the individual worker to be responsive to their efforts to make them productive. Since the State of Oklahoma does not intervene to provide skill development in the core areas related to smart technologies, this suggests that the state does not see a current dysfunction that would compel them to fund skill development in automation. However, key policy and industry reports (Deloitte, 2018; Prudential, 2018) predict there will be a skill disruption for automation. All the state training providers in their focus group agreed by acknowledging that when smart technologies are introduced '*so then the skill changes*'. Although they did not expand to define these skills, it could be interpreted that a high-skill level will be needed in order to program and maintain the machines (robots). This aligns with the discussion on automation and skills in the literature where an increase of automation and robotics requires new jobs with higher skills (Elliott, 2017; Krzywdzinski, 2017; Ra et al., 2019; Rumsey et al., 2019). Human capital theory is a 'central guiding principle of economic thought and management' (Harvey, 2007, p.2) and permeates the business culture in Oklahoma. The findings in this study from the production workers, many of whom are lower-paid employees, indicate their immersion within human capital theory and lifelong learning in a neoliberal society. This finding is also an extension of an LLL approach. Each individual felt they had no worth to the organisation unless they learned how to use the new technology. A6, when commenting about manufacturing workers he interacts with, states, they should '*reach out to get that knowledge themselves'*. This statement implies that A6 sees those workers who do not obtain the desired knowledge (specifically regarding automation) are less valuable to their employers. These findings resonate with Grace and Rocco's (2009) assessment of the dangers of LLL under neoliberalism (see section 2.6) where the pursuit of learning can lead to the loss of freedom for the individual worker.

The findings from this study echoed those from Muehlemann & Wolter's (2011) and Grugulis, Holmes & Mayhew's (2017) research into productivity and skill, and showed similar concerns relating to cost and ROI. In particular, they highlighted the fact that if a manager could not clearly see any benefit to the operation, he would not stop production for skill development. In regard to the impact of automation and other digital technologies, the production workers claim that they as individuals are responsible for learning any new technology.

In both Chapter 4, Findings and in this chapter from W6, it can be shown that production workers' views regarding their personal responsibility for skill development firmly illustrate the effect of human capital theory and lifelong learning. Faure et al., (1972) state that individual workers have to continually build up their body of knowledge through their life course, and will never be a 'complete man' (Faure et al., 1972, p.vi).

What the findings seems to suggest is that from some study participants there are the embryonic beginnings of recognition of the need for a concerted approach to skill formation and delivery, similar to some of the central elements of a skill ecosystem. For example, we see these beginnings in the findings of M4, a manufacturing manager. His sharing of his frustrations with trying to form partnerships with education providers illustrates that the current system shaped by a HCT and LLL approach isn't working. M4 discovered that as he started to make relationships with different levels of education, VET and HE, none of them were interested in working together with him to address his workers skill development needs. His recognition that partnerships with stakeholders in education are necessary for the development of the required skills needed in his workforce demonstrates his valuation of collaboration or business engagement with education. M4, seeking to partner with the education structure to shape the current and future skills of the manufacturing workforce, acknowledges that the current system is dysfunctional and is a nod to the desire to form strategic partnerships. This collaboration between education and industry is a key feature of a skill ecosystem approach (Hall & Lansbury, 2006; Buchanan et al, 2017). These strategic partnerships are features of skill ecosystems as have been seen in Australia (Payne, 2008) and more recently in Indian manufacturing where skill ecosystems are being implemented to enable the integration on automation (Chenoy et al., 2017).

Another example of the beginnings of an embryonic recognition of the value a skills ecosystem would bring is A6's suggestion of holding a conversation between state training providers and manufacturers on how training can benefit their operation. In addition, M5's acknowledged that he believes that his manufacturing team may not have enough *'margin'* to stop production to train but his remarks also indicated the possibility that

he would seek help from other stakeholders when planning his skill structure. If M5 were to seek help from organisations outside of his company, such an action would provide the conditions in which a skill ecosystem could benefit his operation.

In this chapter it has been shown that several managers believe the members of their workforce are responsible for taking up opportunities for developing their own knowledge of specific skills when they are presented. It has also been shown that workers and managers are already surmising the potential benefits that strategic partnerships between employers and educators, features of a skills ecosystem, could have on improving the development of skills for manufacturing.

Chapter 6 – Discussion

6.1 Introduction

In this Chapter, I address my research question: How does one group of (state training providers, manufacturing managers, and manufacturing production workers in Oklahoma understand skill as a concept within Oklahoma manufacturing. I attempt to answer the question by analysing the findings presented in Chapters Four and Five. The five main themes that emerged from those findings are: the influence of one's environment in developing skill; the shift in manufacturing from technical skills to employability skill; creating, communicating and 'seizing' opportunities to learn new skills; parity of esteem; and challenges to developing skill. These themes will be analysed in terms of their relation to this study's four main research questions.

Section 6.2 presents an analysis of the findings regarding the participants' understandings of the concept of skill, with a particular focus on the impact of a worker's environment on this understanding. Section 6.3 addresses the participants' perspectives on employability skills. This is followed in section 6.4 by a discussion of initiative, which the participants considered to be the most important employability skill. In section 6.5, I analyse the findings regarding the participant views about workplace learning opportunities that are centred on informal and formal learning and the practical application of theoretical knowledge in manufacturing contexts (manufacturing theory). This is followed, in section 6.6, by a discussion of education structures and bias, which form the parity of esteem within Oklahoma. One of the challenges to developing skill in manufacturing stems from managers often prioritising production over skill development, as well as from the impact of automation on manufacturing. These perspectives are discussed in section 6.7. The Chapter closes with a summary of how the five themes in the findings address the four main research questions.

The findings are critically analysed through the theoretical lens of human capital theory, lifelong learning and the skills ecosystem approach and then located in the literature (Chapter Two). The final Chapter of this dissertation will present the study's conclusions, limitations, professional implications and recommendations.

6.2 Understanding the concept of skill

The first question that this study addresses is how does one group of state training providers, manufacturing managers, and manufacturing workers in Oklahoma understand skill. The participants indicated that those involved in the manufacturing industry primarily understand skill as a group of abilities that contribute to a worker's productivity on the job; moreover, they view those skills as being influenced by a nurturing environment during childhood and the place of work. The participants generally viewed skill in terms of what employers want their employees to be able to do while they are carrying out their occupational responsibilities.

The findings related to the manufacturing managers' and production workers' perspectives clearly indicated that the nurturing relationships in an individual's life, starting during childhood and continuing through their life course to the workplace, play a crucial role in their understanding of skill. M6 stated that the environment in which an individual grows up is '*fundamental*' for an individual's growth and development. He believed that the influence of a person's environment on skill was the foundation for his own understanding of how skill is acquired.

People who nurture others provide opportunities and experiences for the individuals to learn. It is through these experiences that an individual grows in self-awareness and discovers where their potential talents lie. M5, a manufacturing manager, believed that nurturing relationships in the workplace was important. He felt that he displayed discernment by creating the environment and the time for an individual to learn. M5's conviction that nurturing managers are '*… going to be looking for opportunities to help them get better'* aligns with the belief that, as a manager, he needs to create a nurturing environment for skill development. Nurturing managers make themselves accessible to the individual worker, adequately communicate the opportunities for a worker to learn a new skill, and even create a plan of skill development. M5's understanding of skill contrasts with Grugulis & Stoyanova's (2011) claim that management practices do not offer opportunities for skill development. Clearly M5's understanding is that he has the responsibility to develop skill for his workers by creating a nurturing environment in which he is

able to provide training. M5's comment indicates that he would likely benefit from a skills ecosystem approach to his dilemma because it would allow him to work outside of the confines of current management practices. Key features of a skills ecosystem approach would assist him in creating skill development opportunities through the cooperation of state training providers and other stakeholders (Buchanan et al., 2017).

6.3 Employability skills

Since the participants tended to think of skills as a group of abilities that employers are seeking, it was important to identify which abilities were considered to be most crucial for the manufacturing workforce to have. This issue relates to the second question of this study, namely: "From the perspectives of this study's participants, what skills are perceived as necessary in Oklahoma's manufacturing workforce?" Among the skills that were mentioned, two themes in particular received a lot of attention. The first theme is what the participants generally referred to as 'employability skills'; these skills were discussed in contrast to what the participants called 'technical/trade skills'. The second theme that received attention revolved around the concept of initiative, which will be addressed in section 6.4.

The participants' discussions of skill indicate that they feel the most important skills in manufacturing for an individual worker to have are employability skills. Employability skills were viewed as important by all three participant groups (state training providers, manufacturing management, and production workers). 'Employability' is the focus of a current conversation within US industry and education. With a low unemployment rate – 3.9 percent in the US and 3.2 percent in the State of Oklahoma (US Bureau of Labour Statistics, 2018), it is important that those who are hired are employable (Biesta, 2011; Cappelli, 2012). A low unemployment rate means that manufacturers have a smaller supply of candidates from whom to choose as workers; therefore, they are more focused on those with employability skills, as they believe they can teach them the required technical skills after they are hired.

'Soft skills' are defined by Hurrell et al. (2016) as non-technical skills. They are also often described as the skills necessary for improving 'worker attitudes and

flexibility' (Grugulis & Vincent, 2006, p. 598). The attention to soft skills as part of the employability skills discussion aligns with other research which concludes that soft skills are the most desired skills sought by employers (NACE, 2012; Collet et al., 2015; Hurrell, 2016; Humburg & van der Velden, 2017). Cunningham & Villasenor (2016) also note that whilst employers value all skill sets in their employees, the employability skills which are of greatest value to them are socio-emotional skills (p.126). In the three focus group discussions in this study, the participants described soft skills in various ways, using different language. The state training providers and production workers referred to soft skills as 'productivity skills' or 'living skills'. However, the manufacturing managers described soft skills as 'employability skills'. Payne (2017) discusses the new age of skill defining which has emerged. He categorises them as 'generic', 'transferable', 'basic', 'employability', 'soft', and 'social' skills (p.55). The participants' views that employability is a key aspect of the skills desired in workers supports Payne's conclusion that there has been a shift in how industry defines skill. The views of the participants in this study are consistent with those found by Payne (2017).

After closer examination of the participants' understandings of 'employability skills', it became apparent that there are several intriguing variances. First, major research and industry reports (Bieda, 2012; NACE, 2013) state that the major skill required by industry in their workforce is critical thinking. However, in this study, critical thinking was not mentioned by any of the participant groups directly as being a skill that should be required of individual workers. Instead, they referred to '*taking responsibility*', by which they meant the individual worker accepts responsibility for their actions. Elliott et al. (2017) and Payne (2017) state that the differences in defining the desirable skills of today's workforce parallel the diverse definitions of skills provided by economists, education psychologists and sociologists.

A second variance that sets this study's findings apart from others is that the participants focused quite a lot on a skill they called initiative, which they actually referred to as an ability within employability skills. This represents another major difference from the work of Grugulis et al. (2004), Little et al. (2006) and Hurrell (2016), who do not identify initiative as an employability

skill. The participants in this study placed great importance on initiative as a skill and this will be addressed further in section 6.4. A few participants' comments made it clear that they saw initiative as a key 'employability skill'. For example, during the state training providers' focus group, A2 said *'Of all of the skills we have on the board, initiative is the most important.'* The other participants concurred with A2. A3 went on to clarify this point further, stating: *'It's what employers are looking for in their workers.'* Additionally, the individual worker's initiative was referred to as a skill at another point of the discussions. In both the state training providers' and production workers' focus groups, the view was expressed that an individual worker needed to demonstrate a desire or motivation to learn a new skill. A6 explained that workers '*… have to want to develop the skills. They have to have a desire that they want to develop the skills.'* Another production worker also explained how personal motivation is an indication of initiative to learn. This view can be seen in W6's statement: '*I think it comes from within. If you want something you have to go get it … You have to want to learn what you need to be good at it.*' These examples show that initiative was understood by the participants as an employability skill.

The participants' comments also provide strong evidence that manufacturing employers want ready-made workers when they leave VET and HE, at least in terms of employability skills. A2, an advisor to industry, shared what he frequently heard from manufacturers: '*I can teach them how to do the job, I have a hard time showing them … teamwork, communication, and the ability to improve.*' Some participants gave the impression that they believed an employer wishes to hire a workforce that is employment-ready, possessing all the necessary knowledge and skills for employment. If these participants' assumptions about what employers actually desire are accurate, then these manufacturing employers' expectations of the workforce are not supported by an individualised LLL approach (Elder, 1994). But a skill ecosystem could provide a way forward for them by bringing together VET and industry in strategic partnerships focused on creating 'skills formation strategies' (Windsor & Alcorso, 2008, p.7). Focusing on developing networks between these stakeholders to identify real causes of skills problems and develop appropriate solutions for all stakeholders. Many LLL advocates argue that employees will

continue to learn about and develop employability skills even after they have begun their employment and through their life course (Faure et al., 1972; Coffield, 1999; Ball, 2009). In other words, there are no potential employees who already know and can demonstrate all the employability skills to be an effective employee. Rather, the workforce is comprised of employees who have some (maybe even many) employability skills, but they will grow to learn more employability skills as they carry out their jobs. The next section discusses the skill of initiative as it pertains to learning new skills.

6.4 The skill of initiative to learn new skills

The participants' proposal of initiative as a skill differs from other research on employability (Coffield, 1999; Little et al., 2006; Humburg & van der Velden, 2017). According to Coffield (1999), 'employability' is where 'the responsibility is passed to individuals to renew their skills regularly to ensure employability' (p.480). One of the views expressed by the participants in this research study is that manufacturers want to employ individuals who display the employability skill of initiative as they are more likely to look for ways to develop their skill.

When probing W5 to expand on his own personal initiative, he said, '*I just told myself I can do this, let me try to do this. I can do this let me help you out. Kind of developed and improved myself.*' W5's illustration of how he learned, involved a great deal of what he describes as '*…initiative, motivation and a little bit of pride or self-worth*'. The lenses of HCT and LLL can help to illuminate why W5 believes his initiative to learn is a valuable skill. W5 sees the responsibility for current and future skill development arising from the individual worker's own motivation to learn. Coffield (1999) suggests that this is problematic as there are many barriers that prevent an individual from learning and developing skill. While W5 was able to overcome many such barriers to learn what he wanted to learn, his statement is based on a contestable ~~false~~ premise because it may be unachievable for other workers faced with the particular demands of their work and life. He stayed at work unpaid and had the confidence to ask peers in other departments to teach him. These conditions are unlikely to be available for every worker.

Although the participants cited initiative as being the most desired skill in an individual worker, the manufacturing management participant group commented that in their experience, initiative is a skill only present in a small percentage of their workforce. M6 said he could '*count on one hand*' over his long career the number of workers he saw display initiative by taking '*the opportunity when [training] was offered and funded*'. W3 and M2 agreed that initiative is rarely seen. W3 associated the lack of initiative with '*millennials*', whom he described as a '*new generation of workers*' that feel '*entitled to work and to be given advancement*'. He thought it was up to the individual to display initiative and that it was a personal decision: '*You get what you want out of life by going for it.*' W3 offered even harsher comments regarding his younger colleagues' lack of initiative, describing them as '*sit[ting] on the couch and play[ing] Xbox or PlayStation*'. This view aligns with Becker's central premise of human capital theory. The members of all three of the focus groups, based on the contestable premises of HCT, saw individual workers as having full responsibility for 'their investment decision' in their own skills (Olssen, 2006, p.219).

When W3 expressed how he feels when a co-worker does not wish to learn new skills, he showed little empathy or understanding. Again, the contestable premises of the HCT/LLL theoretical framework do not help illuminate the complexities of these peer relations. The Capabilities Approach is helpful here in that it draws attention to the need for a wider skill set with a social dimension. Lanzi (2004), discussing Sen's capabilities, argues that individuals need more than 'job–oriented competencies and skills'; they also need 'life-skills and life-options in terms of being able to know, to do, to be and to live together in a social compact' (Lanzi, 2004, p.3) to create a mutually beneficial environment for skill development.

In addition, it is possible that the production workers' frustration with the lack of initiative displayed by their co-workers could have been exacerbated by an unfounded assumption of a lack of 'worker discretion'. Billett (2015) terms 'worker discretion' as the link between the opportunities for the individual worker to learn and their decision-making when 'seizing' that opportunity to learn. Billet compares his previous qualitative research on learning through work

with data from a large national Australian survey conducted by the Australian Programme for the International Assessment of Adult Competencies (PIAAC) (Billett, 2015, p.215). He concludes that 'worker discretion' is exercised every day through normal work activities, but 'this kind of activity is associated with individuals learning new knowledge and its monitoring, appraisal and further development' (2015, p.228). His analysis of various industry sectors showed that manufacturing had one of the lowest worker discretion levels (Billet, 2015). Billet's emphasis on 'worker discretion' is especially useful for the analysis in this study as it draws attention to a route for assisting workers in developing the employability skill of initiative.

In contrast to Billet's conclusion that individual workers exhibited increased discretion based on their education level, the participants in this study made no distinction between the initiative unskilled production workers are capable of displaying and what trained engineers could display. M2 commented on the lack of initiative he saw in his engineering students. He illustrated this with an example of students in their third year of a four-year programme. When he asked how many of them had toured a manufacturing facility, only two raised their hands out of a class of 30. Despite the fact that these students were in the process of getting a higher education in engineering, the majority of them did not show the level of initiative M2 desires in workers. These findings challenge those of Livingston's (2017) research, which concludes that less worker discretion to learn is apparent in working-class employees. Manufacturing is often described as an industry in which the majority of the workforce is 'low-skilled and 'blue collar' (Curran, 2010). Students pursuing HE degrees are not usually classified as working-class.

Sections 4.3.1, 4.3.2 and 4.4.2 findings show ~~the fact that~~ the participants described employability skills as 'productivity skills' and the 'initiative' to learn and points to the roles that US neoliberal culture and HCT play in shaping workers' understanding of skill. HCT has as its questionable premise the individual's responsibility for increasing their capital and worth (Schultz, 1961; Becker, 1964, 1976; Mincer, 1974) and the individual worker's capital is considered to be gained through the acquisition of skill. These participants' views also illustrates the questionable premise that skill is being defined

according to the needs of business rather than according to the needs of the individual worker so an economization of the skills discourse is taking place among these participants. The next section discusses the findings regarding workplace learning.

6.5 Workplace learning opportunities

The third question that this study aimed to address is: "What are the opportunities for and constraints to shaping skill for the manufacturing workforce according to the study's participants?" The particular opportunities for learning that the participants focused on were informal learning occasions and formal work-based experiences. As challenges to shaping skills, they specifically discussed the educational structures and bias in their area of the State of Oklahoma, management's prioritisation of meeting production goals over skill development, and the demands for new skills with the introduction of more automation. These opportunities and challenges will be discussed in the next three sub-sections.

6.5.1 Informal and formal learning

Researchers contend that most individual workers' skill is acquired informally in the workplace at his or her own discretion (Billet, 2015; Livingston, 2017). These trade skills or practical skills (Hager, 2004) are also developed informally in the home environment during childhood. This point aligns and gives credence to the continued recommendations by research, industry and education (Tynjälä, 2008; Keep & Mayhew, 2010) to increase work-based learning in the workplace. Eraut's (2011) research indicates that there is a preferred avenue of work-based learning in the form of apprenticeships. These include a nurturing component of manager and/or mentor involvement in the skill development throughout the learning process, whereby the worker is learning from others. A6 commented that the role of a manager is someone who can identify opportunities for skill development for their workers. He explained that a good manager should encourage learning by saying to workers, '*Hey, you're doing really well at this and maybe we should look at doing some additional training to help you grow the skill.'* A6 saw the manager's role as to nurture the individual worker and create opportunities for further growth. This aligns with the manufacturing manager's belief that the organisation, especially the manager, is responsible

for creating opportunities for skill development. Indeed, as M4 also noted: '*The employer is responsible for creating the opportunity.'* By '*opportunity*', he meant what was created within the organisation for skill development. For that opportunity to be 'seized' by the individual worker, it had to be communicated properly throughout the organisation so that they would be made aware of it and then be able to take advantage of it. These comments imply a belief held by the participants that when the three factors of creating, communicating and 'seizing' the opportunities to learn a new skill are present, a formal approach to learning occurs (Hager, 1998; Tynjälä, 2008).

These findings concur with those of Hager (2004) and Tynjälä (2008), who note that most skill is developed in the informal learning environment of the workplace. What this study shows is that while manufacturing managers and state training providers recognised the existence of informal learning, they also believed that, as manufacturers, they needed to do a better job of creating opportunities for skill development and communicating these to workers. The opportunities that they felt were lacking in their organisations require a more formal approach to skill development. So, while informal learning is the path by which most employability skills are developed, this study shows that there is still a desire among production workers for formal learning. The purpose of the next sub-section is to examine the practical application of theoretical knowledge in manufacturing contexts.

6.5.2 Practical application of manufacturing theory

The participants' views align with Wheelahan's (2010) belief that manufacturers wish to employ individuals with a foundation of manufacturing theory to be applied in manufacturing contexts. In the participants' narratives highlighted in section 4.3.1, they defined '*technical skills*' within their context of manufacturing in Oklahoma as the '*application of theoretical knowledge*'. This technical trade skill is more specifically defined as having a theoretical foundation of manufacturing knowledge and being able to apply that theory in the workplace. The practical application of theory was referred to as '*understanding how to do the work'*. The participants defined some of these applications as blueprint reading and geometric dimensioning and tolerance. According to all the participants, VET and HE students lacked theoretical

knowledge and the ability to apply it in practice, which they considered to be a skill. This point is illustrated by M6's comment: '*We will spend a good year trying to teach engineers how to apply what they have learned.*' M6's view is that students often lack the required manufacturing theoretical knowledge and application that is applicable to the '*real world of work*'.

Wheelahan (2010) discusses the role that theory and knowledge play in skill development. The findings of this study align with Wheelahan's research in two core areas that shape skill. First, she explains that as industry becomes more complex, there is a greater need for recent graduates and the current workforce to have a theoretical foundation. This theoretical knowledge helps the individual worker to develop manufacturing skill. It also helps them to have the ability to apply theory in a practical setting to solve production and operational problems. The apparent gap in the theoretical knowledge of manufacturing workers is a major reason why people's understanding of skill is being addressed by the participants in this study. M6 concluded that the lack of theoretical knowledge was reflected when production problems occurred and manufacturing workers had little theoretical knowledge to pull upon to address these problems. Second, the VET curriculum is weakened by containing little theoretical knowledge to support the individual's foundational manufacturing learning.

Young (2006) and Wheelahan (2010) mention the need for what they call the work-based practice of testing and growing theoretical knowledge. It is through work-based learning and testing that the individual becomes capable of putting into practice the theory which they have learned and can adapt and grow their skill to new manufacturing processes. As demonstrated in section 4.3.5, the comments made during the manufacturing managers' focus group align with Young (2006) and Wheelahan (2010). This is evident, for example, in M2's comments regarding the fact that his institution is '*growing apart from industry as the graduates are more research-focused and not as practical*'. M3, reflecting on her previous job as a trainer for a manufacturing company, also indicates this view when she lamented that she should have taken '*a couple of more steps*' and told graduates who were coming to work for them '*this is what you learnt and now this is how you apply it in what you are doing*'.

Hager (2004) and Tynjälä (2008) broadened this point further, proposing that there is little evidence that theoretical knowledge, amongst other skills, is transferred from education into the workforce. Eraut (2004) and Stenström (2006) support this view. Cunningham & Villasenor (2016) note that the learning outcomes of education show that students are not consistently taught the practical application of skills that labour markets need (p.103). This observation can be aligned with production worker A3's suggestion: *'you take the theory and apply it in a practical purpose'*. Furthermore, since the participants agreed that the practice of theoretical application was not in fact occurring, or that if it was occurring, it did not seem to be transferrable, it may be that industry is not offering the opportunity for students to develop the necessary theoretical application through work-based learning at their manufacturing facilities. It is worth highlighting that this option for the students was never mentioned by any of the participants in this study. This absence could align with research on apprenticeships - a work-based learning option. Lerman (2014) observes that, as an industry, manufacturing saw the least success in apprenticeships. The lack of opportunities for apprenticeships shows that manufacturers are reluctant to offer work-based learning options. And yet, the participants in Oklahoma manufacturing in this study recognised that in order to develop the skills that manufacturers desire in their workforce, students need an avenue for workplace application. Here is where the skills ecosystem approach is helpful. When M2 states, '*I know in the university we are growing apart from industry*', he is recognizing that a greater collaboration and interface in skill development between education and industry needs to occur. HCT and an LLL approach have not solved the concern for theoretical application, but a skills ecosystem approach would prioritize the collaboration between education and industry in order to address this concern (Payne, 2008; Windsor & Alcorso, 2008; Dalziel, 2015).

There is evidence that education, government and employers agree that industry has a problem with skill, and, in particular, with the supply of current and potential workers with the correct skills for the job (Cappelli, 2015). Moreover, the findings from the participants in this study indicate that employability skills and the application of theoretical knowledge are developed pre-employment.

6.6 Education structures and bias

Part of the confusion regarding the understanding of skill within the context of Oklahoma manufacturing is that manufacturers are unaware of how to create and communicate opportunities for skill development, either within the workplace or with local education partners. The findings pointed to the associated high costs and the lack of a clear education structure as the contributing factors that constrained the creation of opportunities for skill development for the manufacturing workforce. Analysis of M4's comments regarding his experiences of taking on a role of responsibility for his manufacturing workforce suggest his frustration and confusion regarding the complicated structure of education in the state. Reflecting on his own frustrated attempts to access help from educational institutions, he explained that the education divisions are 'siloed' and lamented: '*Why am I doing this? I mean, why do I feel like I have to do this? Why isn't someone chasing me, as opposed to me chasing them?*'

Manufacturers are approaching the partnerships with education for the skill development of their workforce as a consumer-driven process. This finding aligns with the neoliberal context of US business, as explained by Olssen et al. (2004, p.137). The authors argue that the state only intervenes in education when there are 'market distortions' or 'certain dysfunctions'. The findings here suggest that education is siloed in that the state does not currently acknowledge a dysfunction in its understanding of skill and the skill shortage experienced by manufacturers. Some authors argue that the weight of responsibility for skill development lies with the organisations and the individuals, who demonstrate a lack of knowledge of how to navigate the education system (Snell, 2018). The participant groups in this study indicated that even manufacturers are unaware of how to navigate the system. This illustrates the need for a clearer framework by which state resources are made available for advising and assisting manufacturers as they create and communicate opportunities to their employees for skill development. M4's sharing his experiences of 'fighting his way in' to form partnerships with education partners in the state as a solution to equip his workforce with the skills required for their jobs illustrates his frustration. This frustration shows that his workforce doesn't have the right skills and he saw it as a desperate measure to fight his way in with education

partners to find skill solutions. Unwittingly M4's actions of reaching out to education partners around the state seeking solutions to his skills problems demonstrates his behaviour as mirroring the beginnings of an embryonic approach of a skill ecosystem. Finegold (1999) discusses that four elements are necessary for the creation of skill ecosystem framework: 'a catalyst, host-environment, nourishment and a high degree of interdependence' (p.6). M4's experience of acknowledging a skills gap in his workforce could be interpreted as the 'catalyst' that drove him to seek partnership with education to solve his skills issues.

Connected to the structure of education in the State of Oklahoma is the perspective of the state training providers that more attention in the state is given to HE than to VET. A1, who has worked in manufacturing and education for 40 years, commented on the state government's focus on getting young people into HE and lamented, '*They have not identified the required trades that you don't need a degree for.*' This frustration with the focus on HE and the pursuit of college degrees over vocational qualifications was further developed by A3. Referring to how the state's educational leadership allocates funds, she decried: '*You are worthless unless you go to college.*' However, this lack of a parity of esteem between how the state perceives and funds HE and VET differently is indicative of a lack of alignment in the state's workforce and education plans. Henrich (2015) holds that it is a state's key priority to align workforce plans, as outlined in the state plan (WIOA, 2016), with 'regional economic development plans' (2015, p.15). For greater parity, the state's workforce plan should be aligned with the education plan that represents all education sectors, which in turn would reduce confusion (Gambin & Hogarth, 2017).

In section 2.5.1, where policy in the US was discussed, it was important to note that each state is responsible for the implementation of its own skill policy. It should also be noted that most funding for education comes from each state's budget. The state training providers in this study were frustrated with the state governing agents prioritising HE over VET. They believed that the state needs to better educate people on career paths into manufacturing that are non-degreed. Additional funding as explained in section 2.5.1 comes federally to the

state via the Workforce Innovation and Opportunity Act (WIOA) designated for disadvantaged and displaced workers and in response to the States workforce plan. These funds are not accessible to education. This disjointed system, as noted by Grugulis et al (2017), could be better aligned with the implantation of a skill ecosystem approach. A skills ecosystem approach would include a state's workforce and education plans to strategically coordinate by providing a bridge to industry and a cohesive plan for skill development.

I will now move on to address the findings related to the challenges to skill development: production over skill development and the impact of automation.

6.7 Challenges to skill development

Regarding the constraints (or what the participants called 'challenges') to manufacturing, the participants made several observations about what they believe occurs in the workplace that inhibits the development of workers' skills. Two particular challenges were discussed at length: 1) the fact that a company's desire for production goals to be met often takes priority over its desire to have workers develop their skills; and 2) the introduction of automation (or 'smart technology') to the production line and the new skills this technology would require from workers. These two challenges will be discussed in the following subsections.

6.7.1 Production over skill development

While analysing the participants' views about challenges to manufacturing, this section will also address the fourth major question of the study: Can Human Capital Theory and lifelong learning provide a framework with which to understand skill in Oklahoma manufacturing? In other words, is the participants' discussion of challenges better understood by viewing it through the theoretical frameworks of HCT and LLL? The framework will be used critically, alongside the skill ecosystem approach, to look at what the participants understand by skill and skill development and how their discussion can be more fully explained by theories of employability.

The perspectives of the state training providers regarding the risks associated with industry investing in training correlate with earlier findings from Grugulis

et al. (2017) and Muehlemann & Wolter (2011). These authors also found that production is preferred to skill development in manufacturing. A6 commented that manufacturing companies were '*unwilling to take the risk of putting [funds] into training*' when there were other costs to keep production going. A6 demonstrated an embryonic recognition of the need for a skill ecosystem when suggesting '*holding a conversation with manufacturers on how training can benefit their operation*'. As a state training provider representing education stakeholders in the state, his suggestion captures an emerging key feature of a skill ecosystem as discussed by Buchanan et al, (2017). Buchanan et al, (2017) discuss a 'new direction in skill planning' (p.7). In this new direction, key stakeholders are digging deeper to understand system problems. A6, in suggesting meeting with manufacturers to understand why they choose production over skill development, suggests the beginning of a skills ecosystem mindset. Here, the purpose is to work with the manufacturer to think strategically through planning for skill development within the daily structure of their manufacturing operation and by working in partnership with education providers to develop creative solutions to their skills problems.

This perspective even aligned with what one worker, W6, said when observing that in their company, it was difficult '*to balance the workload with the training and the amount of time it takes to train is the negative aspect*'. In other words, this worker perceived that manufacturers see the skill development of their workers as an impediment to meeting production goals. These reflections illustrate the connection that Olssen et al., (2004) discusses between economics and productivity within a business.

M5, one of the manufacturing managers, acknowledged that skill development is needed to increase productivity. However, though he openly agreed with that perspective, he explained that the reason why he does not allocate time at work for formal skill development training was '*because we're so busy getting the product out*'. In doing so, he was falling into the trap of allowing long-term productivity to be overridden by short-term production goals (Muehlemann & Wolter, 2011; Klosters, 2014). As Grugulis and Stoyanova (2006) state, 'performance is taken to mean productivity' (p.3). This point emphasizes the confusion and focus in industry on productivity over skill development. M5's

belief that employees benefit from skill development and that their skill development (if it was actually supported) would eventually help increase the company's productivity is aligned with both LLL and HCT, since both approaches recognise economic growth occurs with skill development (Schultz, 1961; Becker, 1964; Bowles & Gintis, 1975; Valiente, 2014). This finding illustrates that some manufacturing managers know that skills development can have a positive impact on productivity (Keep & Mayhew, 2010). M5's comment shows that some manufacturing managers are even aware that meeting short-term manufacturing production goals can have a negative impact on the skill development of workers. Most of the time, when manufacturing chooses to prioritise meeting short-term goals, this choice has a detrimental effect on the strategic long-term goal of skill development, and therefore also on the company's on-going productivity. At the same time, M5's acknowledgment that his manufacturing team may not have enough *'margin'* to stop production to train workers suggests he is potentially open to seeking help from other stakeholders, such as state training providers, when planning his skill structure. Again, if M5 were to seek help from sources outside his company, such an action provides the conditions in which a skill ecosystem could prove beneficial in ways HCT and an LLL approach have so far been unable to do so.

Several of the production workers suggested that skill development should be regulated so that it benefits the company. For instance, W6 accepted his employer's claim that they would pay for his education '*as long as your education benefits us*'. W5 also agreed, stating that the training '*has to benefit the company*'. As Gambin & Hogarth (2017) explain, human capital theory associates company workforce investment with the economic benefits for the company. The adaptation of lifelong learning as applied by Edwards (2007), McKinlay & Taylor (2014) and McKinlay & Pezet (2017) are also helpful lenses through which to view the findings. In the context of manufacturing, according to the production workers' reflections, it is appropriate for an employer to require an employee to work for a specific amount of time once they have invested in skill development. Doing so demonstrates the employees' willingness to be governed by the management of their organisation (McKinlay & Pezet, 2017).

6.7.2 Automation impact

The foundation of human capital theory (HCT) is the belief that the individual's acquisition of skill increases their capital as a worker and thereby provides them with increased worth (Becker, 1964). The findings showed that most of the manufacturing manager and the production worker participants in this study saw each individual worker as being responsible for controlling his or her own learning and subsequent skill development as it pertains to new technology, even if that skill development does not result in any personal benefit. W6's comments regarding automation reinforces the finding that initiative is a desired skill, as it pertains to learning. Referring to robotic welding, W6 argued: '*So as new technology comes out they should want to have that knowledge and they should reach out to get that knowledge for themselves.'* Recognising how automating welding is going to impact his trade, W6 stresses again his belief that it is up to the individual worker to take responsibility for their own skill development have the attitude of: '*I'll learn that so that I can set that robotic welder up*'.

The state training providers' acknowledgment that *'skill changes'* are required with the introduction of automation and their lack of understanding as to what skills will be needed to integrate automation within manufacturing presents a problem for education. The introduction of a skill ecosystem approach focused on high skills or Industry 4.0, as seen in India's manufacturing, offers a potential solution wherein private and public stakeholders work to establish a plan of integration that includes the required skill development plans for formation and delivery of skill (Chenoy et al, 2019).

This prevailing narrative is evidence of the hold of the neoliberal society, as described in section 2.6.1, on workers and work practices. A neoliberal approach to skill development encourages the individual worker to be responsive to employers' efforts to make them more productive. As the state (and, in many cases, the manufacturers themselves) are not intervening to provide skill development in the core areas around smart technologies, this indicates that Oklahoma does not see automation as bringing 'dysfunction' of the kind Olssen et al., (2004) suggests it will. Finegold & Soskice's (1998) original focus of a high-skill ecosystem would provide a strategic direction for

manufacturers, education and policy makers to create a plan of skill development and career paths around the integration of automation. This however contradicts the skill disruption predicted by key policy and industry reports (Deloitte, 2018; Prudential, 2018).

W6's comments are an indication that he felt he has no worth to the organisation unless he learned the new technology as a lifelong learner. This finding complements Biesta's (2006) observation: 'It seems that lifelong learning has increasingly become a duty for which individuals must take responsibility' (p.176). It also reinforces Grace and Rocco's (2009) assessment of the dangers of the lifelong learning approach, as advanced by Faure et al., (1972), Coffield (1999) and Ball (2009), that the pursuit of learning can lead to the loss of freedom for the individual worker. Coffield (1999) writes about the 'tyranny' of lifelong learning for the individual worker. W6's reflections on his personal responsibility to learn the skills necessary for robotic welding align with the research on the impact of automation on skills that high-level technical skills will be needed by workers in manufacturing (Autor et al., 1998; Frey & Osborne, 2013; Krzywdzinski, 2017; Brynjolfsson and McAfee, 2018).

The final section of this Chapter will summarise the discussion of the findings, while addressing the research questions that have guided the study.

6.8 Summary of the main findings

This Chapter has given an overview of this qualitative study's analysis of the five themes that arose from the findings in support of the research questions. This final section's purpose is to summarise the study's results while addressing the four research questions that have directed the study in relation to perspectives of skill in Oklahoma manufacturing.

6.8.1 Understanding of skill

This section summarises the findings discussed in Chapter Four that addressed Research Question 1: *How does one group of state training providers, manufacturing managers, and manufacturing workers in Oklahoma understand skill?* This question was concerned with investigating the meaning attached to

skill in Oklahoma manufacturing by the key actors of this study and whether they attached any shared meanings to their understanding of skill.

The findings of this study show that the keys actors associated with Oklahoma manufacturing understand skills primarily as it relates to job performance and the creation of a nurturing environment for skill development. The participants never gave a formal definition of skill, either during the group discussions or during the one-on-one interviews. The findings centred on the impact a worker's childhood and work environment plays in their understanding of skill. Skill was viewed as a group of abilities that an individual performs in the service of meeting industry's needs. The participants understood skill generically in terms of the behaviour needed to perform job-related tasks.

6.8.2 Skills needed in manufacturing

This section summarises the findings discussed in Chapters Four and Five that addressed Research Question 2: *From the perspectives of this study's participants what skills* are perceived as necessary in Oklahom*a's manufacturing workforce?* This research question sought to investigate what skills the key actors believed needed to be displayed by workers in manufacturing, and also to explore how they described those skills.

During the group discussions and one-on-one interviews, several types of skills were mentioned. However, the findings show that the participants zeroed in on three skills that they saw were crucial at this time for manufacturing in Oklahoma. The most important skill was not a single skill but rather a group that fell under the umbrella term: 'employability skills'. The participants included under that term skills that have also been labelled 'soft skills' by researchers These skills are not 'technical' or 'trade' skills (Grugulis et al., 2004; Little et al., 2006; Hurrell, 2016). By 'soft skills', the participants had in mind skills such as taking responsibility, teamwork, and communication. Although some researchers argue that a soft skill, employers are looking for today in the workforce is critical thinking, this particular skill was never mentioned by the participants. In addition, the literature and the findings both indicate that these employability skills are not consistently developed in new graduates (Cappelli, 2012; Wheelahan & Moodie, 2017).

A second skill that was singled out in the findings is the employability skill of showing initiative. While initiative is not often thought of by researchers as a particular skill, the participants in this study discussed it as if it were a specific skill that a person learns that can then be exercised on the job. The participants believed that manufacturers in Oklahoma desired workers who showed they could take the initiative themselves to learn what they need to learn in order to become more effective/productive workers. The manufacturing managers and production workers in this study frequently lamented that many workers do not take enough initiative to learn the skills that would advance them in their careers.

Lastly, it was clear from the findings that both the manufacturing manager and the production worker participants saw a need for workers in manufacturing to have a fundamental theoretical knowledge that is acquired formally in HE or VET. A manufacturing theoretical foundation was seen as a valuable skill that enables a worker to both understand production processes and also solve manufacturing problems as they arise in the day-to-day production operation. The participants understood that manufacturing theoretical foundation skill was primarily obtained through formal education. This skill has historically been expected for employability; however, the participants believed that workers best learn to apply the theoretical foundation in a workplace learning environment. The managers were confident they could teach workers the specific technical and trade skills necessary for production operations, but they still wished to employ workers who have a basic understanding of the foundational theories of manufacturing.

6.8.3 Challenges to and opportunities for shaping skill for manufacturing

This section summarises the findings discussed in Chapter Five that addressed Research Question 3: *What are the opportunities for and constraints to shaping skill for the manufacturing workforce according to the study's participants?* The concern of this question was to pursue the participants' understanding of where and how workers could obtain the skills employers desired, and what, if any, impediments existed to prevent the development of those skills. This section will discuss the constraints represented by production and automation, which

the participants saw as ‘challenges’, and the opportunities that work-based learning can provide for skill development for Oklahoma manufacturing.

From the study, it was evident that taking workers out of production for training is seen as a risk, as it may lead to the operation for which the manager is responsible not meeting its production goals. Human resources or other company leaders may wish for their individual workers to learn and they might create the opportunities to learn, but if these opportunities are not communicated and time for this development to occur is not built into the manufacturing production schedules, learning often does not take place (Lerman, 2014). This study has demonstrated that when a manager is learner-focused, they champion learning by creating the environment and communicating the opportunity to learn. One participant even noted approvingly that they had heard a learner-focused manager tell another worker about the benefit of taking opportunities to learn skills because acquiring specific skills would be valued by other employers if something ever happened that caused the employee to lose their job. Their approval of what they heard the manager say indicates an embryonic support for a skills ecosystem approach in which skills are developed regionally even if they are used for the good of the regional economy rather than only specifically for one’s employer.

The findings from the participants’ group discussions indicate that the introduction of automation connected to smart technology presented skill-transition challenges for the manufacturing operation and the individual worker (Bughin et al., 2018). The state training providers warned of the impact automation would have on manufacturing skills and saw a shortage in the necessary skills for Oklahoma manufacturers they worked with to transition advanced technologies into their operations. The state training providers findings align with researchers (Elliott, 2017; Krzywdzinski, 2017; Ra et al., 2019; Rumsey et al., 2019) who acknowledge that industry will see a need for a more highly-skilled workforce. By claiming that Oklahoma manufacturing will soon not need middle-skill machinists, this finding supports Frey & Osborne (2013) who see the nature of the change of increased automation in a manufacturing operation will see a decline in middle-skill workers. In support of this finding, the production workers acknowledged that new skills would need to

be developed for smart manufacturing, but assigned to themselves the responsibility for the necessary skill development. This finding aligns with Faure et al., (1972), Coffield (1999) and Ball (2009), in their critiques of LLL, when they argue that it is an approach that often leads to the individual worker's loss of freedom.

The findings of this study indicate that the participants did indeed believe there were opportunities to develop skill. Skill can be developed through informal occasions, such as when a worker observes and imitates the skills of a co-worker. While Hager (2004) and Tynjälä (2008) suggest that most learning of skill in industry occurs informally, the participants still voiced the opinion that management ought to be responsible for providing for its workers' skill development through formal experiences, such as training programmes. Another area where the participants thought there was opportunity for potential workers (especially VET and HE students) to learn manufacturing skills was in work-based programmes like apprenticeships. Students need to be able to learn how to apply the manufacturing theories they learn about manufacturing to practical activities in a specific manufacturing context.

Similar to Little et al. (2006) and Jackson (2013), the participants also believed that work-based learning can have the outcome of developing the employability skills most desired by the manufacturers in their scope of responsibility. However, other authors (Mohrenweiser & Zwick, 2009; Lerman, 2014; Hanusek et al., 2017) argue that apprenticeships in manufacturing have not been beneficial. But Cunningham & Vilasenor (2016) made the important distinction that when apprenticeships are introduced pre-middle adulthood in the life cycle in partnership with HE, family, and the workplace, they have greater success in developing technical and socio-emotional skills that are related to employability skills (p.122). This conclusion would align with the perspectives of the study participants.

This study's findings reflect the need for employability skills and opportunities for students to put theory into practice. The participants believed that industry and educational institutions (HE and VET) need to partner together in order to create and be a catalyst for work-based learning. When participants lamented

the lack of application to the workplace while students were learning manufacturing theory, they were indicating an interest in the opportunity for a more strategic collaboration in the process of skill development. A skills ecosystem approach could potentially address this interest. If education and industry were to hold frequent conversations and dialogues where they focus on how to help students gain work-based learning experience, which the skills ecosystem approach promotes, students would be able to put theory into practice more frequently than is occurring while HCT and an LLL approach have dominated the skills discourse. This partnership, in addressing concerns like putting theory into practice, would represent a shift from the current situation of 'siloing' discussed by the state training providers and manufacturing managers.

6.8.4 HCT and LLL as frameworks for understanding skill in manufacturing

Lastly, although there are several lenses through which this study could have viewed the key actors' discussion of skill and skill development in Oklahoma manufacturing, HCT and LLL are used for two reasons. First, both help explain how individuals in manufacturing in a neoliberal setting are encouraged to be learners. As indicated in the findings, the production workers in this study also saw themselves as responsible for their own growth by learning how they can develop those skills required by employers. Second, both theories provide a lens on the development of employees' skills from an economic focus. When discussing the challenges that confront Oklahoma manufacturing, specifically the common practice of prioritising production goals over workers' skill development and the introduction of automation, this study has sought to address Research Question 4: *Can HCT and LLL provide a framework to understand skill in Oklahoma manufacturing?*

For HCT, a worker's human capital is linked to their acquisition of knowledge and skill that helps them to be a competitive and productive contributor to a stronger society; the more knowledge and skill a person acquires, the greater their 'human capital' is. For LLL proponents, even after 'formal education' (HE and VET education) people should be empowered and create meaning for their lives by taking opportunities to manage their own learning, whether in highly structured or informal activities. Both perspectives help to make sense of the

study's key actors' belief that individual workers are responsible for their own learning and skill development (as seen when they show initiative). Developing a worker's skill would be seen primarily by manufacturing managers and production workers as not only helping the manufacturers raise productivity levels, but also as assisting the worker in becoming a self-determined individual who can create new opportunities for themselves.

When the two challenges to manufacturing were discussed, differences of opinions emerged among the key actors as to whom they thought is primarily responsible for workers' skill development. The manufacturing managers and production workers often held the same perspective: the individual worker should initiate ways to acquire the skills that would make them more productive at work. However, the state training providers held the perspective that the employer is responsible for creating, communicating and providing opportunities for workers to develop skills. Within the framework of LLL, the state training providers' comments make sense because the employer can be held accountable to empower workers to take opportunities to learn. However, within the framework of HCT, the onus to obtain skill is placed on the individual, who should be increasing their own human capital and employers do not need to intervene with skill development unless they are regulated to do so or there is some urgency. The perspectives of the manufacturing managers and production workers align with the tenets of HCT. As the managers would prefer to keep costs down and production schedules uninterrupted, they desire workers who have the initiative to get training in their own time, rather than come off the production line to do so. The workers also thought that if their company needed them to develop skills, they should take the initiative and go and get that development, either informally by watching others or formally outside of the workplace. But the state training providers' views are not consistent with HCT, since they advise employers to budget funds and make time during work time for skill development. This latter approach takes the responsibility of acquiring knowledge and skill away from the individual, who is no longer self-directing their development.

A similar difference of opinion occurred regarding the impact of automation and smart technology. The manufacturing managers and production workers

believed that workers are responsible for learning the skills that will be required for the new technology, while the state training providers again believed that employers are responsible for providing workers with the training they will need. HCT helps to frame what the managers and workers are saying about skill, but it is LLL that aligns with what the state training providers understand about skill development as being the responsibility of the employer.

In addressing this fourth research question, it can be argued that yes, HCT and LLL, when used together, can provide a helpful framework to clarify the understanding of skill among the study's participants. However, these two theories insufficiently explain what actually occurs in practice. HCT and recent LLL approaches attempt to explain what will occur in industry from the employer's perspective. In other words, the theories envision what employers think would be an ideal scenario for the skill development of their employees. But the findings in this study cast doubts that the theories can explain what the key actors claim actually occurs in their industry. HCT and LLL theorize that employers and employees will take the necessary actions so that employees will learn the skills employers require. But among the practice of manufacturing managers in this study, that is not the case. They want employees to learn the required skills in order to increase production (as HCT assumes they will and should). Nonetheless, if they determine that the time to learn the skills interferes with meeting production goals, then they are not willing to reduce production for short periods of time in order to train employees for new skills. This is the case even though they know that workers acquiring those skills will help to meet long-term production goals and economic advancement. So, although HCT and LLL align with certain perspectives of those in this study, they do not account for why employers experience a shortage of the required skills for manufacturing and what to do about it in the actual practices of the findings of these key actors. This is a serious shortcoming in the theories and why they fail to sufficiently explain the practice of the study's key actors; state training providers, manufacturing managers and production workers. What the findings of this study show is that manufacturing managers are critical of the current system and its shortcomings and seem to be supportive of what can be characterised as an embryonic approach to a skill ecosystem.

6.8.5 Skill ecosystem approach

This study's findings illustrate several areas in which study participants' criticisms of the current approach to skill would be better served by a skill ecosystem approach. One area that was mentioned by M3 is the need for 'strategic direction'. Another area where a skill ecosystem would appear to be a better approach is when M4 mentions his desire for specific 'collaboration' between his industry and education to identify and develop skills for his current workforce. One more area with the skill ecosystem approach would be helpful is noted when M2 stated that education seems to be '*growing apart from industry'* because graduates have not acquired specific skills the study's manufacturers' desire. The willingness of participants such as M2 and M4 to converse and dialogue with other partnerships to address the skills dilemma in Oklahoma manufacturing means that the skill ecosystem might be seen as a productive way forward to provide industry with the skills it requires.

Central to the skill ecosystem approach is the understanding that 'strategic direction' and 'collaboration' or coordination is required between the skills needs of industry partnered with the regions investment in education and education's willingness to partner with industry to align skill development in the skill ecosystem framework (Dalziel, 2013). Collaboration between industry, education and other regional stakeholders has been shown in New Zealand, as discussed by Dalziel (2015), which illustrates how a skill ecosystem approach can produce workable solutions that address skill shortages regionally. This study earlier identified manufacturing as an industry is struggling with a skill shortage (Busemeyer & Iverson, 2014; Deloitte, 2018). A skill ecosystem approach offers a better solution than HCT and a LLL approach to address the needs of current and future skill development centred not only on automation integration but also ensuring that new workers are equipped with the desired employable skills and theoretical foundation of manufacturing skills required within Oklahoma's manufacturing industry. When the state training providers acknowledged the current and future impacts of automation on changing what skills would be needed in manufacturing and that this skill change would become a problem for education to address immediately, they are indicating the kind of partnership scenario a skill ecosystem aims to create.

Research into skill ecosystems in Australia, New Zealand, Scotland and India has shown that when features of regional stakeholder partnership, by which is meant firms, individuals ,education and policy are working together towards a skill solution (such as those offered in Figure 2.1), a flourishing of the skill ecosystem is seen (Payne, 2008; Dalziel , 2017; Buchanan et al., 2017; Chenoy et al.,2019). A6's interest in understanding system problems by meeting with manufacturers is an example of the partnerships envisioned by a skill ecosystem approach. And, M5's concern that there is not enough 'margin' to stop production to train workers illustrates the type of opportunity that a skill ecosystem approach could effectively tackle. Participants are demonstrating an embryonic interest for the pathways to solutions a skill ecosystem provides. The final Chapter of this paper draws together the conclusions of the entire study and lays out its limitations. The Chapter will end with recommendations for future research and practice, and also looks at the implications for my professional practice.

Chapter 7 - Conclusions

7.1 Introduction

Oklahoma, like the entire United States, seeks to have a vibrant manufacturing industry. However, that vibrancy is under threat because of a shortage of workers with the skills necessary to take Oklahoma manufacturing forwards in the 21st century. Without a sufficiently skilled workforce, any hopes of maintaining an effective, competitive manufacturing climate are in danger of vanishing.

The purpose of this study was to explore how the three groups of key actors in this study (state training providers, manufacturing management, and production workers) perceive skill as a concept within their area of the manufacturing industry. As introduced in section 1.1, manufacturers are confused today in Oklahoma, and elsewhere in the US, about what is meant by skill and how to train the current and future workforce with the skills required for the manufacturing industry. I also examined the question of the obstacles that need to be overcome in order to develop a clearer understanding of skill.

The first Chapter of the dissertation presented the introduction to the problem of skill within Oklahoma manufacturing, located within my professional role as a workforce advisor in Oklahoma manufacturing. Chapter Two reviewed the literature around the skill discourse, especially the studies located within the theoretical framework of human capital theory and the approach of lifelong learning and introduced the approach of a skill ecosystem. In Chapter Three, I presented an overview of the research methodology used in the study. Chapters Four and Five presented the findings of this study. Chapter Six presented an analysis of the findings in light of the literature and the theoretical frameworks employed by the study.

This final Chapter presents a summary of the study and then turns to discussing the implications. After that, I discuss the limitations and recommendations of the study, before closing with a reflection on my professional practice and recommendations for possible future areas of research related to this topic of study.

7.2 Summary of the study

This empirical research study was located in an interpretivist paradigm with elements of a constructivist approach. I chose this approach and a qualitative framework over others as I wanted to place my chosen participants' voices, knowledge and experience at the centre of my research. Denzin & Lincoln (1994), Mackenzie & Knipe (2006), and Marshall & Rossman (2011) hold that each paradigm within the qualitative research approach rests on different assumptions. In choosing an interpretivist paradigm with elements of a constructivist approach my assumption was that I was positioning myself in empirical research as the producer of data that focuses on experience. It was a natural choice for me to approach the understanding of my research question based on the experiences of members of my three chosen participant groups: state training providers, manufacturing managers, and production workers. The choice of a constructivist approach was also centred on conducting research that values the voices, experiences, and knowledge of practitioners connected to their area of Oklahoma manufacturing (Tierney & Lincoln, 1997, p.116). As this study was a small-scale study of 18 participants, no generalisability assertions are made to reflect all of Oklahoma manufacturing. To draw on the insights and perspectives of my participant groups, I chose to use two research methods: focus groups and one-on-one semi-structured interviews. Each of the three focus groups contained six key actors from the same sample group and the discussion lasted for no more than 60 minutes. I deployed a facilitated discussion method, as outlined in section 3.4.1. From each of the three focus groups, I chose two participants with whom to conduct the one-on-one semi-structured interviews. The purpose of these interviews was to delve deeper into the data produced in the focus groups that addressed this study's research questions, thereby adding further validation to the data through triangulation (Fielding & Fielding, 1986; Hatch, 2001). After transcribing and analysing the data, both manually and using NVivo, five key themes were identified, from which deeper sub-themes emerged (see Appendix 8). The five key themes centred on the key actors' perspectives of skill in their specific area of manufacturing. The five identified themes were: influence of the environment on skill; shift from technical to employability skills; creating, communicating and 'seizing' opportunities to learn new skills; parity of esteem; and challenges in developing skill. Findings related to the themes and sub-themes can be found

in Chapters Four and Five, and they are analysed in Chapter Six. In the following sections, section 7.3 recommendations are outlined then in section 7.4 limitations to the study are discussed.

7.3 Recommendations for skill development

This study presents recommendations for practice and implementation in the study participants' responsibility areas for the manufacturing industry based on the insights uncovered regarding the understanding of skill from the perspectives of three key actors in the study: state training providers, manufacturing managers, and production workers. Confusion and frustration exists within Oklahoma manufacturing due to the current inadequate supply of manufacturing workers with the necessary skills to keep pace with the manufacturing sector's growth or to maintain current manufacturing operations. Several outcomes from this research have implications for manufacturing policy and/or practice. These outcomes and implications centre on four key areas of the findings: environment, employability skills and theoretical foundations, and responsibility for skill and future skills development.

7.3.1 Nurturing the desire to develop skills

The study's findings indicate that nurturing relationships in an individual's life, starting from childhood and continuing through their life course to the workplace, play a crucial role in their skill development, and especially the skill of initiative or the desire to learn. People who nurture others provide opportunities and experiences for the individuals to act with initiative and learn. It is through such experiences that an individual grows in their awareness of where their potential talents lie.

In the workplace, nurturing relationships are more apparent when managers display discernment and create the environment and the time for an individual to learn. But managers could also make themselves accessible to the individual worker and adequately communicate opportunities for a worker to learn 'initiative' as a desirable skill of the employer. They could even create a plan for how this skill is developed in their current workers. This research study suggests that a manager needs to provide a strategic nurturing environment in which the workers feel motivated and empowered to learn. It could be argued

that managers may be governed by their companies' economic goals and merely desire development of those skills that immediately help to reach production targets. While this is accurate among most manufacturers, managers have it within their power to strategically plan opportunities to develop and create environments that nurture their workers to learn how to demonstrate initiative.

7.3.2 Enhancing student employability with work-based learning

In their accounts, the participants of this study stated that the most desired skills for an individual worker in a manufacturing operation are 'employability skills', especially initiative, which is demonstrated by a desire to learn. These are foundational skills on which the success of an individual worker depends. Another desired skill that was considered important for manufacturing workers to have is a strong manufacturing theoretical foundation combined with workplace experience of applying that theory to the manufacturing operation. It was considered by the participants that when a worker has a foundation of theoretical knowledge and experience of workplace application, they can develop the manufacturing technical skills required for modern manufacturing. This foundation also enables workers to adapt to future technology changes. Therefore, it would appear evident that industry has to look at ways to bridge the gap between theory and practice. Opportunities exist for manufacturers to partner with key stakeholders, such as educational institutions, to provide experiences for students in VET and HE. Industry, in partnership with education, can offer venues for work-based learning. A skills ecosystem approach could provide the framework for industry and education in which to partner and create strategic relationships. It is in such an environment, through the practical application of theoretical knowledge acquired in the classroom, that students can develop the skills most desired by industry. Students could be given opportunities to gain work-based learning experience in the form of apprenticeships, internships, senior design projects, and job shadowing.

7.3.3 Manufacturers and state initiatives for workers' skill development

A recurring theme emerging throughout this study was responsibility for skill, that is, who is responsible for developing the skills desired by manufacturers in their workforce today and in the future? According to the findings of this study, it was felt that the responsibility for skill development lies with what the study

participants referred to as the 'community'. Within this community, the two parties that bore most of the responsibility for skill development were believed to be the individual worker and the employer, with specific emphasis on management. The participants believed that industry should create opportunities to learn, managers should communicate those opportunities, and it is the individual worker's responsibility to take the initiative and 'seize' those opportunities for skill development. These outcomes connected to responsibility for skill development in manufacturing present four implications.

First, for manufacturers to create opportunities for skill development, they need to know *how* to create those opportunities, either internally or externally in partnership with VET, HE or other state workforce partners. The findings show that education partners are working against each other since they are all competing for the same funding from the state (see section 5.2.1). What the findings also show is that some manufacturers are looking to partner with education. Industry led partnerships with education and workforce agencies focused on skill ecosystems and skill development career paths could provide a strategic solution (Finegold & Soskice,1988; Finegold, 1999; Payne, 2008; Buchannan et al., 2017; Chenoy et al., 2019). This shift makes it opportune to consider that a skill ecosystem approach would provide a better grounding for manufacturers than their long-standing adherence to the production of human capital supported by a neoliberal lifelong learning approach, which the findings presented in this dissertation suggest is not effective, and even counter-productive, to fulfilling employers' needs for an appropriately skilled workforce. Industry led partnerships with education and workforce agencies focused on skill development career paths could provide the beginnings of a strategic solution.

Secondly, manufacturers have to make strategic business decisions to make funds available for skill development and/or the state needs to make more funding available for this same purpose. The latter will be necessary given that Oklahoma is currently a Republican-run state focused on decreasing state funding for education and skill development. To assist industry with creating opportunities for skill development, incentives for tax relief should be extended. Olssen et al., (2004) state that it is only when disruptions exist in human capital markets necessary to maintain a neoliberal economy that the

state intervenes. This study's findings indicate that Oklahoma manufacturing is currently faced with just such a disruption, which therefore makes this a good time for the state and national governments to become involved through funding options. In relation to communicating opportunities for learning a new skill, in the 2007 Report *New Strategies for the Education of Working Adults*, it was recommended that the government needed to offer more incentives for employers to invest in 'credentialed and portable education' for both 'basic and postsecondary skills' (Bosworth, 2007, p.2). One strategy would take the form of tax incentives for companies, which aligns with the study's findings regarding the need for industry involvement in skill development. Tax incentives can be applied by a local government or at the state level to motivate employers to invest in workers' skill development.

Thirdly, manufacturing managers play a key role in communicating not only the opportunity for current workers to learn and develop skill at work, but also for incoming workers to do the same. Manufacturing managers also play a key role in providing the environment, the staff, and the experience for informal and work-based learning to take place.

As the study has shown in the analysis of the findings (section 6.7.1.) and in the literature review (section 2.4.1.), one of the main challenges to acquiring skill cited by the participants are the risks and costs of stopping and adjusting production schedules in a manufacturing operation. Skill development is usually seen as the responsibility of the operational manager. Taking workers out of production for training is seen as a risk, as the operation for which the manager is responsible may not meet its production goals that day. Human resource managers or other company leaders may wish for individual workers to learn and may create opportunities to learn, but if these opportunities are not communicated and if time for this development to occur is not built into the manufacturing production schedules, skill development often does not occur (Lerman, 2017).

Lastly, in terms of the ability to 'seize' opportunities to learn, it needs to be made easier for individual workers to be responsible for their own skill development if they so desire. One implication of this study's findings is that

there should be a change in the incentive and funding models offered to the individual; this could involve skill development vouchers provided by the state which could be used for external learning opportunities. A core element of a voucher system is that the learner is receiving a 'government subsidy – either in terms of real money or in terms of entitlements to a given amount of education – to be spent at the educational institution of their choice' (Jongbloed & Koelman, 2000, p.10). The main goal of a voucher system is to provide freedom of choice. Currently, Oklahoma State funding neglects the majority of workers. Oklahoma Office of Workforce Development (OOWD) is funded via the WIOA, but it only targets unemployed, underemployed veterans and youth (WIOA, 2016). It does not currently fund training for those already employed and lacking the necessary current and future manufacturing skills.

In the US today, there are two federal education tax incentive programmes that support lifetime learning: American Opportunity Credit and Lifetime Learning Credit (IRS Tax Guide, 2015). The latter is a tax credit which can help parents and students by paying part of the cost of the first four years of college. Eligible taxpayers may qualify for a maximum annual credit of $2,500 per student. Generally, 40 percent of the credit is refundable, which means that an individual could receive up to $1,000, even if they owe no taxes. The Lifetime Learning Credit scheme assists people with paying for undergraduate, graduate and professional degree courses, including courses to improve job skills, regardless of the number of years in the programme. Once eligible, a person can qualify for up to $2,000–$4,000. Although these schemes offer important tax credits for those in manufacturing seeking a degree, federal and state governments need to expand incentives with regards to skill development by providing for working adults who desire non-degreed credentials.

7.3.4 Strategizing for future skills

As part of the US, Oklahoma will continue to face labour shortages and an imbalance in the supply of skills required for manufacturing (Friedman, 2012; Hemphill & Perry 2012; Abraham, 2015). The findings from this study were consistent with a prediction made in World Economic Forum's *Future of Jobs Report* (2018), namely that it will become even more apparent to endow the current workforce with new skills connected to smart manufacturing:

> Industries are set to take diverse routes in the adoption of new technologies, and the distinctive nature of the work performed within each sector will result in disruption to jobs and skills that will demand industry-specific adaptation (World Economic Forum, 2018, p.9).

The participants in this study voiced their concerns about the impact smart manufacturing would have on manufacturing skills and saw a shortage in the necessary skills for Oklahoma manufacturing to incorporate advanced technologies into their operations. In relation to the skill shortage, one outcome of this study is the recommendation that manufactures need to think strategically about the impact advanced technologies will have on their workforce and the associated skills they will need to adopt to navigate these changes (see section 6.7.2). Many industry reports predict the future disruption that the IoT and associated advanced technologies will have on skill within manufacturing (Optis, 2016; Prudential, 2018; World Economic Forum, 2018). They argue that skill development for future skills, in particular advanced technologies, will see the need for jobs being restructured, and new sources of labour sought, such as people with disabilities, refugees, women and felons. In addition, as this research study has shown, new skills will be needed not only to run advanced technologies such as robots and cobots but also to set them up and maintain them. The recommendation for manufacturers is that they will need to create new career paths and new job roles (Antonucci et al., 2017) and provide training for their workforce or time for experimentation, which, as shown in the study, has already worked for some manufacturers. These new jobs should reflect a need for high-skills from the workforce as they transition to increased automation (Autor et al., 1998; Frey & Osborne, 2013; Krzywdzinski, 2017; Brynjolfsson and McAfee, 2018). This shift in demand for high-skills makes acting as a catalyst makes it opportune to again consider that a skill ecosystem would provide a better approach to create the framework for a strategic approach to both understanding skill and skill development, partnering industry, education and other key stakeholders (Anderson & Warhurst, 2012; Dalziel, 2015; Buchanan et al, 2017)

7.4 Limitations of the study

As mentioned in Chapter Three, as no study can be totally exact or all-encompassing, there will always be certain limitations. This study was specific

to the context of the sample groups' experiences in Oklahoma manufacturing and, as a qualitative study using an elements of a constructivist approach focused on the experiences and knowledge of individuals connected to that industry (Tierney & Lincoln, 1992), it involved a small sample of only eighteen participants. Hence, I make no assertions of generalisability or claims that the results of my data apply to all of manufacturing in Oklahoma.

In selecting participants, I was mindful of Creswell's (2007) notes of the importance of selecting what he refers to as 'appropriate' candidates who are open to sharing 'their story' (p.133). Looking back on this study's research design and its data collection and analysis processes, two clear limitations come to mind. First, there was a certain limitation connected to the gender of the study's participants. In the focus groups, which consisted of a total of eighteen participants, only two were women. There is a strong gender divide in manufacturing, which is very male-dominated in Oklahoma and the US (Deloitte, 2018, p.4). Indirectly, advisory organisations that focus on manufacturing tend to employ experienced males who have worked in manufacturing and are able to share their experience to advise other manufacturers. There were no women in the manufacturing production workers group. As a woman myself, I did not think about this issue when choosing the participant manufacturing company. It was only upon reflection that it became apparent to me that it would have been valuable to seek the "story" of female production workers in a male-dominated industry. It is rare for manufacturers to hire women for production roles. This perpetuation of men ~~ales~~ in manufacturing, especially among production workers, illustrates what Acker describes as the 'gender segregation of work' (Acker, 1990). She outlines five interacting processes whereby an organization is 'gendered'. The first of these processes is the construction of divisions by gender, including allowed behaviours, locations of physical spaces, access to hierarchical power and authority. For example, men in Oklahoma manufacturing often see women manufacturing workers as better equipped for product assembly, because they stereo-type women as having finer motor skills than males and these particular skills are frequently required, especially with small component assembly. Understanding skill in manufacturing in Oklahoma could be deepened and extended if the role that gender construction plays in the Oklahoma context is considered when assessing what contributes to

manufacturing processes. One way I would suggest to counterbalance this potential limitation would be to seek out manufacturers who employ females in production roles and to specifically explore the ways jobs are 'gendered' by employers and co-workers.

A second limitation was that the perspectives of certain important stakeholders were missing. For example, I could have incorporated a focus group sample consisting of economic developers in local, state and federal government. Skill within Oklahoma manufacturing is gaining attention due to the industry's continued growth and increasing problems recruiting skilled workers. The incorporation of this extra group would have provided a broader perspective and shown the views of economic developers and legislative aids working for the State of Oklahoma as well as those of federal senators and representatives who impact policy in relation to the research questions of this study. Legislative aides work with senators to draft legislation and policies that support the development of skills within manufacturing, both in the individual states and nationally. These elected officials are the representatives of the people. Economic developers are the individuals that attract business to a state and grow current businesses.

7.5 Recommendations for further research

This study gained useful insights from the eighteen participants representing three participant groups who work or have influence in the area of skill development for their specific area of responsibility within manufacturing: state training providers, manufacturing managers, and production workers. The findings indicate that further research is required to create a body of knowledge around skill in manufacturing. As Cappelli (2015) concludes:

> It is difficult to think of another labour market issue for which academic research or even research using standard academic techniques has played such a small role, where parties with a material interest in the outcomes have so dominated the discussion, where the quality of evidence and discussion has been so poor, and where the stakes are potentially so large (2015 p. 283).

As a follow-on from the findings of this research study and to extend the body of knowledge around the topics of skill and skill development, I have three

recommendations. First, I would suggest conducting a quantitative study involving a larger sample group in the State of Oklahoma. The purpose of this quantitate study would be to gather data regarding the obstacles that manufacturing managers view as preventing them from creating opportunities for skill development and what solutions they would offer to overcome these obstacles. As this study shows, there is great reliance on the individual worker demonstrating initiative as a self-directed learner. Employers have the responsibility to ensure that the individual workers possess the right skills to do their jobs. However, it is less clear whose responsibility it is to plan and execute that skill development. LLL promotes the idea that the individual worker has to solve the learning issue for the employer.

Second, a comparison study could be conducted, with an emphasis on employability skills, analysing a VET manufacturing programme with a work-based component pre-, during and post- instruction to compare and contrast any changes observable in the students' employability skills, as well as in their theoretical and technical skill development. This would be a qualitative and quantitative study deploying one-on-one structured interviews of the students, who would be invited to reflect on the employability skills they thought they possessed before starting the programme, and those they had during and then after their programme of instruction. In addition, the students' managers and instructors would complete pre- and post-instruction surveys to analyse what skill development they see in the student during the programme of instruction. Comparisons would be drawn between both findings with the aim of measuring growth in employability skills. The goal would be for the students', through reflection, to share what employability skill growth they had experienced from their programme. The preferred programme to assess would be one that included a work-based learning component and focused on advanced technologies.

Lastly, I would recommend that a qualitative study be conducted that looks to identify the behaviours of those managers who see themselves as passionate about their own skill development. Moreover, the study should attempt to establish whether there is any correlation between this behaviour and the putting in place of a work environment that nurtures skill development within

their manufacturing operations. The aim would be to ascertain whether, as was mentioned in this study's accounts, managers who attend to their own skill development also create and communicate an environment of skill development for their workers. To gather data on aspects relating to the creating and communicating of skill development opportunities, a qualitative approach using one-on-one interviews with two participant groups should be used. The two participant groups would consist of, one a group of managers, who create a nurturing environment for skill development, while the second group would consist of be who reported directly to the managers from group one.

7.6 Contributions to professional practice

The process of completing this EdD has been a personal journey of challenge and growth. As my career has been focused on training and skill development, this study process has given me time to reflect on my motivation and question my strongly held beliefs that each individual should be empowered to learn. Now at the end of this process, I see that I was an individual who was totally aligned with a human capital and lifelong learning perspective of skill development and held the belief that each of us should be continually learning and growing. Authors such as Grace and Rocco et al. (2009) and Ohliger (1981) have led me to transform my beliefs and to be more accepting of those individual workers who are content with their places in life and at work. The production workers' accounts shocked me as I had not anticipated seeing how much personal responsibility they would place on themselves for creating, initiating and financing their own skill development. From a professional perspective, this new understanding has given me the motivation and drive to facilitate ways in my professional practice in the State of Oklahoma to shift that financial and opportunity burden of responsibility from the individual to both the state and the manufacturers.

Through this 24-month journey, I have seen the shift in my career as a result of my readings and exposure to what is going on within skills research in the US and globally. I have seen my employer and other key stakeholders in the state turn to me for direction regarding skill development in Oklahoma manufacturing. Their interest has led to a job being created for me as director of workforce and community partnerships for Oklahoma manufacturing at the

Oklahoman Manufacturing Alliance (OMA). The OMA is part of the national Manufacturing Extension Program (MEP) and acts in an advisory capacity to manufacturers. As the director of workforce and community partnerships, I have been tasked with helping manufacturers across the state to develop solutions to address the state's manufacturing skill shortages. In this role, my focus is to facilitate workforce solutions among manufacturers, economic developers, legislators, state training providers and other groups to help ensure a skilled manufacturing sector in Oklahoma. The aim of this role is to give visibility to the OMA as a key player and to provide a bridge with manufacturers in their attempts to recruit and develop the current and future manufacturing workforce in Oklahoma. In this new work role, I have planned and facilitated 20 group meetings with workforce boards, education partners, manufacturers, and other stakeholders to identify the workforce-related programmes required to help build a strong manufacturing ecosystem. These strategic initiatives are illustrative of elements of a skill ecosystem. Moreover, I have designed a manufacturing skills pipeline framework and formed a state-wide manufacturing workforce committee with 25 manufacturers. In collaboration with the committee, we have established three subcommittees working on key workforce initiatives: advanced technology, work-based learning, and a partnership with the Department of Rehabilitation Services. In early 2019, we facilitated a strategic planning session and created a three-year plan that requires working in partnership with education (HE and VET), workforce partners, and state agencies to achieve these workforce goals (see Appendix 11). I was fortunate enough to meet with the Governors' workforce advisory committees' chair, who has asked our committee to become the state manufacturing workforce ecosystem, and has adopted our framework and strategic plan to address workforce challenges for Oklahoma manufacturing.

In addition, as one of our state senators has asked for input, I have been working with his office in drafting amendments to the Retain Innovation and Manufacturing Excellence (RIME) Bill, submitted to Congress on June 25th 2018 (US Congress, 2018). This bill has been read in Congress twice and referred to committee. The purpose of this bill is to create a programme that retains and funds retiring manufacturing workers for up to 90 days to transfer their skills to the new worker that will replace them. The suggested amendments to the bill

centred on its eligibility requirements, adding clauses that funds would be given to those centres that will manage the funds provided by the Act, which must be able to:

> … demonstrate their ability to assess, advise and train manufacturers on how to transfer the job-specific skills and training through the implementation of a training structure and train-the-trainer program focused on knowledge capture and transfer (RIME Bill, 2019, p.3).

As Sennett points out, workers who desire to do well in the workplace and value the skill of their craft can become frustrated, discouraged and apathetic if leadership continually chooses to meet production quotas to the exclusion of the individual worker's skill development and if education fails to provide the 'tools to do good work' (2008, p.9). This path of excluding individual worker's skill development is one that Oklahoma manufacturing is by and large following. As an alternative I would argue that, instead, it needs more comprehensive investment in its workers' skill development in partnership with all of the key stakeholders (manufacturers, educators, state agencies, economic development offices and legislators) to create a strategic skill direction for a future manufacturing workforce.

Appendix 1: Participant Information Sheet

University of Glasgow

College of Social Sciences

Participant Information Sheet

Study title: Right Staff, Right Skills: An exploration of the skills agenda in Oklahoma manufacturing as perceived by state workforce agencies, senior level management and production staff.

Researcher: Sharon Harrison

Supervisor: Dr Lesley Doyle

Course: Dissertation, Doctorate of Education, University of Glasgow

Invitation to participate in the research

You are being invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

The purpose of the study

The purpose of this study is to seek your input into how you perceive the skills agenda in Oklahoma manufacturing.

You will be invited to an interview and/or focus group where you will be asked for your perspectives on the skills agenda in Oklahoma manufacturing. The interview will last no longer than 60 minutes. The interview will take place at Metro Technology Center, 1900 Spring Lake, Oklahoma City, OK, 73111, USA, at a time of your convenience. With your agreement, the interview will be audio recorded.

Taking part in this project is entirely voluntary. Should you subsequently decide not to participate you are free to withdraw at any time, without giving a reason, and if you do not wish it, any information you have given will not be used in the study.

Confidentiality and Storage

All data will be stored in a locked cabinet or in a locked file on my computer and will be dealt with confidentially*. It will only be seen by myself and my supervisor. The interviews will be confidential and neither you nor your place of work will be identified by name in any assignment or publication arising from the project. Participants may be referred to by a pseudonym. All electronic or paper copies of data will be destroyed when the project is complete.

Use of the information

I will use the recordings and transcripts of our conversation to get a better understanding of how the skills is understood in Oklahoma. A second aim of the study is to develop an understanding of how state agencies and industry assign responsibility for skill development in Oklahoma manufacturing. The research may also appear in journals published online or in print, in a book or a conference paper. Your personal information will not be used in any publications and you will not be identified in any written materials.

Disposal of personal information

Following the successful completion of my EdD or before the end of 2020, whichever comes first, I will destroy any personal information that I have collected for the purpose of this study. All paper documents will be shredded and electronic files will be completely deleted from my computer. The de-identified transcript and materials created will be held for no longer than 10 years for possible future research or study.

This study has been considered and approved by the College of Social Sciences Ethics Committee at the University of Glasgow.

Contact for further information

If you would like further information, you may reach me at

Please feel free to contact the university's ethics officer and my research supervisor if you would like to raise any issues regarding the conduct of the research. Contact information as follows:

a) Research Supervisor

Dr Lesley Doyle, Department of Adult and Continuing Education, Faculty of Education, University of Glasgow. St. Andrews Building, 11 Eldon Street, Glasgow, Scotland, UK, G3 6NH

Email: Lesley.Doyle@glasgow.ac.uk

Office: 011-44-1413301805

b) College of Social Sciences Ethics Officer

Dr Muir Houston, University of Glasgow. St. Andrews Building, 11 Eldon Street, Glasgow, Scotland, UK, G3 6NH

Email: Muir.Houston@glasgow.ac.uk

Office: 011-44-1413303426

* Confidentiality will be respected unless there are compelling and legitimate reasons for this to be breached. If this was the case we would inform you of any decisions that might limit your confidentiality.

Thank you for reading this and taking part in this study

Appendix 2: Participant Consent Form

University of Glasgow

College of Social Sciences

Consent Form

Title of Project: Right Staff, Right Skills: An exploration of the skills agenda in Oklahoma manufacturing as perceived by state workforce agencies, senior level management and production staff.

Researcher: Sharon Harrison

Supervisor: Dr Lesley Doyle

1. I confirm that I have read and understood the Participant Information Sheet for the above study and have had the opportunity to ask questions.

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.

3. I understand that this study aims to protect my anonymity and confidentiality and that this will involve the secure storage of data, a process of de-identification of data and the use of a pseudonym or an ID number in any publication.

4. I consent to (**please tick YES or NO**):

   - Being interviewed **Yes/No**
   - The interview being audio tape recorded **Yes/No**

Name of Participant ……Signature ……..

Date ……

Name of Researcher …… Signature ……

Date ……

Appendix 3: Focus Group Plan

Focus group plan – 60 minutes – each group

A. Before the participants arrive:
- Test the audio recording equipment to make sure it is working and that the sound is recording at an acceptable level
- Make sure that I have coffee and iced water available
- Have copies of all required paperwork - Consent Form and the Plain Language Statement
- Draw up a table so as I can get basic information about the members of the focus group e.g. gender, age, anything which might be useful for describing my focus group sample

B. Preparing to start the session:
- Offer the participants some refreshment
- Ensure before starting that we are seated at a good visual and hearing distance
- Read out the Consent Form and have it signed by the participants, along with the Plain Language Statement if not signed
- Get everyone to add their details to my table
- Switch on the audio recorder

C. Main Session:

1. Give a very general intro to the group on the topic

2. Give out post-it notes (5 each) 4 sets of 5

Probe 1:

In Oklahoma, what is positive and negative about our ability to educate and train the workforce?

1. Don't tell them more than is necessary or you will interfere with their own responses. Don't allow discussion at this point

2. Ask them, independently and without discussion, to each give five separate responses, one on each post-it

3. They will then be asked to stick the post-its randomly on the flip chart paper that is on the walls of the room

4. Give out some more post-its

5. The group will then be asked to organise their points into themes on the wall, move the post-it notes around so they end up in columns that make sense to them

I will ask them to give each theme (column) a heading

- **take notes in notebook**

The group will be asked to go back to the table to discuss what they've done and why

With my notebook prominently displayed, I will ask them to expand on the themes that have emerged

Probe 2

What do you understand by skill? (meaning)

1. Don't tell them more than is necessary or you will interfere with their own responses. Don't allow discussion at this point

2. Then ask them, independently and without discussion, to each give five separate responses, one on each post-it

3. They will then be asked to stick the post-its randomly on the flip chart paper that is on the walls of the room

4. Give out some more post-its

5. The group will then be asked to organise their points into themes on the wall, move the post-it notes around so they end up in columns that make sense to them

I will ask them to give each theme (column) a heading

- **take notes in notebook**

The group will be asked to go back to the table to discuss what they've done and why

With my notebook prominently displayed, I will ask them to expand on the themes that have emerged

Probe 3:

Where does a person get their skill from?

1. Don't tell them more than is necessary or you will interfere with their own responses. Don't allow discussion at this point

2. Then, ask them, independently and without discussion, to each give five separate responses, one on each post-it

3. They will then be asked to stick the post-its randomly on the flip chart paper that is on the walls of the room

4. Give out some more post-its

5. The group will then be asked to organise their points into themes on the wall, move the post-it notes around so they end up in columns that make sense to them

I will ask them to give each theme (column) a heading

- **take notes in notebook**

The group will be asked to go back to the table to discuss what they've done and why

With my notebook prominently displayed, I will ask them to expand on the themes that have emerged

Probe 4:

Who should be responsible for the development of these skills, both in and outside the workplace?

1. Don't tell them more than is necessary or you will interfere with their own responses. Don't allow discussion at this point

2. Then, ask them, independently and without discussion, to each give five separate responses, one on each post-it

3. They will then be asked to stick the post-its randomly on the flip chart paper that is on the walls of the room

4. Give out some more post-its

5. The group will then be asked to organise their points into themes on the wall, move the post-it notes around so they end up in columns that make sense to them

I will ask them to give each theme (column) a heading

- **take notes in notebook**

The group will be asked to go back to the table to discuss what they've done and why

With my notebook prominently displayed, I will ask them to expand on the themes that have emerged

D. Ending the session

Summarise the discussions, turn off the audio recorder and thank the participants for their time.

Remember to collect the Consent Form and Plain Language Statement. Shred any documents that have been left and clean up refreshments.

Send a thank-you note to the participants within 24 hours of the interview.

Appendix 4: Focus Group Questions

Focus Group Questions

1. In Oklahoma, what is positive and negative about our ability to educate and train the workforce?

2. What do you understand by skill in Oklahoma manufacturing?

3. Where does a person get their skill from?

4. Who should be responsible for the development of these skills, both in and outside the workplace?

Appendix 5: Participant Coding

Participant Group	Position	Age	Gender	Code
1. State Training Providers				
	CEO	63	Male	Provider 1 - **A1**
	Coordiantor	54	Male	Provider 2 - **A2**
	Coordinator	73	Female	Provider 3 - **A3**
	Director	60	Male	Provider 4 - **A4**
	Manager	52	Male	Provider 5 - **A5**
	Project Advisor	25	Male	Provider 6 - **A6**
2. Manufacturing Managers				
	Director of Engineering	60	Male	Manager 1 - **M1**
	Director of Process Improvement	42	Male	Manager 2- **M2**
	Director of Human Resources	50	Female	Manager 3 - **M3**
	VP of Human Resources	40	Male	Manager 4 - **M4**
	VP of Manufacturing	36	Male	Manager 5 - **M5**
	VP of Manufacturing	65	Male	Manager 6 - **M6**
3. Production Workers				
	Electrical	60	Male	Worker 1 - **W1**
	Machinist	55	Male	Worker 2 - **W2**
	Machinist	27	Male	Worker 3 - **W3**
	Maintenance	50	Male	Worker 4 - **W4**
	Manufacturing Operations	36	Male	Worker 5 - **W5**
	Welder	30	Male	Worker 6 - **W6**

Appendix 6: Participant Cameos

State Training Providers

A1 – CEO

A1 has 40 years of workforce and training experience focused on manufacturing at a state and national level. His experience has been focused on developing skills solutions for the at risk populations.

A2 – Coordinator

A2 had a productive manufacturing career in operations before transitioning to the role of coordinating training within VET for manufacturers in Oklahoma over the last 12 years.

A3 – Coordinator

A3 has been creating training solutions as a company owner then training provider for over 45 years. Her experience spans many industries but she specialises in manufacturing and new technology.

A4 – Director

A4 serves in a management role within the state VET system focused on advanced technology and manufacturing. He is career educator.

A5 – Manager

After 35 years as a manager in a large manufacturing operation, A5 moved into a role of advising manufacturers on operational and training solutions to address business problems and growth.

A6 – Project Adviser

A recent graduate, A6 was in his third year of employment advising manufacturers on work-based learning solutions.

Manufacturing Managers

M1 – Director of Engineering

Having worked in manufacturing operations overseas and at various US locations since high school, M1 transitioned into a director of engineering role working on special projects with a local manufacturer. He received his engineering degree at night school.

M2 – Director of Process Improvement

As an engineer, M2 has extensive global experience in engineering and process improvement as a consultant and employee. Currently, he works finding solutions to manufacturing problems as a contract employee.

M3 – Director of Human Resources

M3 has worked throughout her 25-year career in manufacturing and has experience in training and development, recruitment and organisation development.

M4 – VP of Human Resources

As a senior management professional with 20 years of human resource management experience, seven of which have been in manufacturing, M4 is actively involved in state-wide workforce committees.

M5 – VP of Manufacturing

Having worked in manufacturing since college graduation, M5 has served in management roles for the last 10 years and is responsible for a team of 300.

M6 – VP of Manufacturing

With a 40-year career in manufacturing, working for the same manufacturer, and having started straight out of high school, M6 pursued his engineering degree while employed full-time. He has extensive experience of creating training programmes to develop required manufacturing skills for his manufacturing operation.

Production Workers

W1- Electrical Technician

A veteran who received his technical training in the US army, W1 transitioned to civilian employment, working in manufacturing at various locations around the US.

W2 – Machinist

As a machinist, W2 received his training OTJ and has worked at several local manufacturers and job shops.

W3- Machinist

Having received machining certification from the VET system right out of high school, W3 has spent the last seven years with the same manufacturer.

W4 – Industrial Maintenance

With 30 years of experience working in manufacturing within the state, W4 received his training OTJ and has worked with over five different manufacturing operations.

W5 – Manufacturing Operations

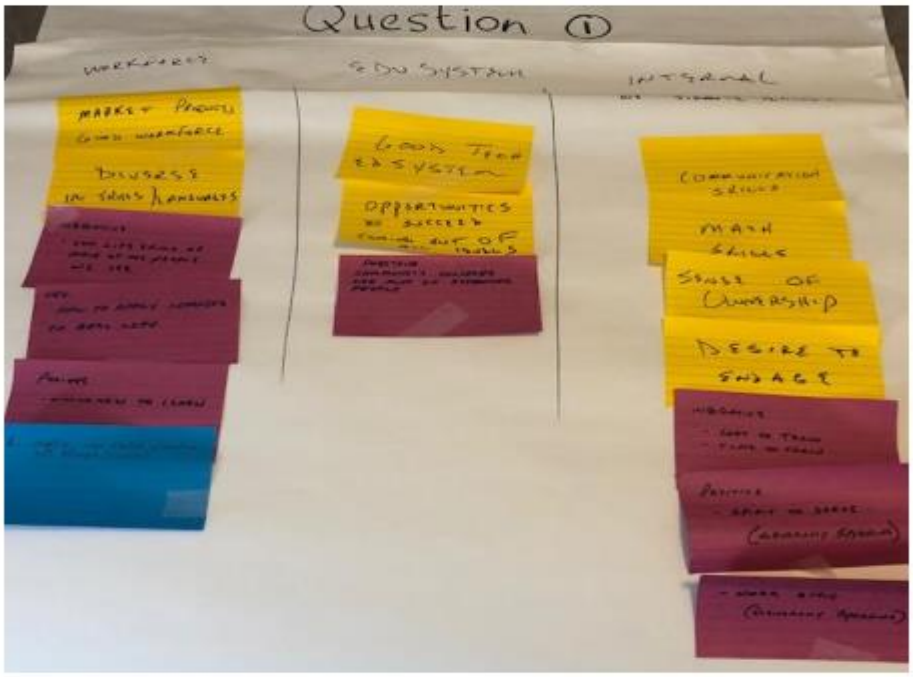
During and post-high school, W5 attended VET, moving from industrial maintenance to machining. He has been working in manufacturing for the last 15 years while working to complete an engineering degree, which he hopes to complete in the next two years.

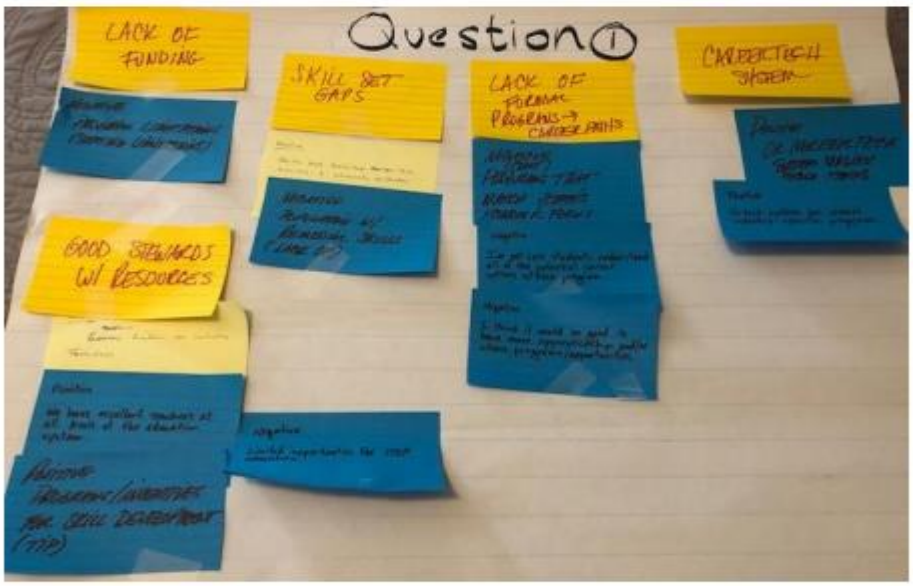
W6 – Welder

A self-described “welder for life”, W6 started welding in HS and, since graduation, has worked with two different manufacturers as a welder. He has recently been promoted to a team lead.

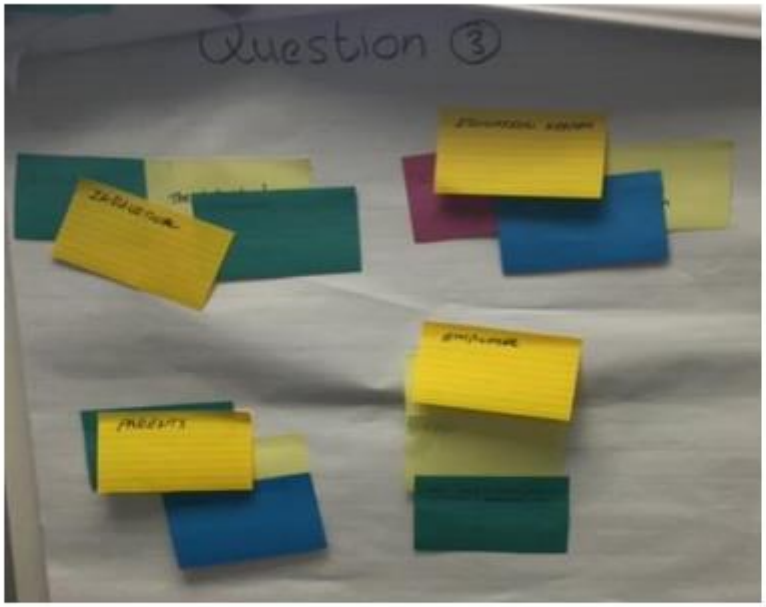
Appendix 7: Photos of Focus group flip charts with generated themes

Focus Group 1 – Manufacturing Managers – Prompt 1

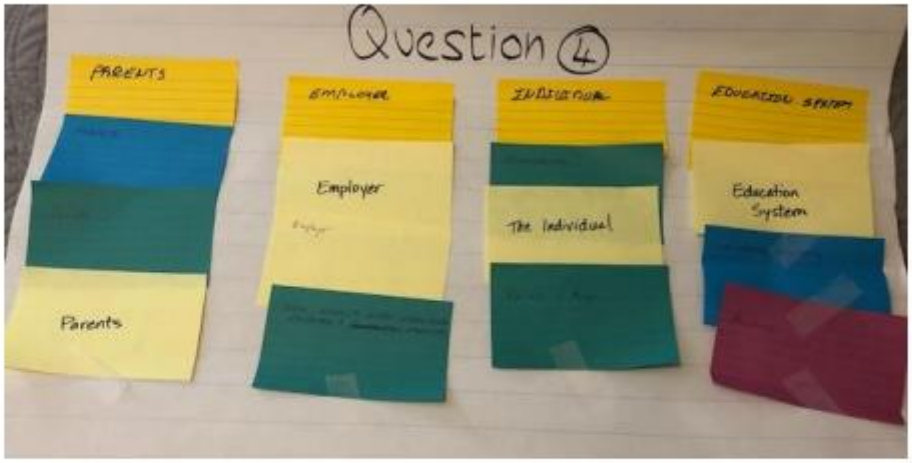


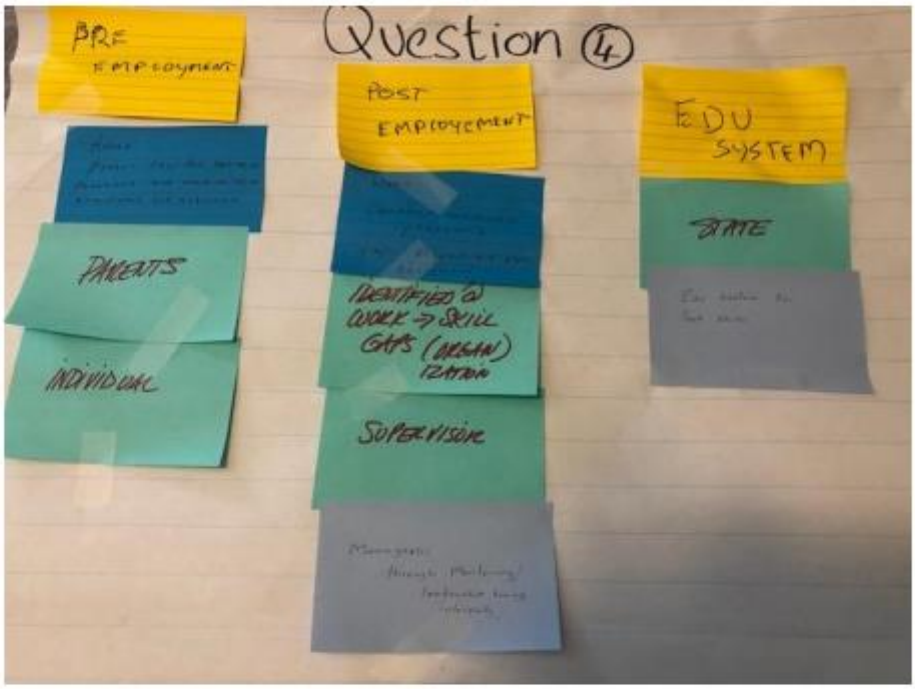


Focus Group 1 – Manufacturing Managers – Prompt 3

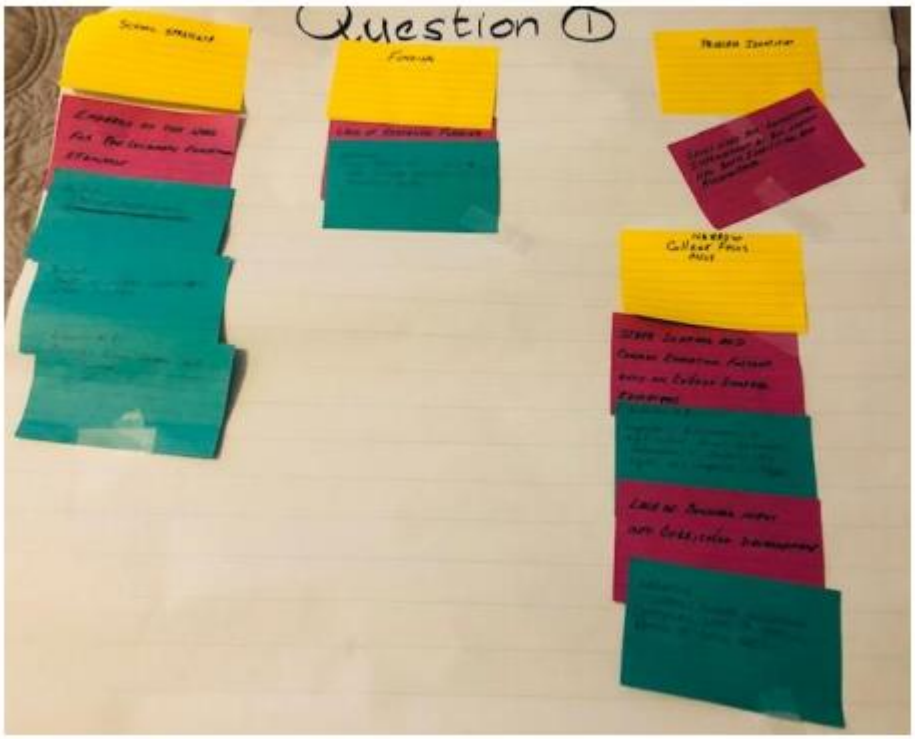


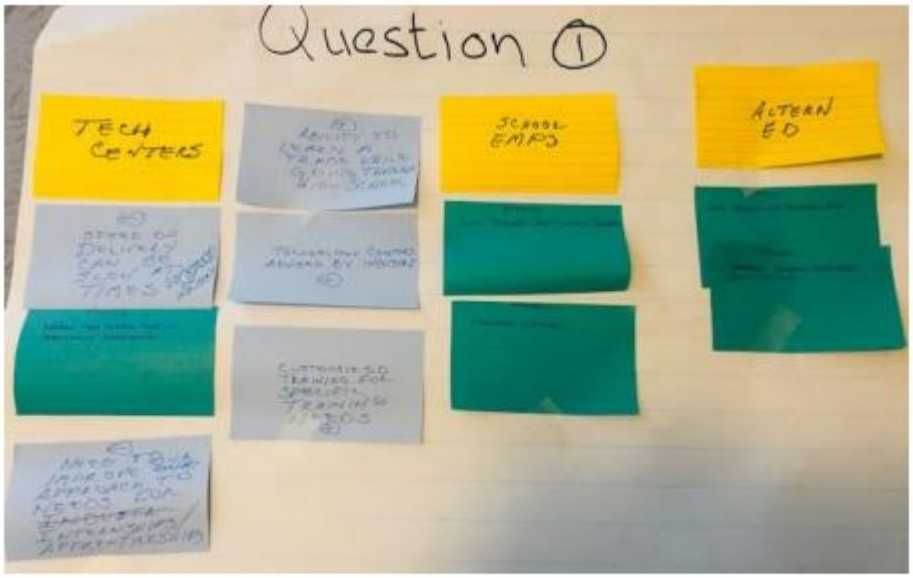
Focus Group 1 – Manufacturing Managers – Prompt 4



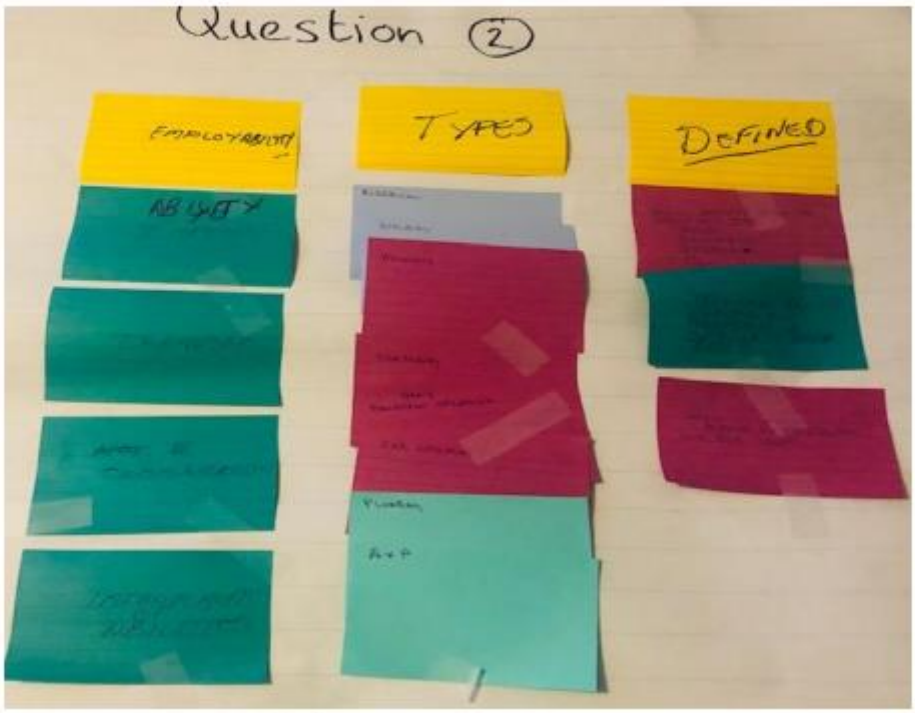


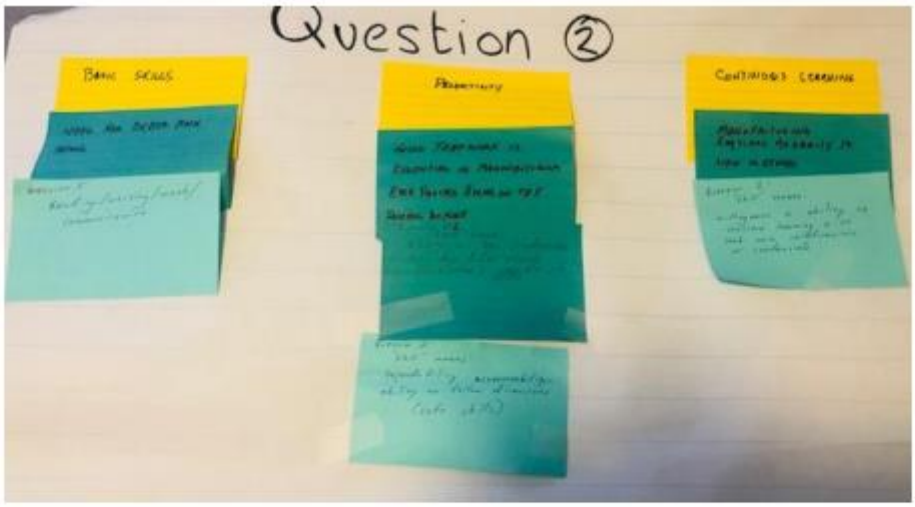
Focus Group 2 – State Agency Workers – Prompt 1



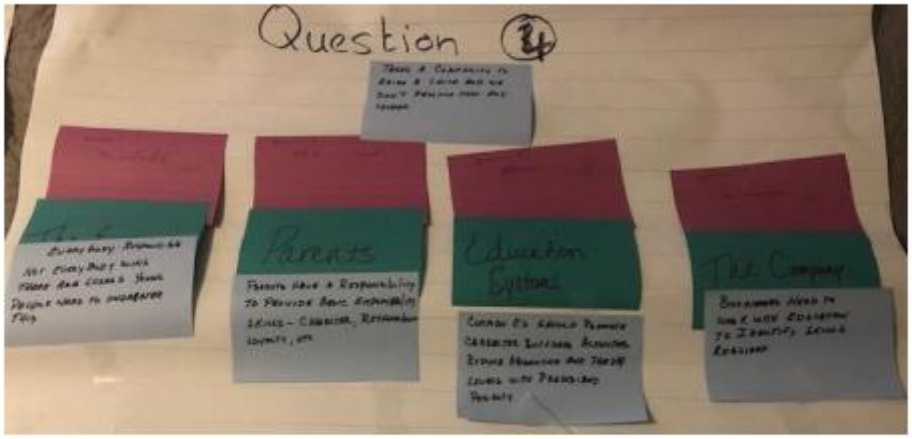


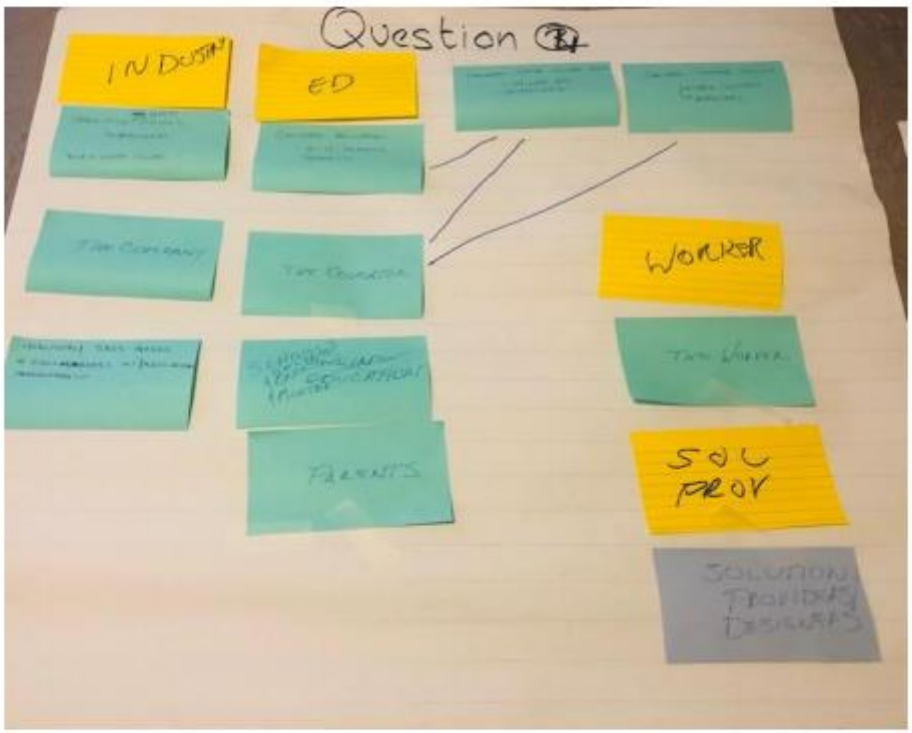
Focus Group 2 – State Agency Workers – Prompt 2



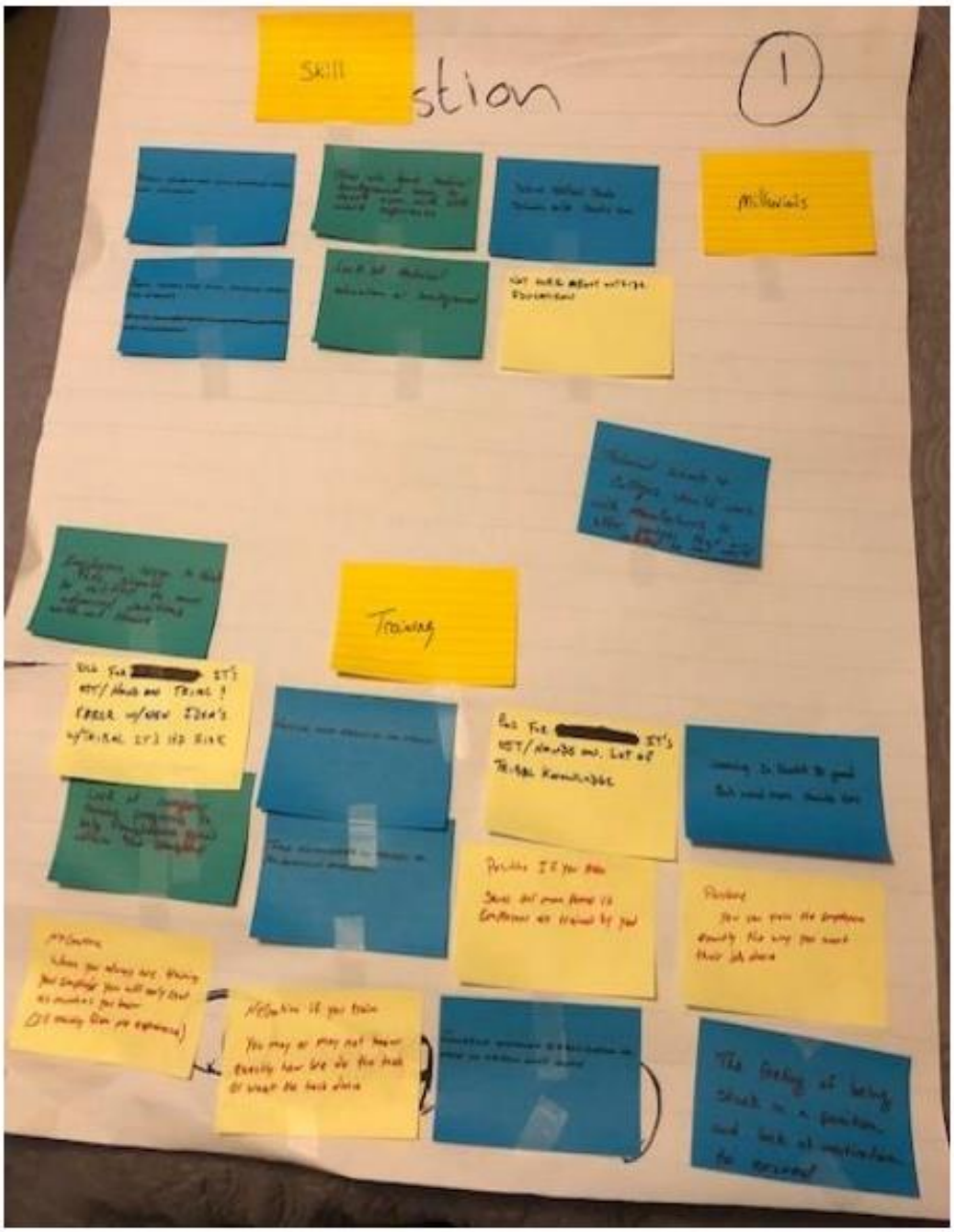


Focus Group 2 – State Agency Workers – Prompt 4

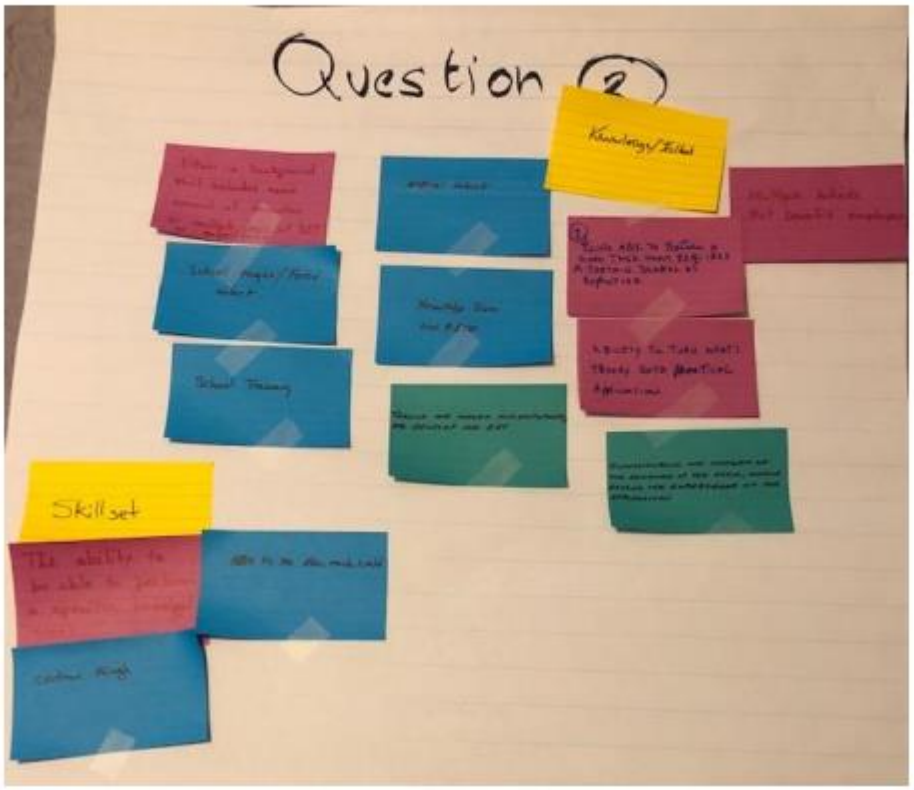




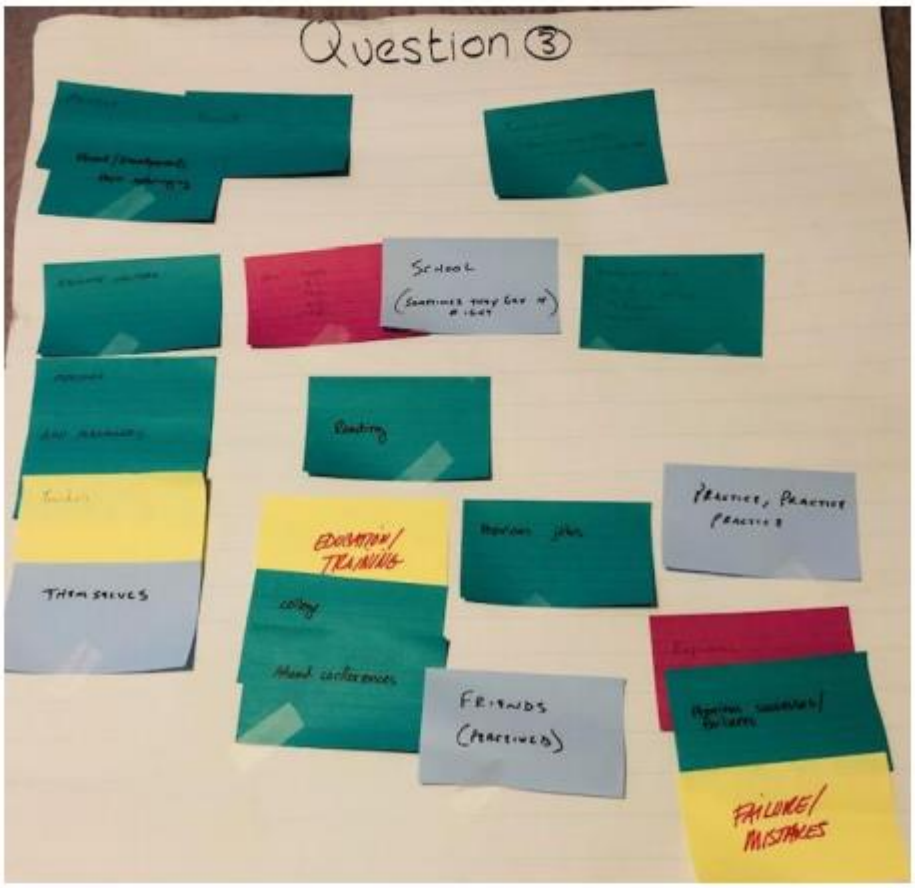
Focus Group 3 – Production Workers – Prompt 1



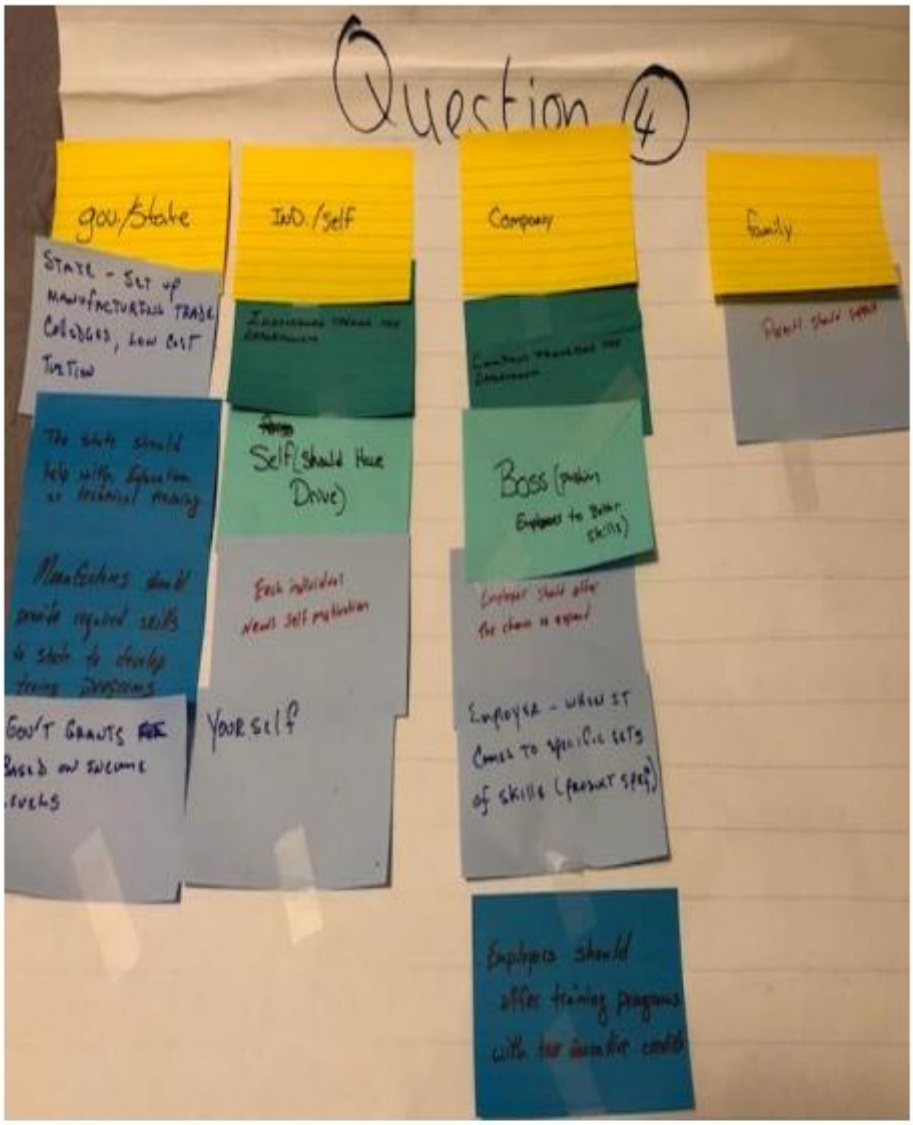
Focus Group 3 – Production Workers – Prompt 2



Focus Group 3 – Production Workers – Prompt 3



Focus Group 3 – Production Workers – Prompt 4



Appendix 8: Main Themes and Sub-themes

THEMES	Influence of the Environment	Shift from Technical to Employability Skills	Creating, communicating and seizing opportunities to learn new skills	Parity of Esteem	Challenges in Developing Skill
sub-themes	Nurturing relationships	What are employability skills	Opportunity - create and communicate	Education structures	Unwilling to take the risk of skill development
	Born with a natural talent	The soft skills - 'puzzle'	The individuals initiative to seize opportunities to learn	Lack of career path focus in education and industry	Automation impact - 'flexible and adaptable'
		Different sense of work ethic'			Accessability to 'skill' development
		'Failure is an opportunity to learn'			
		The theoretical application behind technical and trade skills			

Appendix 9: Mind map

Appendix 10: Transcript coding excerpt

Production Workers Focus Group Excerpt

W3: some trades have hands on in trade school and some do not. The hands on is a positive. I'm more of a hands on person and that helped me. So what would that be?

W2: the types of learner, audio, visual, kinesthetic

F: the training, what are you meaning by that?

W6: both. It's a positive if you're structured enough and can get it done in the company. The majority of people in my department need training but trying to balance the workload with the training and the amount of time it takes to train is the negative aspect of it.

F: good point

W5: and even what kind of training is it. Is it training you an do OJT or is it something you have to go do like the seminars or even classes we do or technical training and what is available. I don't know what other companies are doing and if they are doing something different than what we are doing. All I know is what we do and I feel that we lack majorly in training.

W4: I think that is kind of a handicap for us in a way. I think there needs to be balance there, in as much like in some cases like W2 .His skillset for guys in machine shop need book training on how to operate the machines but at the same time you also have to have the hands on knack of being able to work with tools and fixtures and things like that. They need to know the reason why they do something,

W1: the manufacturing theory. It can be self-taught and self-paced.

Appendix 11: Manufacturing Workforce Committee – Subcommittees

OMA Workforce Committees

Department of Rehabilitation Services (DRS)

Manufacturers are challenged by an inadequate supply of workers and an unemployment rate of 3.6%. We are exploring the feasibility of building a partnership with the Department of Rehabilitation Services to establish an open avenue of opportunity. We want to connect DRS clients who are looking for jobs to manufactures who are prepared to accommodate their needs.

2021 Key Outcomes:

1. Become a partnership with DRS and other potential support organizations.
2. Develop process and resources for manufacturers to work with DRS on 'customized employment': toolkit, best practices, etc.

Key Companies:

M-D Building Products/Stroud Safety/Kimray/Ditch Witch

2019 Priorities:

- National benchmarking
- Deeper HR training on disabilities and 'reasonable accommodations'
- Choose a path by end of Q4

Advanced Technology

Advances in manufacturing technology present opportunities for manufacturers and associated workforce challenges. To assist manufacturers with the adoption of future technologies, our goal is to identify core job roles and skills necessary to adapt to new technology.

2021 Key Outcomes:

- End of 2021 we have a qualified pool of applicants equipped with Advanced Technology and Fundamental Principles certified Program (ATFP) ready to enter the workforce.
    - Certification – CTE level
    - Training Program
    - Marketing of Program

Key Companies:

Kimray/OSECO/SNT/Nordam/BakerHughes/Mohawk/Autoquip/AW Bruggerman/Valiant/

2019 Priorities:

- CTE commitment
- Benchmarking
- Identify curriculum structure

Work-based Learning

Research and practice show that when future and current employees engage in the activity of work-based learning they have greater success of skill adoption and retention within the manufacturing operation. Our aim is to explore and create a plan for the adoption of a work-based learning strategy for manufacturers within the state.

2021 Key Outcomes:

Current Employees:

1. Career Progression Plan/Ladder
2. Skills/Training Matrix tied to Career Progression Plan/Ladder

Future Employees:

1. CPT adapted and expanded
2. Introduction to manufacturing for 9th and 10th graders
3. Engagement Plan for Manufacturers

Key Companies:

HemSaw/OklahomaSteel/Valiant/UnitedHoldings/3M/ProgressiveStamping/Ditch Witch/PACCAR/Tulsa Centerless Bar/Mohawk

2019 Priorities:

- CTE commitment
- K-12 commitment

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