# Exploring the skill and career development expectations of mature IT field engineering personnel- a Grounded Theory approach

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A thesis submitted in partial fulfilment of the University's requirements for the Degree of Doctor of Business Administration

2024

University of Worcester

## Acknowledgements

I would like to acknowledge the University of Worcester for such a well-formed course structure and great facility that allowed me to realise an unexpected long life long personal challenge to undertake and complete a doctoral study programme.

To my original course tutor’s Dr Lynn Nichol, Professor Jas Dhillon, Theresa Mitchell and Professor Alison Kingston who patiently educated and evolved an IT professional back into academic study and delivered guidance and coaching to enabled me to evolve to become a researcher.

To Catherine Ross who has undertaken the primary role of supervisor through the later phase of my research and has been core to the creation of this thesis I give my heartfelt thanks because without your guidance I struggle to believe this would have been completed (thank you).

I would like to also acknowledge the contribution of the late Anita Pickerden who sadly passed away during my research but who delivered highly valuable input and engagement even through times of sickness and will not be forgotten.

I would like to acknowledge Lynn Nichol who has remained as a core part of my University of Worcester educational journey from my very first day and more recently a part of my research study team and has been a massively positively and beneficial influence throughout.

I was also fortunate to join my doctoral study programme with a great cohort of individuals who have continued with support throughout my academic study and who I wish well as they conclude their own studies.

I would like to emotionally thank my family and close friends who been by my side as I faced the challenge of returning to academic study after so many years and have been a crucial element of me concluding this research effectively.

And finally, I would like to thank my organisation for its full support and encouragement to undertake this study allowing me access to organisational resources and a mandate to pursue whatever study avenues were deemed to be viable and beneficial.

# Abstract

This study aimed to investigate the skills and capabilities and organisational support required by older or mature IT field engineering workers to remain effective in the changing information technology industry. The purpose of the research was to equip CompanyX, a leading information technology organisation who employ a population of ageing IT engineering workers with an understanding of the career development activities that will benefit the personnel they employ as they move into a later career stage.

The research was undertaken as a grounded theory study of CompanyX and qualitative in nature utilising constructivist grounded theory methodology (Charmaz, 2006). Semi structured interviews were used to capture and create data from a sample population aged 45 and over. The analysis highlighted the mature IT field engineers benefited from a vast amount of accumulated skill and knowledge by virtue of their long tenure in the IT industry however their ongoing value may not be fully understood by their resource managers and the organisation. The research presented the mature IT field engineer's realisation of the need for new skills to remain productive and effective in the future workforce and the importance of a job with the flexibility to accommodate the demands of external life factors that may change their work life priorities.

The research identified two significant contributions to theory. The emergence of the importance of understanding the mature IT field engineer perception of ***self-worth and value*** which was historically positive earlier in their tenure due to the high demand for their original technical skills and the job they performed but found to be diminished in recent times because of both skills and professional obsolescence. The research indicates it will be beneficial to change the resource manager style from an authoritative approach to a collaborative coaching style focusing on value over productivity metrics, to redesign jobs to minimise the

impact of ageing and increase work life flexibility in addition to investment in future focussed skills to ensure the IT field engineering career remains relevant which will contribute to the mature IT field engineer's perception of self-worth and value and meaningful contributions.

The second contribution to theory builds on the initial contribution and positions the emergence of ***self-worth and value*** as the primary consideration when seeking to understand the mature IT field engineers' professional identities, in favour of perceiving value as the accumulation of technical certification and accreditation positioned within existing research (Tsakissiris,2015; Smith, 2016; Rahmatika, 2022). The findings reinforced technical training and certification remain important to mature IT field engineers as evidence of competency, however the debilitating effect of skills obsolescence even with a vast array of existing IT technical certifications has repositioned the importance of understanding the engineer's perception of their self-worth and value.

Several contributions to practice were recommended by this research. However, the most significant contributions include a suggestion for the British Computer Society (BCS) to apply greater focus to older IT worker skills development and elevate the value and perceived status of professional membership, CompanyX to reward mature IT field engineers for knowledge sharing and reuse, the need for mature IT field engineers to take increased responsibility for their own skills & career development and for managers to assist the mature IT field engineers with the adaptation of their historical engineer professional identities.

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# Chapter 1: Introduction

## 1.1 Introduction

This chapter will summarise the rationale of the research and describes the phenomena that led to the decision to study the skills and career development needs of an age defined information technology (IT) field engineering population within CompanyX. It will begin with a brief explanation of relevant IT historical industry developments and how they have shaped the need for technical jobs and skills. The chapter will elaborate on the emergence of the personal computing technological era pervasive in the 1980s, which is an important milestone guiding the age range for the selected research participants. It will also include a brief explanation of the structure and broader employee landscape of CompanyX, with focus on the IT field engineering roles at the core of the research. The chapter will conclude by positioning the research aims and objectives defined to understand the skills, organisational support and career development required for the defined mature IT field engineering population to remain effective.

## 1.2 Rationale for the study

This research seeks to understand the skills and career developmental needs of a population of mature or older IT field engineers within CompanyX, a large information technology organisation, who were affected by ongoing technology industry changes that impacted the requirements for their historical roles and highlighted the importance of skills and jobs for future employment. This grounded theory research activity considered two significant areas of academic scholarship as a study of the skills and careers of a population of older IT field engineers, a subject area and worker community found to have little existing research. Firstly, self-worth theory and concepts (Covington and Beery, 1976; Covington, 1992) as a consideration of the mature IT field engineers desire to understand their personal value and worth based on their skills and job relevance to CompanyX to ensure they realize productive and rewarding careers. Secondly, the impact of skills, job and work life expectations on their professional identity (Ibarra, 1999; Schein, 1978) as a result of the mature IT field engineer jobs and experiences as mature IT engineers working within an industry undergoing significant changes which are bringing the value of historical engineering worker characteristics into question.

The post second world war IT workforce has spanned numerous technology advancements driven by market needs and innovation (Vega-Gonzalez, 2007). Technology innovation has disrupted existing solutions and delivered ground-breaking products to establish new industries (Naidoo and Hoque, 2018, p. 644). Examples of disruptive innovation include the personal computer, the internet, cloud computing and the mobile technology era. The continual introduction of new technology solutions stimulated the need for corresponding training and skills development for the IT professional employed by specialist IT services organisations or to train technical personnel within non-IT companies. The existing information technology engineering workforce of the last 30 years were affected by a number of external and internal forces, including accelerated technology-led industry change (Vega-González, 2007), an incoming population of IT literate digital native younger employees (Livingstone, 2009) whilst becoming an ageing population of existing personnel concerned affected by legacy task obsolescence, and the need to acquire new skills (Government Office for Science, 2016, p. 39; Docebo, 2019).

Technology innovation has influenced IT industry changes over multiple decades in tandem with IT engineers ageing across the same period. This has created a mature technical engineering community with outdated skills and future career concerns. By understanding the optimal skills requirement for current or changing technical jobs, guided by timely intervention and intentional career development, the mature IT engineering community can be equipped with relevant skills and capabilities to be effective in the future workforce. The following sections will summarise significant historical developments in the information technology industry to explain how they created the need for technical IT services personnel, with IT field engineers a relevant example of one such job and role.

## 1.3 A brief history of the x86, personal computing era

A comprehensive review of computing fundamentals, including a complete history, is a vast topic and beyond the scope of this research, therefore this thesis focuses on a time span commencing at the creation of the personal computing industry of the early 1980s (Zakari and Yar, 2019), a career entry point for the IT field engineers within this research. The personal computer or computing systems in general, are electronic or electromagnetic data processing devices that accept instructions via programming to guide the automatic operation of the system (Dasgupta, 2014). The IT system development practices and systems developed within the 1980s were based on inventions and innovation from prior years. For completeness, relevant IT developments spanning the last 50 years are discussed to position 1980s personal computer architectural innovations in context.

### 1.3.1 Dawn of Digital computing - Colossus

Colossus, believed by many to be the first programmable computer, was designed by Tommy Flowers and built by British codebreakers to decipher enemy messages during the Second World War (Michie, 2002; Schmidhuber, 2006; Wells, 2011; Shipley, 2012). Following on from Alan Turing's computational machine, the programmable nature of the pioneering Colossus platform signalled the dawn of digital processing in a reusable form. It was programmed via instructions fed in via punched tape, to be processed to deliver a calculation based on a single, defined outcome. Colossus was a substantial platform requiring a room-sized space to house a single machine, weighing a ton and requiring specialist personnel to operate it. A working version was launched in London in 1943 after many months of development, which was then moved to Bletchley Park to assist with the war effort (Copeland, 2006; Shipley, 2012). Whilst the single purpose Colossus computing platform in the UK was a top-secret project, the activities of the Electronic Numerical Integrator and Computer (ENIAC) computing project in the US were well known. The ENIAC, the first American electronic digital computer operational in 1945, and similar platforms, highlighted the potential of multi-purpose, programmable computing platforms capable of accepting instructions that defined the processing outcome (Goldstine and Herman, 1980).

**The industry impact of Colossus**

The story and activities of Colossus were highly classified until 1970, with little information being publicly available until the partial government classification was lifted (Randell, 1980). This research considers the role and activities of mature IT engineering personnel in the present day along with the earlier Colossus project, thereby offering a template of two separate engineering roles that remain evident today. Technology engineering activities were essential to successful system operation during the 1940s Colossus project, with two primary roles required to maintain the system, being design and commissioning engineers. The lack of task centric definition and granularity of the engineer roles only allows for a loose comparison with modern day engineering activities, with the design engineer responsible for the architecture and further development of the solutions and the commissioning engineer aligned with implementation and hardware maintenance of the operating platform (Copeland, 2006). The secret nature of the platform and the need for unique intellectual and technical skills led to the careful selection of members of the Colossus team who, subsequently, could not discuss their unique activities due to the secret status of the technology project. Similar to the UK skills shortage created via the launch of Colossus, the US government trained a substantial number of men and women for technical posts to facilitate the launch of ENIAC and other digital computing platforms (Herman and Goldstine, 1980, p.150).

### 1.3.2 Post War – The rise of the mainframe

The use of digital technology for military or business impact accelerated after its successful use during the Second World War. Accelerated growth of the information technology industry resulted in a shortage of skilled engineers due to the introduction of the IBM mainframe computers for commercial use. Aligning history with the outcome of this research, the post-war IBM mainframe computer era stimulated the need for a similar technology engineering skills pool similar to the earlier war time Colossus approach with the need for programmers to create the instructions required. Architectural engineers were also required to design the computing platform and field-based commissioning and maintenance engineers were needed for hardware installation and failure remediation. The mainframe revolution created a skills shortage for suitably qualified talent and quickly became the destination employment target for potential employees possessing technical aptitude or an engineering mind-set. The mainframe, followed by smaller systems with similar operational functions called minicomputers, continued to dominate the information technology industry through the 1970s (Vega-Gonzalez, 2007). A detailed appraisal of 1970s computing is beyond the scope of this introduction but would include systems from the UNIVAC, Xerox, Digital Equipment Company (DEC), Altair and Apple, to name a selection of the most impactful vendors. They continued to evolve computer systems until the arrival of the IT platform fundamental to the roles of the engineers within this research, the IBM PC and the Intel 8086 era.

### 1.3.3 The x86 Personal Computing era

At the beginning of the 1980s, a new computing platform was launched and was based on the 8088 and 8086 processing technology from Intel, a microchip manufacturer, but was targeted as a self-contained personal computer for an individual user. An important element of the new personal computer (PC) system was the ground-breaking operating system created by IBM and an emerging software company called Microsoft. The new operating system, designed for the Intel processor range differed greatly from the large, centralised processing approach of mainframe computing technology to power smaller, standalone self-contained personal computers for use by a single use. The personal computer, or PC industry was born. Personal computer-based technology quickly became a best seller and drove a boom for personal computer systems and associated devices. So great was the impact of the IBM PC that Time magazine, famed for highlighting great human beings, named the computer in 1982, "Machine of the year" (Ceruzzi, 2003, p.269).

A new workforce of IT engineers, from the existing mainframe computer workforce, were trained to install, configure and maintain PCs, entered the industry in addition to new workers attracted by the new PC technology platforms. The 1980s personal computer era provided the catalyst for the careers of the mature IT field engineers, circa over 45 years old and beyond who are at the core of this research study. It is their career journeys, some from the start of the 1980s PC boom and others more recent, that will deliver the knowledge basis for this research driven by their lived experiences through multiple decades of IT innovation.

### 1.4 Who or what is CompanyX?

CompanyX is a circa 40-year-old information technology systems integration company. The primary role of the organisation is to solve business problems by the sales and support of information technology (IT) software & hardware products and services. With over 20000 employees undertaking roles that include sales, customer services, support and maintenance and systems engineering, CompanyX is a leading solutions provider in the UK and EMEA regions. IT field engineering is a critical element of the CompanyX value proposition with over

4000 engineers of different roles and skills with an age span from 18 year old apprentices to workers beyond the current UK state pension age. CompanyX was selected as the case for this research due to its inherent population of IT field engineers within the age span designated by the researcher, access to data and the opportunity to contribute to practice and academic theory.

CompanyX began in 1981 reselling IT products and technical services based on the emergence of personal computer (PC) based technology and the introduction of such systems into the business market. The launch of smaller, easier to use desktop based personal computers, larger IT systems and ancillary devices for enterprise office users created a new market to compete with the existing mainframe computer platforms. CompanyX is well established within the information technology and business systems industry with an employee headcount that has grown steadily from a few hundred people in 1981 to over 20000 IT engineering and non-technology workers stated in the 2022 annual report.

The business and customer engagement approach of CompanyX includes the following:

- The sale of IT and computer hardware and software
- The sale of installation and technical services
- The sale of IT systems maintenance and post-sales support services
- The sale of contractual or managed services to maintain and support customer IT services and technology outcomes.

Several roles are required to perform the sales and support tasks expected by customers of CompanyX. An exhaustive list is not relevant to the research question however the key jobs includes.

- Executive leadership
- Sales

- Engineering
- Consulting
- Project Management
- Customer services
- Contractual and managed services
- Operations and support
- HR & personell Management
- Finance

The primary function of CompanyX is to sell, design and implement IT products, services and solutions for large enterprise organisations to allow applications and business systems to be available to customers and users. IT field engineers as a resource pool who install and maintain technology systems, are an important technical employee community within CompanyX, an organisation which positions the management, development and retention of technical staff high on the corporate agenda.

#### 1.4.1.1 The (Information Technology) IT field engineer job

The concept of engineering may be problematic and confusing with it described as a practice, a process, a profession (Lopez-Cruz, 2022) to name a few designations. Engineers are practitioners who use technical, mathematical and scientific principles (Moaveni, 2010) to solve problems in additional to the creation and implementation of new systems and ideas (Lawlor, 2013). The same confusion positioned for engineering as a concept also applies to the computer or (Information Technology) IT engineer job role which may aligned to multiple classifiers such as information systems, computing, or information technology (ACM, 2020) with the similarities and differences only discerned after granular levels of scrutiny actual job or outcome.

Within the CompanyX technology resources group, multiple information technology jobs and roles exist with an additional designation used to identify the specialist nature of the role, for example systems engineer, infrastructure engineer, consultant and the focus of this research, IT field engineers. The field engineer term is used within many disciplines to denote an engineer predominantly working external to the CompanyX services locations, delivering services and support on a customer site or facility (Graffis, 1965). The field engineering job was historically an important one within CompanyX based on the need to offer IT services to CompanyX customers guided by mutually determined service level measured, contractual requirements.

### 1.5 The definition of mature IT field engineers used in this research.

The literature search of mature or aging population documentation suggested the published age ranges describing midlife, ageing or mature differed based on the author or research requirement and lacked a consistent and universally published definition. For the purpose of this research, circa 45 years old was positioned as the commencement age for the mature definition based on the potential for at least two more decades of employment before the current UK state pension claim age of 65. The UK government literature that defined mature as over 45 years old was used to ensure data obtained from CompanyX describing the mature engineer population was consistent across all selected individuals. The researcher used the UK government segmentation listed in (Figure 1) for guidance, which indicates the the 45-59 age group is also used in government publications (Government Office for Science, 2016, p.18).

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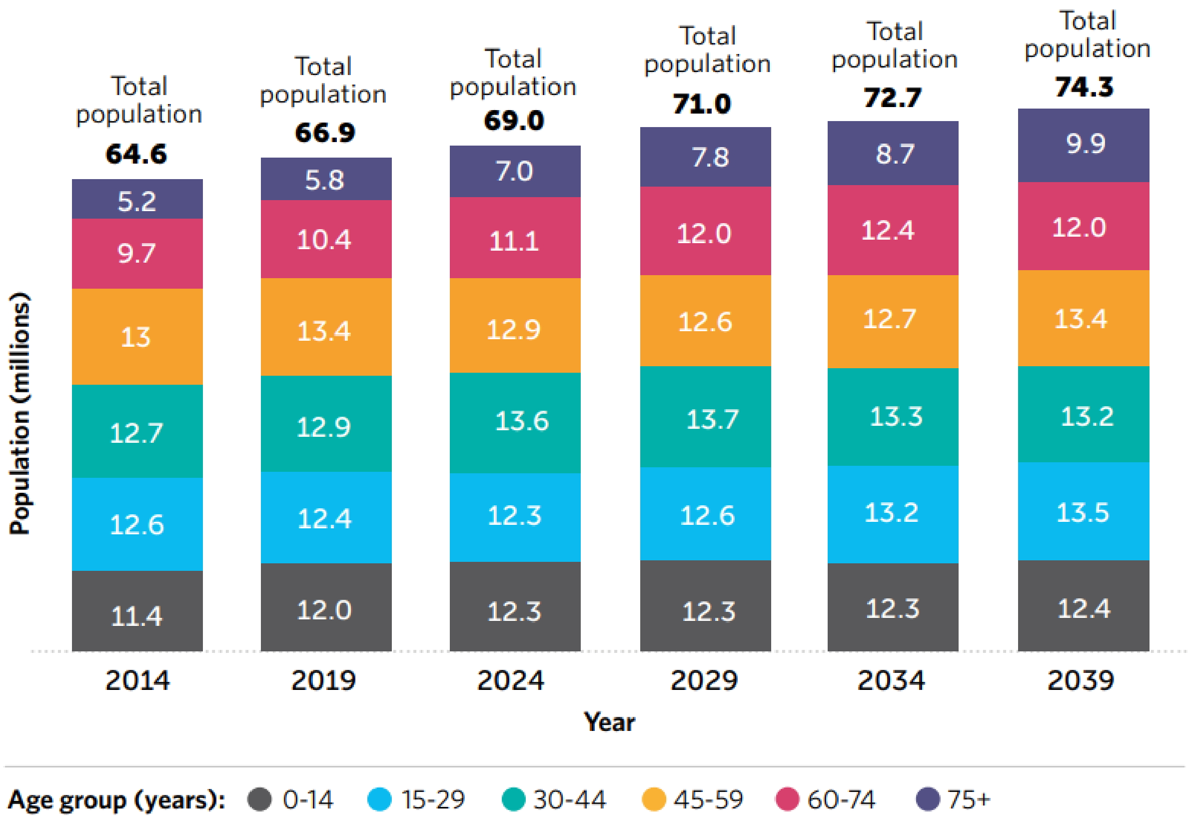


*Figure 1 – ONS UK population growth projections*

### 1.6 How does the age span align with IT engineering?

The age span for this research includes engineers aged 45 and over. This range offers additional significance when considering information technology history due to the volume and type of technology platforms the engineer potentially accessed across their career span. The world's first commodity microprocessors were created in the mid-1970s by chip manufacturer Intel, starting with the 4004, 8008 and evolving to the landmark 8086 to deliver compute functionality at the heart of new technology systems (Wood, 2008; Kaushik, 2010; Domas, 2017x`). An IT field engineer aged 45 or over with a career of twenty years or longer has been employed across many of the ground-breaking advancements in computer-based technology, including the launch of the Intel 8086 processor-based personal computers in the 80s, mobile and smartphones in the 90s, and rise of the internet in the 2000s (Vega-Gonzalez, 2007). The Intel x86 architecture continues to be the market leading personal and office computer processing environment within current Microsoft Windows-based platforms and non-windows systems from vendors, including Apple.

### 1.7 The drivers for this research

This research was driven by a need to understand an aspect of the IT industry that important to the researcher - the current and future career skills considerations of mature IT field engineers within CompanyX. A research design and theoretical approach suited to investigating the lived experiences of the CompanyX engineers was essential to determine if existing activities or unexplored practices would be highlighted within the research. The existence of a substantial population of engineers aged 45 and over, offered the researcher a valid community and data source to undertake the research. No existing hypothesis or theory was apparent prior to commencement nor considered to be the catalyst for the research and it was important to the researcher to obtain first-hand engineer accounts of areas of concern and ideas that may suggest beneficial changes. The researcher, an employee of the same organisation as the participants, had to balance an insider researcher presence but also had to be careful not to disrupt working practices or abuse the trust of the engineers (Bonner and Tolhurst, 2002). Acknowledgment of the researcher positionality as an insider researcher with an explicit co-creation role with the research participants was an important factor in the selection of a viable research methodology conducive to the construction, rather than location, of knowledge.

A qualitative research approach was selected over a quantitative method based on the researcher's objective of deriving meaning from verbose enquiry seeking to understand experiences (Gray, 2009, p.36). Ethnography was the initial research method considered and is based on the use of an observational approach to understand lived experiences and participant stories (Taylor, 2002), however the level of immersion within the engineering community to understand their day to day working lives to an effective degree required to undertake a successful ethnographic study would not be possible due to site access and the time required (O'Reilly, 2012). The goal of understanding a previously nonresearched topic and potentially creating a theory or developing discrete action items based on the generated research data without a prior hypothesis led to the decision to undertake this research of IT field engineers within CompanyX utilising a constructivist grounded theory method (Telles-Langdon, 2011). The use of grounded theory to undertake data collection and analysis was guided by the objective to achieve an analytical rather than descriptive research outcome (Arshad, Ahlan and Ibrahim, 2013) and well positioned as an approach to develop a substantive theory.

## 1.8 The researcher as an insider

The positionality of the researcher describes the philosophical viewpoint and beliefs that influence the research (Holmes, 2020) with the concepts insider and outsider used to explain the perspective adopted (Saidin, 2017). The researcher was employed by CompanyX at the time of the study in a senior technology strategy and thought leadership role with a tenure of over 10 years, and as an internal employee was considered an 'insider researcher' (Kanuha, 2020) who benefited from in-depth knowledge about the changing external market forces and industry impacts that shifted customer needs for existing engineering services. Additional considerations were required due to the study undertaken by an insider researcher which included the importance of considering bias and remaining objective (Throne, 2012), or applying undue influence over the participants (Dwyer and Buckle, 2009). However, the researcher had no line management responsibility or regular or day-to-day engagement with the IT field engineers irrespective of the age range prior to the access requested to undertake this research.

The pace of change and ongoing technology introduction in many new areas including software and cloud computing led the researcher to contemplate if the older community within the CompanyX IT field engineering population with potentially dated skills, were adequately equipped to remain effective in the fast-changing IT industry with new technology and services requirements. The preliminary literature search found no existing literature focusing on mature or older IT field engineering information technology workers therefore indicating a research gap. However, existing research was used to inform the main research question and outcomes. Goles, Hawk and Kaiser (2008) researching information technology workers described the need to reprioritize the importance of technical and non-technical capabilities as a result of industry changes to replace declining skills with new. Digitisation and the pace of change (Rachinger *et al*., 2018) was also indicated as a driver to gain new technology skills in emerging areas. Hawk et al., (2012), in addition to the attractiveness to IT professionals of the flexibility offered by a protean or boundaryless career development approach (Gubler, 2011). Existing literature also indicated the need for ongoing development due to IT workers considering skills and knowledge important elements of their professional identity (Katz, 2005). The literature summarised in this section, in addition to the researchers IT industry knowledge and experience led to the development of the main research question in section 1.9.

## 1.9 Research Aims and Objectives

### Research Aims

This study aims to understand the challenges faced by mature IT field engineers to remain effective in the continually changing information technology industry. This research addresses the career and skills needs of an ageing community of IT field engineering workers concerned about their future career prospects, based on real world considerations about the applicability and future relevance of the tasks they perform within their historical and current roles.

The following over-arching research question guided this study:

What skills, knowledge and organisational support do mature engineers perceive are required to remain effective within the information technology workforce?

Several sub-questions drove the semi-structured interview process:

- What career-aligned challenges are currently faced by mature IT engineers in the workplace?
- What do the mature IT engineers believe are the skills required to be productive?
- How are the accelerated technology changes in enterprise organisations affecting the skills required within the mature IT engineering workforce?
- What support should organisations put in place to enhance the careers of mature IT engineers?

**Research Objectives**

- To study a group of mature IT engineers within CompanyX.
- Undertake semi-structured interviews with a sample of mature IT engineers.
- Analyse co-created data using grounded theory.
- Generate findings and create a theory, if applicable

This research was based on CompanyX, an industry leading information technology product sales and service delivery organisation. The researcher, as an employee of CompanyX, sought to understand several issues affecting mature IT field engineers within the CompanyX technical resources group. A grounded theory-based research approach was selected for this research due the benefits it offered when seeking to understand real world experiences, in this situation the challenges of the mature IT engineers lived experiences and the systematic approach to data collection & analysis which potentially benefited a novice researcher (Charmaz and Thornberg, 2021).

Grounded theory was not the research approach initially considered for this study; an ethnographic approach was originally desired by the researcher based on the potential to obtain an in-depth understanding of people within their natural context (Hammersley and Atkinson, 2007). With relevance to this study, ethnographic research was positively cited as valuable in social science research in information technology organisations in the 1980s (Blomberg *et al*., 2002). However, ethnography, after a thorough review of the research aims, was considered impractical due to the length of time required in the field for the researcher to investigate the areas of consideration effectively. Instead, a grounded theory based research approach was deemed an effective research approach to investigate and understand the issues highlighted within the research aims where limited extant research was available to gain insight.

This research aims to deliver a contribution to professional practice aligned with furthering understanding of the career and skills development needs of the maturing IT workforce. With nearly thirty years employed in the IT profession, the researcher was aware of the need to extend the body of academic work explicitly aligned with the development of the profession as both the technology and the personnel- employed within the profession has evolved.

### 1.10 Conclusion

This chapter summarised the rationale of the research and the decision to focus on mature IT field engineers with an emphasis on skills in addition to their current future career considerations which may impact their professional identity within CompanyX. The chapter explained several definitions utilised to deliver the scope of the research along with the decision to utilise the mature IT field engineer's population within CompanyX for the grounded theory study.

The explanation of the historical context of technological milestones that created the x86 personal computer-based industry that remains pervasive and effective in the present day, helped to position the role of the now mature IT field engineering workforce. The chapter concluded with an initial explanation of the researcher's job role and 'insider' positionality as an employee of CompanyX and how this influenced the research aims and original question.

The chapter that follows will explain the research concepts and aims that drove the initial literature scoping activity and guided the research.

# Chapter 2: Preliminary literature review

## 2.1 Introduction

This section discusses the preliminary literature review process and the areas identified via a limited search of extant work associated with subjects applicable to this research. The topics included careers and mature IT engineers, skills development in technical domains, and the impact of IT-enabled digitisation on organisations, which may influence the skills required by technical employees. Appraisal of literary work in these areas and associated topics assisted with the positioning of this study in relationship to existing research.

## 2.2 Literature reviews in grounded theory research

A literature review helps the researcher to search for and to locate literature related to the study topic (Creswell, 2014, p. 27). Grounded theory was chosen as the methodology for this research and uses literature reviews in a different manner when compared to other forms of qualitative research. The founders of the grounded theory methodology suggested researchers should "ignore the literature on the area under study in not to contaminate the emergence of categories" (Glaser and Strauss, 1967, p. 37). The result of this academic guidance led to the creation of a preliminary literature review within this chapter to determine the research gap, followed by a later main literature review within Chapter 5, which was informed by the coding process.

This section describes the preliminary literature review undertaken to locate and evaluate existing academic literature that offered an appreciation of the research topics. While undertaking this review at this early stage, it should be noted that the researcher was not fully steeped in the literature to be constrained by it (Strauss and Corbin, 1998, p. 49). However, it was deemed important by the researcher to commence awareness of relevant academic work to the benefit of the overall research activity. Dey (1993, p. 65) explains, "In short, there is a difference between an open mind and empty head and the issue is not whether to use existing knowledge, but how”. Charmaz (2006) considers the contested nature of grounded theory literature reviews and highlights it as an ongoing activity in relation to the grounded theory. This research was guided by Charmaz’s constructivist grounded theory and whilst acknowledging the Charmaz perspective of an ongoing literature review, this review was separated into preliminary review (the sections that follow) at the start of the research and a later in-depth review after the coding process for theoretical integration.

The following section describes the preliminary literature review undertaken to search for literature discussing the career and skill choices of mature IT engineers. The section documents the potential author tensions, the outcomes of the preliminary literature review and summarises how an intentional systematic approach to such review is aligned with the original intention of the grounded theory method (Hussein *et al*., 2017, p. 1200). The literature search was guided by a number of broad search terms driven by theoretical sensitivity, with a selection of terms listed in Figure 2 and expanded upon in Appendix 1.

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| Preliminary Literature search strings - 2018 | | | |
|---|---|---|---|
| Generation X IT engineers<br>Generation X IT consultants<br>Generation X IT specialists<br>Generation X IT resources<br>Generation X IT workers<br>Generation X IT employees | Ageing IT engineers<br>Ageing IT consultants<br>Ageing IT specialists<br>Ageing IT resources<br>Ageing IT workers<br>Ageing IT employees | Generation X Information Technology engineers<br>Generation X Information Technology consultants<br>Generation X Information specialists<br>Generation X Information resources<br>Generation X Information workers<br>Generation X Information employees | Mature IT engineers<br>Mature IT consultants<br>Mature IT specialists<br>Mature IT resources<br>Mature IT workers<br>Mature IT employees |
| Mature Information Technology engineers<br>Mature Information Technology consultants<br>Mature Information specialists<br>Mature Information resources<br>Mature Information workers<br>Mature Information employees | Digitisation IT skills<br>Digitisation IT engineering | Ageing Information Technology engineers<br>Ageing Information Technology consultants<br>Ageing Information specialists<br>Ageing Information resources<br>Ageing Information workers<br>Ageing Information employees | |

*Figure 2 - Literature search string examples*

The search engines and platforms outlined in Figure 3, plus other relevant literature repositories were used to locate content to gain an appreciation of existing literature in the broad research area and to determine if a gap in knowledge existed. An in-depth literature appraisal was not undertaken in order to remain aligned to grounded theory guidance to minimise early stage literature searches.

| Preliminary Literature search sources - 2018 |
|---|
| Search sources:<br>scholar.google.com, Worcester university library (Online & in person), Worcester University Meta search capability, Researchgate.com, journals.sagepub.com, link.springer.com, core.ac.uk, the Google.com search engine (located sources cross check via Worcester University Online library meta search engine). |

*Figure 3 – Literature search sources*

## 2.3 Preliminary literature review findings

A literature review is a contextual, informative, evidence-based appraisal of current collective knowledge of a subject (Winchester and Salji, 2016). The preliminary literature review was undertaken in a limited form considering Glaser's and Strauss' guidance to delay substantive searches of literature to remove the potential to contaminate the researcher's viewpoint (Glaser and Strauss, 1967, p. 37; Dunne, 2011, p. 113). McGhee *et al*. (2007, p. 339) explains an exploratory review of the literature can useful if undertaken prior to the final decision regarding the general focus and specific method of the study.

The search topics were intentionally broad using the context of CompanyX and included mature engineer skills, development of technical engineers, impact of digitisation on IT skills, and career development IT engineers as examples of the range of search topics. The topics were used as search terms (examples summarised in Appendix 1) to search online academic data sources and physical documents to obtain an awareness of existing literature and research.

The preliminary literature search failed to locate relevant literature describing the career development needs of IT field engineers or more importantly, mature or older IT engineers. This helped to confirm the existence of a knowledge gap due to this research focusing on the mature IT field engineering cohort within CompanyX. However, by changing the search criteria from IT engineering to IT professionals, the importance of career satisfaction was found to be more important to IT professionals than non-IT professionals who may then consider a career change if affected by diminishing skills (Fu, 2010). Additionally, Goles, Hawk and Kaiser (2008) researching information technology workers emphasised the importance of replacing declining skills with newer and demand technical and non-technical skills to remain relevant. Joseph, Ang and Slaughter (2005) also using the IT professional term determined the prototypical IT career path in the IT industry may not be a dual technical or managerial career, but also include a boundaryless employment or protean self-directed career paths. Boundaryless careers differ from a traditional single employer with the employee, instead working in a portfolio nature across multiple organisations (Arthur and Rousseau, 1996), with protean careers shifting the responsibility of career direction and development from employer to employee (Hall, 1976; 1996). Gubler (2011) via research of IT professionals found protean and boundaryless careers beneficial to talent acquisition and workforce retention with the additional flexibility making careers in IT more attractive to prospective candidates.

A full description of the available jobs and roles within the information technology industry is out of the scope of this research, however, as mentioned in Chapter 1, the broad definitions available within the information, technology field (ACM, 2020), make it challenging to search for universal topics. Hawk *et al.,* (2012) considering workforce shortages of technical personnel in and technology services providers explained the accelerated market change because of digitisation and growth has broadened the skills required IT personnel to include both customer engagement and modern technical skills. Litecky *et al*., (2009) researching the information systems marketplace summarises a rich span of jobs and skills required to obtain an effective career in the IT industry including applications development, database skills, networking to name a few.

The term Information technology (IT) professional describes individuals who are engaged in the design, deployment and support of information or computer-based systems (Fu, 2010). However, multiple definitions exist to define professional and professionalism with (Fidel and Garner, 1990) positioning the importance of control of development, peer review and standards with a broader summary from the UK CIPD including skills, social responsibility, commitment, CPD, judgement, and identity (Baczor and Zheltoukhova, 2017). The IT profession lacks the maturity and perception of professional trust underpinned by values and behaviours granted to the medical or legal professions (Cruess and Cruess, 2012), therefore may viewed as not exhibiting the characteristics of a strong profession (Smith, 2016). An individual's job and skills and experiences in the workplace, are important elements that form their professional identity (Ibarra, 1999). Katz (2005), explains professional identity is important to IT employees with their value, enhanced if they are viewed as experts in the field. Smith (2016) emphasised the importance of an accreditation and certification at the heart of the professional identity of information technology professionals. The knowledge and industry recognised certification individuals obtain helps with their sense of belonging and strengthens their professional identity (Tsakissiris, 2015). Loogma, Umarik and Vilu (2004) extends this further by emphasising knowledge and a deep interest in information technology are at the core of the professional identity of IT specialists. However, Brooks *et al*., (2011) highlights the professional identity of information technology workers may now be challenged due to the accelerated changes in the industry which can include outsourcing of traditional jobs, the need for new skills and a lack of consistency across the industry.

Due to the limited availability of ageing or mature worker IT field engineering literature, broader employee skills and career development outcomes were also considered. The literature review located a substantial body of work aligned with generic HR and academic perspectives on ageing in the workforce, which included discrimination (Weller, 2007), continuing professional development (Galloway, 2000), motivation (Thieme, 2015; Kim, 2006), competitive advantage (Luftman, 1997; Mountford and Murray, 2008) and training effectiveness of older workers (Zwick, 2011). None of the papers and literature reviewed explicitly aligned with the IT profession or technical knowledge workers in other professions but were of sufficient interest based on a focus on workforce ageing.

The significance of the age range positioned for the study was explored within the preliminary literature search. Price and Colley (2007) looked at an ageing workforce, those over the age of 45, and found that employers who wanted to retain staff failed to implement many well-known strategies. Such activities included flexible hours, teamwork and mentoring. The search activities failed to locate consistent definitions and demarcation for workforce age groups that defined the start of the mature age range. However, the over 45 workforce age definition considered by Price and Colley reinforced the time span considered applicable to the research.

Management of older workers and skills development were individually searched to understand general approaches that may also apply to mature IT engineers. Hashim and Wok (2013) focused on older worker competence and the extent to which they are trainable. They found that older workers perform well and are competent and trainable but that differences exist between older academic and administrative workers. Verworn and Hipp (2009: p.193), researching the link between older workers and business innovation, suggests “older workers who take on new or more challenging roles may maintain or improve their performance across their lifespan". Recommendations of this nature may encourage organisations to allow mature workers to remain longer in the workforce.

Digitisation (i.e., the process of converting analogue data into digital data sets) is the framework for digitalisation, which is defined as the exploitation of digital opportunities to transform and restructure economies (Rachinger *et al*., 2018). Digitisation was included in the literature search due to its impact on existing engineer and broader workforce technical skills. The information economy is crucial to the success of the UK (HM Government, 2013). The technology sector employs in the region of two million workers (CompTIA, 2022) and provides circa 8% of the UKs economic output 2021 (Powell, Booth and Sutherland, 2023) with the sector surpassing a valuation of over $1 trillion in 2023 (UK Government, 2023). The UK government's information technology agenda is supported by the department for business, energy & industrial strategy (BEIS) digital, data and technology function (DDAT) who are responsible for the skills, technology platform and programmes (Holderness, 2017). Digital skills and literacy, explained by Eshet-Alkalai, considers any area of increasing importance amid such wide scale digitisation. Eshet-Alkalai (2004: p.102) defines digital literacy "as survival skill in the digital era", thus an understanding of a range of digital literacy skills possessed by the ageing IT workforce may indicate the relevance of such skills to the community.

The preliminary literature review achieved the purpose of building an awareness of the broader research area, identifying terminology that may be helpful later in the study and reinforced the value of the research due to limited availability of literature located corresponding to the research question and aims. The following (figure 4) summarises the early topic areas of interest highlighted via the preliminary literature search for consideration through the research based on relevance with the inductive concepts created by the data.

| **Literature Categorisation – 2018** |
|---|
| Skills development in a multi-generational context (broad search) |
| Engineering worker skills development (broad context) |
| Scientific worker skills development (broad context) |
| Mature worker skill and career development (General) |
| Workforce management and employee motivation (age defined) |
| Mature IT workers skill and career development (IT or information technology explicit) |
| Ageing or older IT workers skill and career development (IT or information technology explicit) |
| Generation X IT workers skill and career development (IT or information technology explicit) |
| IT consultants |
| IT resources (people) |
| Digitisation (impact on technology or IT) |

*Figure 4 - Literature categorisation (historical example)*

### 2.4 Chapter Summary

The objective of this chapter was to gain awareness of existing literature using topics within the context of CompanyX and the research aims. There was a lack of research explicitly referencing mature IT field engineering skills, mature IT career development and mature IT engineer pre-retirement employment decisions. The literature search identified a research gap when framing searches to locate extant literature describing the skills and career development of IT engineers and more importantly mature or older IT engineers.

Guided by a lack of literature located when searching for mature IT field engineering people development topics, the search was broadened in scope to include general personnel development topics relevant to mature or older technical employees, the mature or ageing workforce and skills development of technical or scientific individuals. The broader themes not based on an IT engineering context identified areas, including the digitisation impact, skills development of older workers and workforce motivation option for workers over 45, for analytical consideration within the research. Literature was also located positioning the importance of accreditation and certification at the heart of IT workers professional identity and their sense of belonging. The findings from this preliminary literature review supported the need for this research to fulfil the research aims and objectives based on the existence of a gap with the research on completion contributing to the body of knowledge A further substantive literature review based on the data generated by this study will be summarised in the analysis and findings chapter.

# Chapter 3: Methodology

## 3.1 Introduction

This chapter will explain the research methodology and follows with a detailed explanation of the ontological and epistemological position of the study and expected outcomes. It describes the selection of a qualitative research approaches based on the benefits to a narrative and people-based context. The use of Charmaz's constructivist grounded theory is presented and is well positioned to explore phenomena with limited prior research. This chapter highlights the value of reflexivity due to the insider researcher position at the heart of this study and then concludes with a summary of the ethical considerations that ensured the study was undertaken in a manner that protected the participants and CompanyX.

## 3.2 Ontology

Ontology is "the study of being" (Crotty, 1998, p. 10; Gray, 2009, p. 10) or the understanding of "what is" and it interrogates the researcher's assumptions of reality. This research aims to understand a particular phenomenon which aligns with an ontological position, based on an interpretivist perspective, that no single reality exists and social engagement with the world creates knowledge (Locke, 2001). A relativism-based philosophical viewpoint is congruent with the perspective of the co-creation of knowledge based on participant interactions to be able to understand the mature IT field engineers in their social or work settings. Interpretivism has a 'relativist' ontological perspective (Ryan, 2018, p. 9).

The preliminary literature review exposed a gap in knowledge reinforcing an approach that encourages an exploration of all possibilities, creating new ideas, if required that are well suited for the phenomena. An interpretivist viewpoint differs from a positivist viewpoint with a shift away from a deductive approach that tests an existing phenomena or theory to an inductive "constructed knowledge" philosophy that seeks first to understand then analyse data and then develop a theory. Interpretivism seeks to understand and interpret the meaning derived from the studied subjects as they culturally and socially interact (Crotty, 1998, p. 67; Saunders *et al*., 2009, p. 116). Constructivism, the theoretical perspective linked with interpretivism, argues that truth and meaning is constructed, not found (Gray, 2009, p. 20). Constructivism aligns with the researcher's philosophical view that knowledge is gained via an active construction process, with understanding gained through experience (Adom *et al*., 2016). The driver for this research was personal motivation based on a theoretically sensitive view of the broader IT industry and changes that may affect an engineering workforce with a long tenure. An inductive, constructivist approach is well aligned with the outcomes of this research with the data being central to creating a theoretical view in the context. The research objective of theory development through participant interviews along with data collection and analysis to create meaning aligns with a constructivist research perspective (Bisman and Highfield, 2012).

## 3.3 Epistemology

Epistemology serves to determine how knowledge is known and the characteristics that allow us to determine true knowledge (Guba and Lincoln, 1994, p. 108; Crotty, 1998, p. 3; Kivunja and Bawa Kuyini, 2017). The epistemological viewpoint of this research is informed by constructivism based on the need to explore and understand skills, social interactions, and contextual meaning, within a community of mature IT field engineers with different personal experiences. According to Balbi (2008, p. 16), "constructivism is an epistemological premise grounded on the assertion that, in the act of knowing, it is the human mind that actively gives meaning and order to that reality to which it is responding". By interviewing the engineers, to understand how they view the world and then analysing the data, knowledge aligned to the phenomena was mutually created and was guided by the research objectives within the context of the interaction. Constructivism emphasises the subjective interrelationship between the researcher and participant, and the co-construction of meaning (Mills *et al*., 2006, p. 26).

Working as an employee of CompanyX and with nearly 30 years within the information technology profession brings past experiences, tacit understanding, assumptions, and beliefs that cannot be ignored or deemed to have no influence in the knowledge created. Memos and reflective journals were used to acknowledge and annotate beliefs, positionality, and the co-created nature of the research data. The advantages of an insider researcher include having an existing understanding of the culture, the lack of destabilisation of the social culture, and having existing intimacy with the company and its processes (Bonner and Tolhurst, 2002). The researchers position as an insider of CompanyX helped to put the participants at ease as they were aware that they were talking to someone aligned to the company culture and values. Unluer (2012) explains that the familiarity of the insider researcher position can lead to a loss of objectivity and that this can be countered by remaining reflexive and using constant comparison when analysing data.
The use of reflexivity by the researcher became second nature concurring with (Subramani, 2019) who highlighted the importance of consciously treating reflexivity as a practice of doing research rather than an academic virtue. In this study, having the position of a knowledgeable CompanyX insider played an active role in the creation of knowledge and trustworthiness of the research in a social context due to the researcher's domain understanding of how best to engage with the mature IT field engineers within their work surroundings. Charmaz, summarising an equivalent constructivist stance explains "researchers are part of what they study, not separate from it" (Charmaz, 2006: p.178).

### 3.4 The selection of grounded theory

The research was based on an employee population within CompanyX with an emphasis on 'understanding' the skills, career development needs of mature IT field engineers, which led to the selection of grounded theory as the chosen methodology guided by the benefits of the approach when previously unresearched areas are studied or explanations are required (Sebastian, 2019; Charmaz and Thornberg, 2021). It was important for this research, as the study of the IT field engineering field where limited extant literature was located at the outset, to utilise a research approach with a well-defined process and the findings grounded in the research data to ensure research quality and rigour (Chun Tie, Mills and Francis, 2019) were maintained.

Grounded theory research, which is aligned to an interpretivism based ontology and constructivist epistemology (Charmaz, 2006) is described as "the discovery of theory from data systematically obtained from social research" (Glaser and Strauss, 1967, p. 2). Glaser and Strauss were trained in both the Columbia University quantitative methodology and the Chicago School qualitative research approach and sought to close the gap between theory creation and empirical research. Grounded Theory is a research methodology underpinned by the constant comparison of data to create codes, categories and, where possible, a theory grounded in the data generated (Glaser and Strauss, 1967, p. 21; Charmaz, 2006; Charmaz, 2012, p. 4; Breckenridge, 2014; Kenny and Fourie, 2015; Hussein *et al*., 2017).

Grounded theory as the methodology for this research offered benefits which included the value of theory creation, a constant comparison approach to help the researcher to understand the hidden signals and potential to understand first-hand experiences of the mature engineers discussing a phenomenon with little prior research (Abdellah, 2016; Noble and Mitchell, 2016). Ethnography was also considered based on the potential to understand the experiences of the engineers immersed within their social settings, but the time required to remain within the environment and access challenges made successful execution of an ethnographic approach unfeasible. Ethnographers participate either overtly or covertly in the observation of people's lives, paying attention to what is happening over an extended period of time, and asking questions and understanding issues (Genzuk, 2002; Hammersley and Atkinson, 2007). There was no detriment to the research outcome based on the use of grounded theory over ethnography, with both approaches being person centric and inductive in nature. However, the additional theory creation aspect of grounded theory was an added benefit in addition to the potential to deliver a tangible, theoretical contribution to practice.

Grounded theory facilitates an inductive approach of comparative analysis with the end output the generation of a theory based on findings grounded in the data, words and behaviour of the studied aspects (Strauss and Corbin, 1990, p. 111; Goulding, 2002, p. 40; Draper, 2004, p. 31; Charmaz, 2006). The inductive nature of grounded theory, developing theories from generated data based on their experiences and their views of the future, will facilitate a greater understanding of the skills and career development needs of mature IT field engineers within CompanyX. Grounded theory offers the potential for a substantive theory developed from a particular area of study to be used as a general theory in another area or domain (Alemu *et al*., 2015), positioning it well as a methodology that may deliver a theoretical contribution to practice.

The preliminary literature search highlighted a lack of existing theories or published work discussing the skill and career development needs of the mature IT field engineering community at work. This absence of theories within this topic area led to the selection of the grounded theory methodology to further understanding in the field, thereby leading to the development of a theory. Locke (2001, p. 111) argues that the variety within grounded theory is constrained only by a researcher's creativity and the plausible interpretation of their data. This research within CompanyX is guided by interpretivism, which is based ontological beliefs leading to the initial rejection of grounded theory, based on misunderstood alignment with a positivist paradigm. Charmaz explained, whilst Glaser and Strauss fought the dominance of positivist research in the 1990s, by the 1990s grounded theory had become known for its positivistic assumptions in addition to its rigour and usefulness (Charmaz, 2006, p. 9). Further reading suggested grounded theory as a methodology and method was applicable within qualitative, quantitative, and mixed methods research designs with the application determined by the researcher irrespective of philosophical position (Urquhart, 2002).

The choice between classic Glasserian grounded theory and constructivist grounded theory should be guided by ontological and epistemological research beliefs (Groen, Simmons and McNair, 2017). The need to understand, interpret, analyse and create data to explore topics of mature IT field engineering worker skills and career development where no extant work had been found is in keeping with a constructivist-based research paradigm.

Of the three significant grounded theory approaches, Glaser and Strauss, Strauss and Corbin, and Charmaz, the Charmaz constructivist methodological approach was selected based on alignment with the researcher's epistemological viewpoint and the rigour offered by the well documented constructivist Charmaz framework (Charmaz, 2006, p. 130; Kenny and Fourie, 2015, p. 1278). The nature of constructivist grounded theory, acknowledging the interaction between researcher and subjects to create knowledge (Sebastian, 2019), was well placed to understand the previously unexplored phenomena of the experiences of mature IT field engineers and the skills and development they require to be effective in a changing technology world.

Whilst many grounded theory approaches leverage the original Glaser and Strauss fundamentals, differing approaches to coding, the use of literature and opposing philosophical positions means they are not interchangeable (Willig, 2013, p. 76; Kenny and Fourie, 2015, p. 1272). Glaser and Strauss originally formulated grounded theory as a systematic approach with theory generated based on the use of comparative analysis and theoretical sampling with each data collection stage, based on gaps identified in the previous stages (Glaser and Strauss, 1967, p. 47). Strauss and Corbin adapted the initial grounded theory approach and developed a more prescribed and rigorous approach to coding, leveraging Strauss's axial coding technique (Bryant and Charmaz, 2007, p. 201). The Charmaz constructivist approach uses constructivist ideals to deliver a dynamic grounded theory approach that will enable a more imaginative interpretation of the data (Charmaz, 2006, p. 126; Creswell, 2012, p. 429), which will benefit the investigative nature of this research.

The selection of the Charmaz constructivist grounded theory replaced the initial choice of the Strauss and Corbin derivative. Both theoretical approaches incorporated the core original Glaser and Strauss coding theories however, are interpreted differently. The Strauss and Corbin grounded theory approach was based on Strauss's earlier defined coding paradigms, an approach created to reduce the common tendency for researchers select specific data and precis it (Strauss, 1987, p. 29). Together, they created a step-by-step approach to grounded theory and coding that was more instructive that previous iterations (Charmaz and Bryant, 2007, p. 202). For this research, the heavily documented and rigorous open, axial and selective coding approach defined by Strauss and Corbin was initially considered but was then deemed unnecessarily restrictive with additional the rigour stifling creativity when the methodology was embraced to its fullest extent. The Charmaz constructivist grounded theory mirrored the Strauss and Corbin methodological approach but with different names for the primary stages - initial, focused and theoretical coding. Charmaz acknowledged the value of axial coding but advocated for an alternative approach that would allow the data to expose the theoretical pattern required, not the guidance of an additional framework (Charmaz, 2006, p. 63). Concurring with Charmaz, an axial coding stage was not used within this study due to theoretical sensitivity at play and the richness of data created within the initial and focused coding phases.

Constructivist grounded theorists argue that interviews cannot be neutral and, by engaging in the discussion, ideas are raised and discussed with knowledge mutually constructed (Charmaz, 2006; Mills *et al*., 2006, p. 9). On reflection, the interviewer experienced this first-hand with an interview participant recounting, "I wish someone had held this style of conversation with me previously". This example delivered positive reinforcement of the selection of constructivist grounded theory and suggested that the interviewee gained an unforeseen, unexpected personal benefit from the social interaction facilitated by the interview process.

Charmaz's constructivist grounded theory is not viewed favourably by all including, most notably one of the founding authors of the grounded theory methodology, Barney Glaser. Glaser expressed concern that constructivist elements only apply to a small data collection aspect of the classic grounded theory approach (Glaser, 2002) and the constructivist tone of Charmaz grounded theory erodes the conceptual nature of the original methodology, replacing it with an interpretive description of participant experiences (Kenny and Fourie, 2015, p. 1282). Whilst the Glaser's concerns of the constructivist elements were considered within this research, they were rejected with the possibility to obtain a first-hand account directly from the engineers via the interview process, interpret and analyse the transcribed viewpoints an aspect of Charmaz constructivist grounded theory deemed highly beneficial. Numerous aspects of the core components of classic grounded theory, including memo writing, are retained by the Charmaz constructivist approach to assist with reflexivity, conceptualisation, data analysis, constant comparison and, ultimately, theory creation (Charmaz, 2006), ensuring no concerns existed about effectiveness of the methodology selected.

## 3.5 Symbolic interactionism

Grounded theory was selected for this research based on the importance of understanding and creating a contextual account of a phenomena within the information technology field with limited prior academic work. Symbolic interactionism with documented historical links with grounded theory informed this research based on the importance of determining the meaning the engineers aligned to action and social engagement. Symbolic interactionism is referred to, but without detailed context, in Glaser's and Strauss' initial work, the Discovery of Grounded Theory (Glaser and Strauss, 1967). "Fieldwork was begun first at the private hospital and directed initially only by the frameworks of ideas, known as the .. sociology of work and symbolic interactionism" (Glaser and Strauss, 1967: p178).

Strauss is described as bringing the symbolic interactionist influences of the 1930s University Chicago school of thinking to the approach (Charmaz, 2008; Jones and Alony, 2011, p. 4; Gray, 2015, p. 839). Strauss emphasised field research, viewed individuals as active agents, saw interaction as open ended, took into account language and meaning, and focused on action, all of which informed grounded theory (Charmaz and Bryant, 2010, p. 407). The link between grounded theory and symbolic interactionism was further reinforced via the publication of the 'Lost Chapter' by Corbin and Strauss explicitly aligning the core tenets of grounded theory with symbolic interactionism (Chamberlain-Salaun *et al*., 2013, p. 2).

Blumer (1969), the main historical proponent of symbolic interactionism positions three key premises for the theory:

> “Human beings act toward things on the basis of the meanings that the things have for them.
> The meaning of such things is derived from, or arises out of, the social interaction that one has with one's fellows.
> These meanings are handled in, and modified through, an interpretative process used by the person in dealing with the things he encounters”.

The importance of the interpretation of meaning and agency become significant when considering the Blumer principles above (Charmaz, 2014: p.265). In the case of this research, agency describes the decisions and actions of the mature IT field engineers as they consider the options available that influence their current and future careers. “Symbolic interactionism is theoretically focused on the acting individual; the individual is regarded as determining rather than determined and society is constructed through the purposive interactions of individuals and groups” (Klunklin and Greenwood, 2006).

The awareness of symbolic interactionism within this research was less to do with a default historical alignment but instead guided by awareness of the heavy use of language analysis and interpersonal participant engagement via interviews. Symbolic interactionism focuses on the use of language and symbolic representations that describe social engagement. According to Aksana *et al*., (2009, p. 903), “Language provides a meaning to humans by means of symbols. It is symbols that differentiate social relations of humans from the level of communication of animals”. The world of an IT field engineer and the language used within the industry is guided by a number of highly visible technical symbols that form the dialect but equally invisible social and behavioural symbols at the heart of IT communities. "Any significative theme that spans spheres of reality may be defined as a symbol, and the linguistic mode by which such transcendence is achieved may be called symbolic language” (Berger and Luckmann, 1966: p.40). Understanding the mature IT field engineer’s first-hand account based on the symbolic language transacted within their domain was considered a key outcome which aligns with (Carter and Fuller, 2015: p.1) who described symbolic interactionism as “developed to understand the operation of society from the ‘bottom up,’ shifting the focus to micro-level interaction that’s emerge via discourse during face-to-face encounters in order to explain the operation of society”. By understanding socially derived IT language and discourse, the experiences of the engineers within become clearer.

Engagement with the IT field engineers, informed by an interpretivist epistemology, was based on the importance of interpretation of human behaviour, expectations and outcomes. Symbolic interactionism is equally based on interpretivist perspectives. Blumer (1986, p. 1) describes it as “the study of group life and human conduct”. This paradigmatic view guided the research strategy and approach, encouraging ongoing analysis to continually explore the data for new or hidden meanings. Information technology engineering, also common in other technical disciplines, is awash with symbolic representation via behaviour and the use of acronyms that convey meaning in codes, symbols and subtext, exposing an overt and convert dialect to drive human behaviour and action in a manner that non technologists may struggle to understand.

### 3.6 The selection of a qualitative research method

Two distinct research paradigms, i.e., quantitative and qualitative, were considered when designing the current study. The qualitative research method can be defined as an approach that allows a researcher to examine people's experiences in detail by using specific research methods such as in-depth interviews, focus groups, observation, content analysis, life histories, or biographies (Hennink *et al*., 2011). Multiple academic description of the qualitative research approach and its associated methods exist, which led Ritchie and Lewis

(2003: p.2) to explain the diversity of qualitative research definitions makes the creation of a precise one ‘no mean feat’. However, the people and experience context offered by Hennink *et al*., (2011), is mirrored in a second definition from Haradhan, “Qualitative research is a form of social action that stresses on the way of people interpret, and make sense of their experiences to understand the social reality of individuals (Haradhan, 2018: p.2).

Creswell (1994, p.4) explains the basis of a quantitative approach aligns with the traditional, positivist and empiricist paradigm, whereas a qualitative approach follows an interpretivist, constructivist or naturalist paradigm. This research uses a qualitative research approach to analyse the text-based primary data transcribed from participant interviews, integrated with secondary data derived from cross disciplinary literature (Hallberg, 2010), located by the main literature search undertaken in Chapter5. Qualitative research methods enable focus on the unique individual aspects of the social world (Crotty, 1998) rather than quantifiable, empirical phenomena. Limited research was found via the preliminary literature search to describe the skills, support and career development considerations of mature IT field engineers to ensure they remained effective and employed in the future. Based on the researcher’s desire to understand and investigate a new topic to create knowledge, constructivist grounded theory using qualitative methods was selected for this research as it can be a valuable tool of investigation when little is known about a problem, situation or context (Austin and Sutton, 2014). In keeping with the earlier qualitative research definitions, this is a study of people, their experiences and social interaction elements which are aligned with the tenets of an inductive, qualitative research approach (Charmaz, 2008).

### 3.7 Sampling

Sampling is the selection of a subset of the population of interest in a research study (Turner, 2020, p. 8). The sample was taken from a population of 561 mature IT field engineers employed by CompanyX. The mature engineer age range was researcher-formulated and defined as 45 years old or older. Price and Colley (2007, p. 2), and the UK Government Office for Science (2016, p. 18) also utilise this age range to define older workers. However, no consistent mature or older employee age designation was identified by the preliminary literature search, with authors defining their own. The sampling frame consisted of CompanyX IT field engineers, selected based on a job title within IT field engineer family (the broad span of job labels defining the core role was indicated earlier), UK wide, aged 45 and older, male or female with more than one year of employment. Several new employee induction and initial training activities consume the first six months of employment with the following six months helping engineers to bond with the team and operational structure. Because of this, employees with less than a year of service may possess inadequate assimilation into the cultural and social dynamics of the team and, without a complete year acting on agreed development activities at an annual review, may lack the depth of understanding required to contribute to this research.

Data was formally requested and obtained from the CompanyX human resources (HR) team to construct the sampling frame. To ensure compliance with General Data Protection Regulations (GDPR) and data protection, regulations for access and use of data containing personally identifiable information were followed. Data supplied by the HR service team only contained the engineer’s name, the age (over 45 years) and that they were employed by CompanyX for more than one year. Probability sampling, one of the most rigorous sampling approaches (Creswell, 2012, p. 142) was rejected for this research because a statistical sample was not required nor needed to ensure the population had an equal chance of selection (Showkat and Parveen, 2017). Ritchie and Lewis (2003, p. 78) outlined the importance of a probability sampling approach to deliver a statistical estimate of characteristics that can be applied to a wider population. However, the focus of this research included a narrow age range and specific job title for employees within CompanyX.

Non-probability sampling is a convenient way for researchers to assemble a sample with little or no cost and/or for research studies that do not require representativeness of the population (Verma *et al*., 2017, p.300). Purposive sampling, a non-probability approach that allows for specific selection of the population, was adopted for this research. Nonprobability sampling is a common technique in qualitative research where researchers use their judgment to select a sample (Given, 2008, p. 562). A non-probability purposive sampling-based method was chosen to enable the selection of the desired subset (over 45 years old) of IT field engineering participants from the broader overall population of CompanyX IT field engineers. Purposive sampling ensures all of the key constituencies of relevance to the subject matter are covered and allows for diversity in each criteria so that the impact of the characteristic concerned can be explored (Ritchie and Lewis, 2003, p. 79). A purposive sampling approach was considered applicable because participant selection, mature IT field engineers within a designated age range, was intentional rather than random. Purposive sampling is a set of procedures where the researcher manipulates the generated data, analysis, theory, and sampling activities interactively during the research process to a much greater extent than in statistical sampling (Mason, 2002, p. 138).

Even with the small number of available female participants, gender was viewed as a viable additional subgroup to ensure sufficient representation of the 24 female engineers. Stratified purposive sampling, allowing for a strata or subgroup to be selected was used to develop a modified sampling frame by using the age defined sample sub divided into male and female strata. Creswell (2012, p. 144) echoes stratified sampling as viable “when the population reflects an imbalance on the characteristics of a sample” (gender is an example of this). Figure 5 shows the initial sample selection and population.

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| **Total Population *(within age range)*** | **Number of male engineers *(within age range)*** | **Average age of male engineers** | **Number of female engineers *(within age range)*** | **Average age of female engineers** | **Total stratified research sample *(male and female)*** | **Male sample strata** | **Female sample strata** |
|---|---|---|---|---|---|---|---|
| 561 | 537 | 52.5 | 24 | 51.1 | 30 | 28 | 2 |

*Figure 5 - Research sample dimensions*

The mature IT engineer data file consisted of full name, length of service, regional team name and role title and was analysed using Microsoft Excel for sorting and grouping. Gender was not stated within the file and was determined by the researcher using participant name. It is acknowledged there may be a margin of error utilising participant name to determine gender but this was deemed acceptable by the researcher to align with data handling practices and to ensure minimal personal information existed in the originally requested master data file. Based on the names used, confidence was high that the male and female IT field engineer sample groups were sorted accurately.

Microsoft Excel was used to sort the data into regional engineering groups with each engineer group exported as separate file and sent to the respective engineering regional managers for a data integrity check (to remove leavers) and consider additional HR factors for the engineers listed within the file to participate in the research activity. Valid reasons for exclusion included engineers in their employment exit timeframe, long term health issues (offline, not participating in daily work), outstanding or in progress employment grievance cases, extraordinary organisational change or incorrect categorisation in the human resources master engineer data file supplied.

Five hundred and sixty-one names were submitted to the IT engineering team gatekeepers, the regional managers for review with 90 consequently removed from the master data file. The final sample pool of mature IT field engineers available for selection, over 45 years of age, was 471 mature IT field engineers. Microsoft Word mail merge was used to email the selected IT field engineers with an invitation to participate in the study. The email included an overview of the process and research aims (Appendix 2 & 3), about the semi-structured interview process (Appendix 4) and an explanation of the need to complete an informed consent form (Appendix 5). Section 3.14 summarises the ethics decisions that affected this research.

The invitation to participate reinforced participation was optional as the final selection of candidates from the pool of eligible participants and interview responses would be confidential. Fifty-eight engineers indicated that they were willing to participate, 31 declined, 24 emails bounced back (these employees were no longer within the organisation) and the rest did not respond. The 58 IT field engineers who accepted the invitation to participate were sent an informed consent form in for completion prior to interview commencement. Twenty-five IT field engineers completed and signed informed consent forms (returned as a PDF file or photograph of the signed form). A password protected Excel master working file, stored on the researcher's password protected and encrypted laptop, was separated into tabs to collate and manage participation status with the master list, emailed list, declines, acceptances, bounced emails, and review tabs used to store and manage the information. Microsoft Excel was used to organise the data, with each engineer within the particular male or female strata assigned an identifier code (to replace the full name), followed by an Excel randomly generated number to create a numerate unique identifier code. Three female engineers accepted the invitation to participate and two were included within the first batch engineers selected as available for interview.

## 3.8 Data Collection

The choice of methods is an important aspect of effective research. The research question drives the selection of methodology with the combination directing the selection of appropriate methods (O'Leary, 2004). The need to understand the views and experiences of the mature IT field engineering team members was at the heart of the research activity, which suggested the use of methods suited to a interpretivist perspective.

The primary data collection method was based on one-to-one participant interviews, informal and semi-structured in nature. Edwards and Holland (2013, p. 17) summarised, "within an interpretivist context the interaction between the interviewer and participant in the interview situation creates knowledge". Ongoing reflexivity documented using memos acknowledged the researcher's position of an active participant co-creating knowledge via engagement with the interviewed engineers. Creswell (2014, p. 190) explained that interviews generally involved open-ended questions intended to elicit views and opinions from the participants. Interviews collect rich data for analysis and allow participants to deliver a response with speech, body language and physiology. An interview template was created with open questions so that data would be generated in the context of the central question to ensure a consistent interview experience for all participants (Appendix 6).

Several interview approaches, unstructured, structured, and semi-structured were considered to collect data from study participants. Semi-structured interviews were used employing a mix of closed and open questions often accompanied by 'why' and 'how' follow-up questions to enable the dialogue to meander around the topics on the agenda (Adams, 2015, p. 493). Obtaining an engineer's view without boundaries was important for the outcome of this research, which led to the rejection of a structured interviewing style based on explicit questions with no deviation (Frances *et al*., 2009), in favour of a semi-structured interview format. Using structured interviews may have led the participant towards a set of standardised, closed responses, which would not have solicited a broad, uncoloured perspective of the mature IT field engineer's personal views. A semi-structured interview approach was also used because of its flexibility (O' Leary, 2004) and the ability to ask consistent questions while equally probing for additional information (Ritchie and Lewis, 2003). Thus, enabling the engineers to have a real voice, speak freely and faithfully within the interview, creating an authentic understanding of the phenomena. Hoda (2011, p. 48) cited semi-structured interviews as helping to uncover the real concerns of participants rather than forcing topics onto them, with the importance of obtaining a potentially unheard IT field engineer viewpoint essential to the research aims and objectives.

### 3.9 The semi structured interview process

The interview process began with a confirmation sent to all engineers who expressed willingness to participate in the study (Appendix 8). This ensured, based on a desire to simplify the study logistics and the limited availability of engineers, a sufficient number of available participants was readily available. The optimum number of interview participants is suggested when no further insight is obtained via the interview process and theoretical saturation is reached within the data. Data collection and analysis is complete when theoretical saturation is reached, and no new aspects can be incorporated into the theory (Bohm 2004, p.274). Hagaman and Wutich (2017), agreeing with Guest *et al*. (2006), that 16 or fewer interviews may be enough for studies with relatively homogenous groups. Twenty five initial interview participants were selected an additional group of relevant candidates available on stand-by if required. Theoretical saturation, however, was reached after 22 interviews.

Twenty-two interviews were undertaken from a selection of the population of the CompanyX IT field engineering team based on a length of service greater than one year and over 45 years of age. The interviews commenced in November 2018 and due to the need to accommodate the scheduling needs of the IT field engineers, transcribe the data and follow grounded theory processes, took circa two years to complete. The research participants were interviewed individually with the interview duration ranging from 39 minutes to 69 minutes (circa 60 minutes was the duration positioned to the participants). Whilst standard questions were posed to the participants, the variation in interview duration was a result of allowing the discussions to flow at the pace of the participants to ensure they remained at ease and each interview came its own story (Kvale, 1996). Prior to each interview a participant sheet was circulated by email and each participant was told at the start of the interview that any data generated would be available for them to review if requested, with modifications allowed. Each participant was invited, on completion of the interview, to review the themes and categories to assist with research transparency and understanding, as explained in Section 3.12.

Pilot interviews were undertaken to practice and refine the interview process. The participants were not coached to answer questions to achieve an intended outcome and free flowing discussion was encouraged even extending beyond the normalised research context. O’Leary (2004, p. 96) highlights the need to pilot beyond pure reflection to trial aspects of the research design for appropriateness.

A participation sheet for each interview was annotated with notes and additional question or points of interest to be incorporated into future interviews (Appendix 6). Four engineers responded positively with a desire to participate in the pilot interview phase. They returned completed participation documents that were used to test the semi-structured interview process. Two engineers subsequently requested the removal of their personal details (names) from the study but agreed that the thematic content could be retained and used in the research. The recorded audio from the pilot interviews was professionally transcribed to improve accuracy, saved in Microsoft word, and annotated to highlight points of interest and build closeness with the topic (Halcomb and Davidson, 2006; Bailey, 2008).

Lessons learned from the pilot interviews identified the need for refinement of the interview questioning technique, changes to the interviewing style to increase participant interaction, a reinforcement of the flexibility benefits of web conferencing, improved time management and the data capture activity. The output from the pilot phase delivered beneficial insight, informed future interviews, and contributed to the development of the initial coding stage for the broader population of participant interviews (Robinson, 2014; Carmichael and Cunningham, 2017).

With insight obtained from the pilot interviews, the semi-structured interview approach was modified as follows:

- The primary interview engagement approach was changed to Cisco Webex online audio and video conferencing to improve the interview experience for the participants.
- The interview information sheet and approach was modified slightly to ensure the participant was read a scripted section explaining that the interviews would be audio recorded.
- Participants were asked their age informally at the start of the interview to confirm they were within the age range.
- The researcher intentionally managed time proactively to reduce the time each engineer remained on the call to improve the interview experience.

### 3.10 The use of audio and video conferencing

The use of web and audio conferencing as an operational element of the semi-structured interview process was not the original selected mode by the researcher. Also noted by Sedgwick and Spiers (2009, p. 5), the use web conferencing was the alternative option, with face-to-face interviews favoured, but the participant scheduling challenges resulted in the need for an alternative method. The decision to use the Cisco Webex audio and video conferencing platform as the primary interviewing platform was viable based on the engineers, as technology professionals, being familiar with web conferencing platforms for other collaboration activities and to make interview engagement easier for the participants. Sullivan (2012, p. 57) highlighted the benefits of web conferencing to broaden and make an increased sampling pool more accessible due to the global availability of web and audio-conferencing platforms. Kassianos (2014, p. 25) expressed concerns at the lack of connectedness between researcher and participant during telephone audio interviews, with distance acting as a disruptor. For this research, the use of audio and video conferencing technology increased connectedness and reduced distance by facilitating interviews in a convenient manner, where face-to-face attempts were not be possible (Loch and Reushle, 2008, p. 562). The use of an audio and video conferencing platform overcame location and human-to-human engagement was highly effective for this research delivering cost-effective engagement in time, money, consistency and flexibility for both researcher and participant.

### 3.11 The Gatekeeper role

Gatekeepers are individuals who provide access to the site or approval for the research to be done (Creswell, 2014, p. 188). Two stakeholder groups acted in a gatekeeper role for this research. Before commencement of the study, approval was requested from the CompanyX senior leadership team and granted once recognised ethical procedures were followed. Ritchie and Lewis (2003, p.62) outlined the importance of approaching the organisational hierarchy with sensitivity by gaining clearance and negotiating access via the use of gatekeepers. Alignment of this research with the university’s ethical expectations and a

CompanyX internal ethics review of the research approach and outcomes were sufficient to secure the approval to commence research. The second gatekeeper group were the engineering resource managers with line management responsibility for the participating engineers with the potential to ease or restrict access to the engineering population.
Whilst permission to undertake the research and access the IT field engineers was granted at the senior leadership level, failure to engage the resource managers in a fully transparent mode could have resulted in an unwelcome gatekeeper intervention at a later stage, potentially destabilising the interview participants. Broadhead and Rist (1976, p. 326) explained that entry can be gained covertly, through disguise, manipulation, false pretence and deception or officially, through open and consensual negotiation with the gatekeeper. The research was underpinned by the need for transparency therefore ensuring both gatekeepers and the participants were clear about the research activities proposed and undertaken was paramount.

For this research, the engineering resource managers responsible for the IT engineer groups were informed via an email with an explanation of the process, the interview approach and the objectives of the research. A valid concern was highlighted by an individual resource manager indicating the research may inadvertently select an IT field engineer within the age and job expectations for the research but unaware they may be aligned to health, employment, grievance or workforce concerns that may affect their ability to participate. To ensure research transparency, the engineering resource managers were consulted prior to the initial creation of the interview sample to review and remove participants based on organisational, employee wellbeing or duty of care reasons. Ninety engineers were removed from the sample pool for HR-related or employee care reasons with the remaining 471 available but selected for interview using a random selection option using Microsoft Excel to ensure the engineers selected were only known to the researcher. This important step was deemed essential to ensure employee well-being was paramount and, whilst it meant that a number of intentionally excluded employees were known by the engineering resource managers, the managers had no knowledge of the mature IT field engineers finally selected to participate from the pool of 471.

The engineering resource managers responded positively to the research aims objectives with no further requirement to engage after the completion of the initial HR related activity to exclude the aforementioned IT field engineers. Salmons (2012, p. 17) explained "Sometimes the researcher may gain the advantages of an insider by partnering with an insider assistant, a gatekeeper to the community who can negotiate access to the community and assist in recruiting participants". The approach of Salmons was not embraced in this study due to high levels of trust evident as an insider researcher, the transparency and awareness that research would not be published with the participant names or quotations that may identify them. The gatekeepers assisted with an initial layer of data cleansing, but it was reiterated they should not encourage or discourage participation in the research. Participation was wholly based on the desire of a selected IT field engineers to participate.

## 3.12 Research Quality

### 3.12.1 Introduction

The determinant of research quality differs based on the research method used for the analysis or inquiry. Quantitative research aligns with a positivist ontology and scientific methods consider the validity and reliability of the research method and outcome in relation to the study hypothesis. A lack of universally agreed definitions are evident for evaluating qualitative research. Dornyei (2007, p. 48) explains "general agreement about research quality in scholarly circles stops at the recognition of its importance". The evaluation framework of positioning credibility, transferability, dependability, confirmability, authenticity (Guba and Lincoln, 1994; Creswell, 2007; Flick, 2009) was considered viable for this research but rejected in favour of guidance from Charmaz to evaluate grounded theory research based on credibility, originality, resonance and usefulness (Charmaz, 2006, p. 182).

### 3.12.2 Credibility

Credibility is an aspect of trustworthiness that generally corresponds with the positivist concept of internal validity (Gunawan, 2015, p. 4). Morrow explains that credibility refers to internal consistency and rigour (Morrow, 2005, p. 252). Constant comparison was undertaken throughout the analysis phase of this research following the Charmaz grounded theory approach to ensure the study was grounded in the data with the steps used, documented in Chapter 4.

This study selected the interview candidates via the use of a Microsoft Excel randomising formula to increase credibility and authenticity. Shenton (2004, p. 65) conveyed that a random sampling approach may negate charges of researcher bias in the selection of participants. As such, reflexivity documented within memos was used to reflect, acknowledge and question assumptions, understand bias and positionality (Anney, 2014, p. 276). The reflexive memo in the following section is an example of one of over 100 memos created and documented to reflect on ethical, analytical and theoretical considerations.

**Reflexive Memo – Dated 02/05/19**

I'm starting to realise what a privilege it is to undertake such important research within CompanyX. The potential to use data generated by people who matter to positively affect their futures is now starting to make sense and resonate with me on a personal and emotional level as the research study activity is becoming harder. I benefit from an insider position meaning my awareness of the organisation helps me to understand the social conventions and navigate the organisation effectively to ensure the research is undertaken with rigour, efficacy and discipline.

My current role has ensured I am relatively well known within the technical community which grants me a level of access within that community of practise and therefore facilitates an accelerated level of person to person rapport. I have realised a secondary benefit also exists based on my own tenure which means the research participants view me as somebody who understands their world, but they have no concerns of talking freely and transparently based on fear of professional reprisal. This means “our” engagement and cocreated output in authentic and valuable.

I am energised to ensure I work tirelessly to conclude this research in a manner that delivers value to the organisation, to myself but most importantly to the research participants who stimulated the formulation of the original research question.

Three of the original interview participants were selected in additional to three new candidates selected from the sampling pool to review the generated data, with all participants encouraged to request visibility of their data if desired at any stage of the research. Guba (1981) advocated the use of member checking and granting access to the participants to review coded data to determine if it represents their experiences.

The technical and academic qualifications of the researcher delivered evidence-based acknowledgement of credibility based on 30 years in the information technology industry, manufacturer accreditation in selected technology topics and an MBA in management obtained whilst working within the IT industry. The depth of industry and academic qualifications engendered an increased level of trust in the researcher, with openness and access granted to the mature IT field engineers with minimal restrictions positioned by CompanyX.

### 3.12.3 Originality

Gill and Dolan (2005, p. 13) summarises the importance of doctoral candidates establishing what is unique about their research and how this can be clearly explicated to convey its originality. The preliminary literature review highlighted a knowledge gap, based on a lack of prior work exploring the skills development and career development considerations of mature IT field engineers. This resulted in the desire to create an original body of work anchored to the needs of mature IT field engineers within CompanyX. No academic research of this nature has been undertaken previously within CompanyX and the preliminary literature search was unable to locate similar pieces of work to an academic standard undertaken within other similar IT or computer engineering organisations. This suggests that sufficient originality exists within this research and the through articulation of the research method will help future readers to position the contribution delivered by this research.

### 3.12.4 Resonance

To determine resonance according to the Charmaz definition, the participants should make sense of the categories and the theoretical rendering that resulted from the analysis of their data (Alemu *et al.*, 2015). The inductive nature of the grounded theory coding process created concepts previously invisible but deemed highly relevant when examined by the engineers participating in the study. An additional level of category and concept review was undertaken during the latter part of the theoretical coding stage (Chapter 5) to present the created theoretical coding categories for review to a selection of participants to comment on clarity and relevance. The following quotation from a participant during the review of the final theoretical categories showed the relevance of the research and future value of the output to both CompanyX and the research participants:

> This is perfectly timed because it shows me areas, I should be considering that I have previously thought of and will use at my next appraisal. (Participant 6PH1823)

The use of grounded theory, as an insider researcher in CompanyX, delivered a level of analysis to the participant data created to offer them deeper insights about their lives and worlds grounded in their own data (Charmaz, 2006, p. 183).

#### 3.12.5 Usefulness

Glaser and Strauss explained that formal theories will need to be explained to people outside of the area of study to help them understand its usefulness and degree of applicability (Glaser and Strauss, 1967, p. 240). This analysis focused on the skills and career development expectations of a segment of the mature IT field engineering workforce of CompanyX, with limited academic research discovered, as noted in Chapter 2 as a result of the preliminary literature search. The gap in knowledge suggested that further research into the mature IT engineering age group would deliver a useful and previously unavailable viewpoint. A comprehensive determination of usefulness at this stage may be premature due to the future understanding and appraisal of this research in the academic and professional communities, the only true measure of usefulness.

#### 3.12.6 Trustworthiness

Evaluating this research for trustworthiness and credibility was important to ensure a worthwhile contribution to practice was delivered.  However, it is argued a positivist, measurement driven validation should not be used to judge qualitative research (Lincoln and Guba, 2000) but instead alternative criterion that considers the different worldview held by interpretive researchers (Gasson, 2003). As a piece of interpretivist research based on a naturalistic approach, a lack of hypothesis exists and as such the internal validity obtained via scientific proof of quality does not apply (Scotland, 2012: p.12). The data collection and analysis documented within chapter 4 outlines the approach and steps used to undertake this research. The trustworthiness of data collection can be verified by providing precise details of the sampling method and descriptions (Elo *et al.,* 2014). Memos discussed in the following section were created during data collection, coding stages and throughout the research to document assumptions and reflect the researchers position in addition to a granular explanation of the method used.

Peer debriefing with feedback from colleagues or other researchers (Stahl and King, 2020) and project scrutiny at conferences by other academics (Shenton, 2003) are aids to promote research credibility and trustworthiness.  The UFHRD2019 doctoral symposium held at Nottingham Trent University on 24th June 2019, image in figure 6 was specialist event held within the broader conference to offer doctoral students a public forum to showcase their work and receive feedback.


*Figure 6 – UFHRD2019 doctoral symposium event*

The UFHRD2019 doctoral symposium event was used guided by a suggestion from the researcher’s supervisor to show an early version of the research to obtain feedback and peer review. An A0 poster (figure 7) was created to present the developing research in summarised form for viewing by the symposium attendees alongside other doctoral research students.

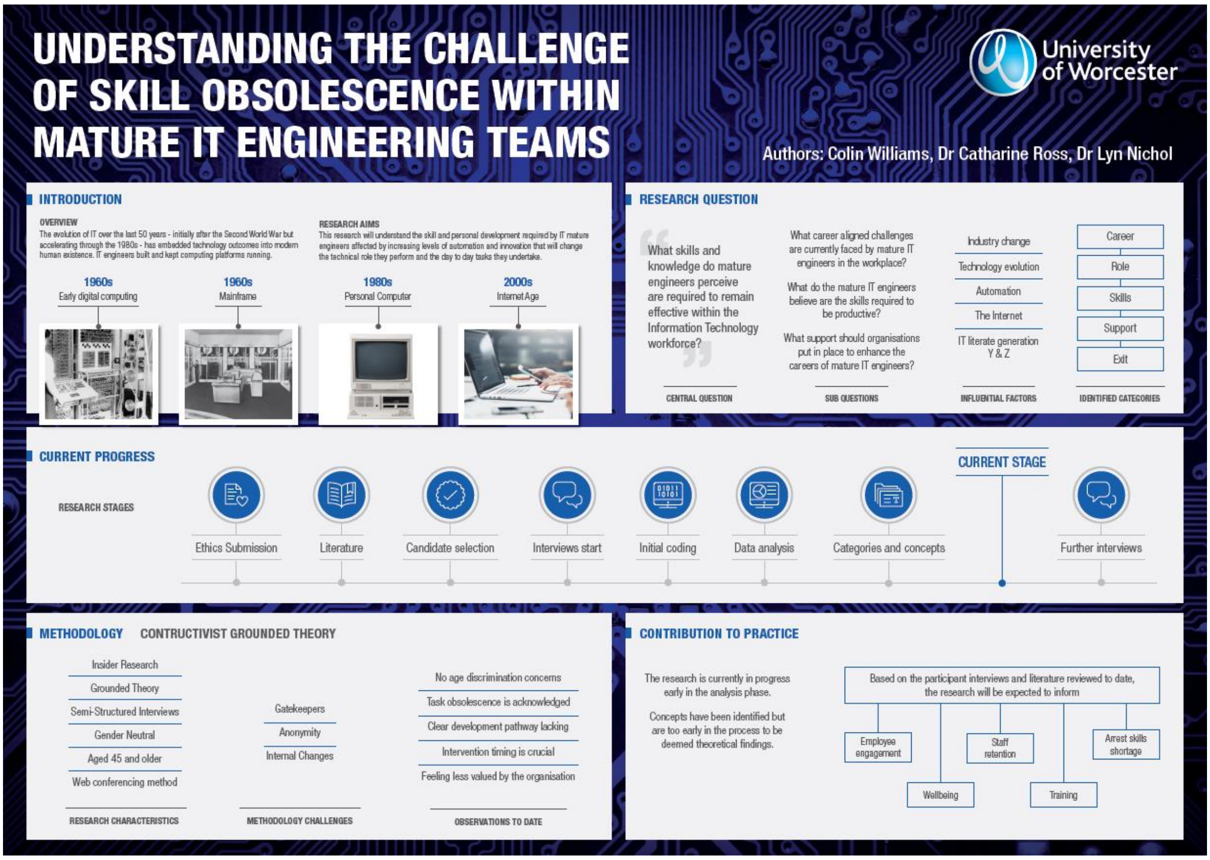


*Figure 7 – UFHRD2019 doctoral symposium research poster*

The doctoral symposium benefited research trustworthiness due to the feedback from the event attendees which was used to increase clarity and modify areas unclear to the event attendees. The changes undertaken as a result of participation within the symposium included a revision of the research title to broaden the research beyond skills obsolescence and to clarify the IT engineering job role. Additionally, the discussions with other doctoral researchers, who were facing similar methodological challenges as junior researchers were beneficial to share tips, learn from each other and embrace feedback. Presentation at the UFHRD2019 doctoral symposium was a valuable contribution to research trustworthiness due to the forum offering a supportive environment to gain objective review and feedback from an audience not connected to the research with the suggested changes benefiting the overall research.

## 3.13 Reflexivity

### 3.13.1 Introduction

Qualitative research is subjective by design and shaped by interpretation and multiple perspectives, which can lead to concerns about data 'trustworthiness' and transparency. Reflexivity allows the researcher to acknowledge their personal status, insider/outsiderness factors, as influences that do not contaminate the data but, instead, are part of the data (Attia and Edge, 2017, p. 35). O'Leary (2004, p. 11) explains reflexivity in research as "the ability of the researcher to stand outside the research process and critically reflect on that process". Undertaking this research from an insider researcher position heightened the importance of reflexivity in order to minimise bias and increase transparency. Reflexivity considers the impact of the researcher's experience, personal viewpoint, and culture on the interpretation of data collected and ensures the research benefits from "reflection in action" (Schon, 1991).

### 3.13.2 Reflexivity in action

Reflexivity played a prominent role throughout this research activity to ensure the assumptions and inherent knowledge of the people and environment were acknowledged. England (1994, p. 244) stated, "A more reflexive and flexible approach to fieldwork allows the researcher to be more open to any challenges to their theoretical position that fieldwork almost inevitably raises".

The following reflexive memo (figure 8) is an example of one of many written to acknowledge and externalise areas of confusion or challenges faced as the activities progressed.

| **Reflexive Memo – Dated 20/9/17** |
| --- |
| I am on my way to becoming an effective researcher with the teaching and learning to date transforming my understanding of the core tenets of the creation of knowledge. Many of the concepts and theories I am absorbing daily I do not understand but I hope in time they will begin to make sense. A reflective approach is already my norm and continues to deliver value in my day to day professional non-academic activities by encouraging me to question assumptions and activities. However, I am enthused by the power and impact of behaving in a deeply reflexive manner as my fieldwork, analysis and creation of findings progresses. Both reflectivity and reflexivity will encourage a level of criticality and constant appraisal to ensure my final work meets the doctoral standard |

*Figure 8 - Reflexive memo*

The created reflexive memos, whether formal or informal were stored in a subfolder on a secure laptop for review throughout the research. Ortlipp (2008, p. 697) documented the benefit of using reflective journals to create transparency in the research process. A structured reflexive journal was not generated for this study, but a log of supervisory engagement and guidance was maintained between the researcher and the supervisory team (Figure 9).

Worcester Excel supervision log book Colin W 2017 230418.xlsx    Open with Google Sheets

Supervision Log Book (Colin Williams)

| DATE | SUPERVISOR | DISCUSSED | PROPOSED ACTIONS | DATE NEXT MEETING |
|---|---|---|---|---|
| 12/4/2017 | CR (Catharine Ross) | CR outlined the supervisory approach and | CW is now clear how to make best us | 27/4/2017 |
| 12/4/2017 | CR | CR discussed an approach that considers | CW to review the main research quest | 27/4/2017 |
| 12/4/2017 | **WS** (is my abbreviation for "Worceste | WS suggested CW considers grounded th | CW to reconsider the merits of a grou | 27/4/2017 |
| 12/4/2017 | WS | CW: Remains keen on the use of an ethno | CW is well invested in the use of Ethn | 27/4/2017 |
| 12/4/2017 | AP (Anita Pickerden) | AP: Suggested revisiting historical exampl | CW to undertake a literature review of | 27/4/2017 |
| 12/4/2017 | WS | WS: Suggested the removal of generation | CW to consider the use of "mature" or | 27/4/2017 |
| 12/4/2017 | CR | CW discussed concerns and confusion ov | CR to circulate a paper based on rese | 27/4/2017 |
| 12/4/2017 | AP | CW discussed Anita's use of questionaires | CW will retain a focus on interviews d | 27/4/2017 |
| 12/4/2017 | | CW&WS: Next contact 26th April. | CW to circulate draft assignment cont | 27/4/2017 |
| 2/5/2017 | CR | The proposal introduction must to be rewri | I need to explain the nature of the IT e | 18/5/2017 |
| 2/5/2017 | CR | Catharine suggested a sample size that in | CW to review the engineer grades to d | 18/5/2017 |
| 2/5/2017 | CR | The current research question is ineffective | CW to revisit the question for one that | 18/5/2017 |
| 2/5/2017 | CR | Catharine suggested considering the subj | CW to consider when defining the res | 18/5/2017 |

*Figure 9 – Supervisory log*

Instead of the creation and maintenance of a diary-style reflexive journal, the researcher opted to generate memos of varying lengths to capture thoughts and suggestions for changes. The ease of creating short, emailed reflexive memos without formatting and structure was a means of recording 'point in time' emotional and academic thoughts (Figure 10). The use of memos and reflexivity is at the heart of the Charmaz constructivist -grounded theory methodology used for this research.

**Reflexive Memo – Dated 22/11/17**

I have currently stalled with confusion in relation to my next step and the lack of comprehensive understanding that my previous research activities have proved effective. This research is a venture into the unknown with my normal work day to day work underpinned by certainty. In the technology world things work or they don't and activities are undertaken to ensure they ultimately work to deliver a satisfactory outcome.

The ambiguity of academic qualitative research is the hardest initial thing so embrace with grounded theory reinforcing the ambiguity due to constant comparison and a lack of conclusion on specific points.

This is proving challenging because the circular process is daunting and can be wearing at times. The intervention of my supervisory team has proved invaluable due to the clear guidance delivered when "do nothing" is the easiest action and by encouraging me to trust the process and initially tolerate the ambiguity knowing the data created will ultimately determine the research outcome. This is not making sense.

*Figure 10 – Reflexive memo*

When undertaking constructivist grounded theory, the researcher worldview affects the research and data creation leading Charmaz (2006, p. 131) to explain, "Constructivists attempt to become aware of their presuppositions and to grapple with how they affect the research". Figure 11 demonstrates the 'self-talk' possible by the use of memos to facilitate the ongoing evaluation of researcher thoughts, feelings and actions in a safe place (externalised, but not public).

**Reflexive Memo – Dated 12/02/20**

Grounded theory research is hard and understanding it comprehensively is time consuming. I am writing this memo less for me and more for the academics that follow behind me to realise the feelings of mental paralysis are not alien. The temptation to truly make sense of the methodology can be all consuming and disconcerting. It is clear a robust understanding is required but balance is required to ensure what should've been a research activity to understand a phenomenon doesn't become a critical appraisal on the many frameworks and dialects of grounded theory.

I made such an error and more than once with the result I lost sight of my research, the objective and stalled short term spiralling into deepening levels of confusion. Supervisory intervention was essential at this point to ensure an objective appraisal of current activities and expected outcome remains top of mind. These experiences may sound negative but are potentially the opposite and supply real world calibration on an effective way to utilise the power of grounded theory as a research vehicle.

It's time to let go of the desire to fully understand grounded theory and accept I have a well formed appreciation of the relevant academic components. It's time to use the Charmaz research approach and trial and error to formulate a viable research template with the eureka moments appearing when data is allowed to guide the theory building activity

*Figure 11 – Reflexive memo*

Constructivist research fosters the researcher's reflexivity about their own interpretations as well as those of their research participants. As an employee of CompanyX, the researcher assumed the role of and insider researcher and this justified consideration of positionality to inform the reflexive stance. Salzman (2002, p. 807) cites Rosaldo (2000, p. 533) who describes a researcher's position as both structural and experimental and shapes perception and cognition, thus limiting what a researcher can learn and know. Awareness of this position and the ongoing impact on knowledge was essential to consider and to be able to absorb reality in the moment. This research was undertaken from an interpretive and constructivist position aligning with the worldview that the researcher and research subject interaction will occur, and this value will inductively co-create knowledge. Charmaz (2006, p. 132) indicates, without engaging in reflexivity, that researchers may elevate their own tacit assumptions and interpretations to 'objective' status.

Avoiding assumption was a primary concern throughout this research with preunderstanding of CompanyX and engineering roles and activities familiar to the researcher. The analysis and theory building activities of this research are grounded in the data but reflexivity assists with the interpretation. Constructivist grounded theorists take a reflexive stance toward the research process which involves both researchers and research participants interpreting meanings and actions (Charmaz 2006, p. 131). Adopting a reflexive stance throughout increased the confidence of the researcher by creating a conduit for internal self-talk and analysis externalised as memos and notes.

## 3.14 Ethics

### 3.14.1 Ethics – a summary

Ethics is the branch of philosophy that addresses moral behaviour in a research context (Wiles and Boddy, 2013). The importance of maintaining participant safety and ensuring the research data or outcomes will do no harm is fundamental within academic and business research. Axiology also considers morality and addresses questions related to what is valued and considered to be desirable or 'good' for humans and society (Biedenbach and Jacobsson, 2016, p. 140). The importance of honest and respectful behaviour towards others informed the choices made during the study and guided the participant engagement approach throughout. This was also influenced by the researcher's 15-year history as a CompanyX employee and, therefore, sharing the same core values as the study participants.

From a philosophical perspective Guba and Lincoln (1994, p. 114) explained ethics as extrinsic to the research and, as such, policed by external mechanisms such as professional codes of conduct and human subjects committees. In the case of this research, external ethical codes of conduct guidelines were followed aligned with the University Humanities, Arts and Social Sciences Research Ethics Committee (HASSREC). An ethics proposal following guidelines suggested HASSREC was submitted for review prior to commencement of the research (Appendix 7).

The content in the original proposal summarised the research aims and methodology and also included an appraisal of the ethical considerations to be acknowledged and addressed. Research involving people gains additional scrutiny due to the importance of avoiding harming the participants involved in the process by respecting and considering their needs and interests (Flick 2009, p. 36). The steps taken to protect the study's participants, CompanyX and the university, from intentional or unintentional harm as a consequence of the research contributed to the ethics proposal gaining approval with no changes required. The intended research approach, General Information Sheet (Appendix 3) and interview structure were also communicated by email to the leadership and management team of the IT engineering community.

The HR team at CompanyX reviewed the researcher content and the university ethics template from the position as an organisation with a duty of care to determine the ethical impact on members of its workforce. Creswell (2012, p. 439) mentions a lack of writing on ethics specific to grounded theory but highlighted the issues of power and authority and the importance of documentation of the concepts and categories of the theoretical model to allow others to recreate the process. However, the core ethics tenets remain common across research methodologies with the importance of acknowledging, understanding and minimising negative human, social and societal impact at the heart of ethical research behaviour. Carey (2010, p. 19) explained it can be daunting for novice researchers to obtain ethical approval for a grounded theory approach due to the ambitious and vague methodical elements and outcomes agreed at the outset of the research. However, for this study, no university proposal ethics challenges were experienced due to the additional levels of preparation to protect the research participants prior to ethics submission.

The research was designed to protect the identities of the selected participants and anonymity of responses generated by the research. Confidentiality involves protecting the identity of those providing research data (O'Leary 2004, p. 54). Each participant was selected using a random function in Microsoft Excel (to ensure the research did not select known names), from the sample pool of data and assigned a unique code only known by the researcher and only documented together with the participants' names in a password protected file. The participants' interview transcripts were held on a password protected storage array and the participants' names were replaced with unique codes throughout. Participant anonymity was maintained via pseudonym codes with the relationship known only by the researcher. Creswell (2014, p. 138) mentions the need for aliases or pseudonyms for individuals and places to protect the identities of participants. Pseudonyms may not be enough to hide identity, particularly when the role the individual plays in a community or organisation is made public (O'Leary 2004, p. 54). The generated transcript data was carefully scrutinised for instances where participant identification may be possible via cross linking different data sources (for example, a documented term, gender and age) to ensure the text was anonymised or not used within the research process.

All data created by the research was processed on a dedicated password protected, encrypted laptop with a backup on a password protected storage array. The data storage and retention principles follow the GDPR Data Protection Act

2018, alongside university best practice guidance and they were also communicated in a written document to the participants prior to commencement of the interview process. An explanation of the approach to data handling, the protection of identities and anonymity of responses was conveyed to all interview participants via email prior to completion of the informed consent form and also at the commencement of the semi-structured interview. Informed consent is a prerequisite for all research involving identifiable subjects, except in cases where an ethics committee judges that such consent is not possible and where it is felt the benefits of the research outweigh the potential harm (Richards and Schwartz, 2002, p. 137).

An ethics related concern was highlighted during the participant selection phase prior to undertaking the semi-structured interviews. The process of random candidate selection from a subset of the engineering population meeting the defined mature range was conveyed to the engineering leadership team with a request for feedback. A resource manager highlighted concerns over the participation of selected engineers when participation may affect employee wellbeing due to existing health, or employee concern factors unknown by the researcher. A revised approach agreed between the CompanyX human resources team and the resource management leadership was the removal of engineers aligned to the highlighted HR or employee care factors from the initial population. This removed 90 engineers and left 471 available for selection with the line management team having no knowledge of the engineer subset selected for interview. The revised approach protected the identities of the participants selected for semi-structured interviews. As a result, the line management team were not aware of who the randomly selected participants from the final pool were. The revised research engagement approach was accepted by the engineering team leadership, allowing the interviews to proceed without further intervention.

A second ethical concern was raised within the participant interview process. Two of the pilot interview participants were willing to participate in data coding and thematic and conceptual analysis but requested that data or terminology that could identify them not be recorded in any externalisation of the research. This was acknowledged with their data used for thematic and coding purposes with no data elements that may lead to individual participant identification.

### 3.15 Chapter summary

This chapter presented the methodology used to undertake this research. The research was qualitative in nature and was guided by Charmaz's constructivist grounded theory methods, which were well suited to understand the previously unknown phenomena described by the research question. The selection of purposive sampling was explained due to the requirement for an age selected subset of a broader population. The chapter also presented how research quality was maintained with a further explanation of the use of reflexivity to recognise the impact of the researcher's 'insider researcher' positionality on the research outcomes. Finally, the ethical stance of the research was outlined, which was considered an important area to ensure the research participants were safe and that both academic and company guidelines were followed. The following chapter will present the methods used to code and analyse the data created.

# Chapter 4: Analysis and coding

## 4.1 Introduction

This chapter will explain the use of Charmaz's constructivist grounded theory methods to analyse the data created by the semi-structured interview process, described in Chapter 3. It will also outline the initial and focused coding stages undertaken, with constant comparison of the data used to create theoretical categories. The chapter concludes with an explanation of the core category that emerged as a result of the process.

## 4.2 The coding process

### 4.2.1 Research coding overview

Coding is a common element of qualitative enquiry, particularly when the data drives insight for future research stages and activities. Coding is a core step in qualitative and grounded theory research done to extract relevant meaning from the data collected (Bryant and Charmaz, 2007, p. 265). As a junior researcher, this was initially confusing, but the coding process and stages are heavily documented areas within the grounded theory methodology. Coding data to unlock insights and develop emergent theories is a fundamental underpinning of the grounded theory methodology (Mills, Bonner and Francis, 2006, p. 5). This study was informed by the Charmaz constructivist grounded theory approach that uses three coding stages, which are in common with the Glaser, and Strauss and Corbin approaches. Figure 12 (Urquhart, 2013, p. 23) summarises the coding stages defined by three of the seminal grounded theory authors, Glaser, Charmaz, and Strauss and Corbin.

| **Author** | **Year** | **Coding Stages** |
|---|---|---|
| Glaser and Strauss | 1967 | Open Coding, Selective Coding, Theoretical Coding |

| | | |
|---|---|---|
| Glaser | 1978 | Open Coding, Selective Coding, Theoretical Coding |
| Strauss & Corbin | 1990 | Open Coding, Axial Coding, Theoretical Coding |
| Charmaz | 1998 | Initial Coding, Focused Coding, Axial Coding (optional), Theoretical Coding |

Adapted from Urquhart (2013, p. 23; Flick, 2018, p. 51)

*Figure 12 – Grounded theory seminal authors*

The inclusion of axial coding as the second stage in the Straussian or the Strauss-Corbin grounded theory approaches encourage a different level of analysis by reassembling data fractured during open coding with the assistance of a coding system or framework (Strauss and Corbin, 1998; Charmaz, 2014). However, the axial coding stage was subsequently rejected within this research, based on a constructivist viewpoint that axial coding could restrict the codes constructed due to the researcher forcing the data to match the system rather than allowing the codes and insight to naturally emerge (Charmaz, 2014, p. 149). This led to the use of initial, focused and theoretical coding as grounded theory's specific data creation and analysis stages, utilised by the researcher, and guided by the Charmaz grounded theory methodological framework.

### 4.2.2 Initial coding

According to Charmaz (2014, p. 116), the initial codes are provisional, comparative and grounded in data. In this study, the coding process began after a detailed review of the generated data. Any interview data that was considered significant, but initially created as isolated elements, were analysed via constant comparison and grouped to start the process of categorising the studied phenomena (Carvalho *et al*., 2002; Charmaz, 2014). Initial coding was used to break down the interview transcripts from the summarised body text via word, line-by-line or section analysis to assign labels or codes that signified a higher-level meaning (Bohm, 2004; Qureshi, Liu and Vogel, 2005; Lawrence and Tar, 2013).

During the earlier stages of the initial coding process, a lack of closeness to the data led to the creation of codes that were more descriptive than analytical. Familiarity and competence of the coding process increased as the analysis progressed. Additionally, following the Charmaz guidance to code for actions helped the newly emerged draft codes to evolve from being descriptive in nature to taking on analytical qualities representing the point of concern conveyed by the interview participant (Charmaz, 2014, p. 116). The shift from descriptive to analytic coding illuminated the research and started to highlight areas of relevance. Theoretical sensitivity and constant comparison were used to continually compare and analyse data across interview transcripts and to theoretically question the data further. Figure 13 presents a line-by-line coding example with initial draft codes and a researcher memo created as notes while considering the line contents and the meaning derived.

**Anonymised interviewee code – 3PH1808 - September 2019**

| Coding Item | Interview Transcript summary | Initial Code (draft) | Researcher Coding Memo (real time) |
|---|---|---|---|
| 4 | I previously worked outside of IT so am used to retraining myself and pushing myself forward | Self-motivated | Positive attitude and still passionate about progression |
| 6 | CompanyX really gave me a chance to change my life way back by giving me an IT job. | New Opportunity in life | CompanyX is viewed favourably.<br><br>Values the job undertaken.<br><br>Discusses job and company interaction warmly |
| 7 | The job really has diminished at the moment. In the old days we built engineered things. Now we only seem to swap out boards from systems now and rarely need to troubleshot faults | Diminishing tasks | Change of tone to one of disappointment. Disillusioned with the reduced complexity of the tasks.<br><br>Engineering tasks undertaken are no longer challenging. This view was previously shared by other participants.<br><br>No evidence of wanting to move away from IT engineering. |
| 12 | We would install operating systems across different systems and also configure the hardware. Now systems just boot and build themselves. It's all getting very boring now. | Job is no longer diverse. | Similar to the comment about task.<br><br>The job variety that existed when there were more and complex tasks to undertake seems to be gone.<br><br>Emotional state of disappointment displayed, in fact it was more of resignation that things have changed. |
| 11 | I would love to learn new stuff, like Cisco and Vmware and the other new things. | Happy to learn new skills | Passionate about learning and keen to learn about need technologies.<br><br>There is an inference that it is challenging to learn new skills with the job anchored to legacy activities.<br><br>Aware of the new and valuable manufacturers and technology areas. Is CompanyX maximising this energy and enthusiasm? |

*Figure 13 – Line-by-line coding example*

Charmaz considered coding to be the pivotal link between collecting data and developing an emergent theory to explain these data (Charmaz, 2006, p. 46)
The process of coding commenced on completion of two pilot interviews, the first interviews of any research participants. Undertaking pilot interviews delivered value by helping to test the research interview instruments and preparation for the ongoing major participant engagement activity (Majid et al., 2017: p.1074). The data created from pilot interviews 1 & 2 were used for thematic and data analysis but on the request of the two engineers, the participant's name or text extracts imbedded within the research could not be used based on reasons of confidentiality and based on personal identification reasons. This was noted in the ethics section with Chapter 3.13. The experience of coding the pilot interviews was used to code the subsequent interviews that followed.

The coding process analyses and subsequently fractures the data collected to assign an analytical code. This could be a word or short phrase that symbolically assigns meaning to a portion of language-based or visual data (Hennick, Hutter and Bailey, 2011; Urquhart 2013; Saldana, 2016). However, it was found during the process that coding labels alone did not capture the thinking and decisions made when the data was considered. Short and long hand theoretical memos were written throughout the coding process to engage in reflexivity during and after the participant interviews to make sense of the data. Figure 14 is an example of a theoretical memo created during the initial coding phase based the data of Pilot 2. It highlights a passionate engineer questioning their happiness with the role based on changes over time. Memos of this nature became an important source of insight based on the opportunity to think without boundaries and document ideas in a 'safe place'.

**Memo 7th July 2018 – Pilot 2**

Pilot 2 is a mature engineer with a substantial length of service. With a career in IT engineering prior to joining "the company" pilot engineer 2 was a prominent engineer prior to arriving.

The role initially undertaken was the installation of file server platforms, understanding and resolving hardware system faults by the removal and replacement of the failed parts and basic networking IT systems to for access. The role required good technical awareness than a depth of technical expertise, however Pilot 2 described themselves as a person who passionately likes technology and possesses an engineering mind-set in their own words "still a geek". This is a point where real passion is expressed with stories of dismantling technology as a child examples of a mind-set driven to understand how things work. Surely that remains a valuable quality to have in the present day because such interest can drive innovation based on a personal desire to take new or difficult problems in a fearless manner.

The tenure of pilot 2 has evolved over time with the role originally interesting due to the level of ongoing technical engineering interaction with the technology remaining high. The volume of systems to install or repair was substantial and remaining busy and intellectually stimulated helped to make the role enjoyable.

More recently in the last three to five years the level of engineering intervention and complexity has diminished due to IT platforms failing less and remaining operationally viable for longer before inadequate performance drove the need for replacement. Pilot 2 believes the role is "dumbed down" and now questions the level of enjoyment gained from the role. This will be an area of further questioning to determine if others have fallen out of love with the role and why. If this is understood "what next" is far easier to theorise and create.

*Figure 14 – Theoretical Memo*

The output of the analysis of the transcribed participant interviews became the primary source of codes to establish a relationship with the data, researcher and the respondents (Bryant and Charmaz, 2007, p. 80). It was important not to over analyse during the initial coding phase, as the data was informative but lacked theoretical density. Coding procedures are used to build, rather than test a theory by giving the researcher tools and guidance for handling large amounts of data (Strauss and Corbin, 1998,p. 13). Learning the coding procedures via the pilot process helped to prove the effectiveness of the digital conferencing platform, deliver clarity on how to manage & analyse data, and increased researcher confidence by surfacing activities that would be reused during the later coding phases.

Constant comparative analysis of the transcript data and the creation of theoretical memos increased researcher intimacy with the data resulting in greater levels of theoretical sensitivity which encouraged in-depth questioning of the meaning within the data. Effective coding requires the researcher to wear an analytical lens (Saldana, 2016, p. 7). This familiarisation and analytical behaviour helped previously unseen areas of relevant value emerge within the data, resulting in the creation of initial codes.

### 4.2.3 Initial Coding – Going beyond the pilot interviews

After the pilot interviews, the initial coding activity continued as blocks of interviews were competed and transcribed. The objective of the initial coding phase was to gain an initial understanding of the interview data and build on the codes created during the pilot stage. Flick (2018) indicated that the initial or open coding stage is used for exploring the data and produce short, simple, precise and active codes. After the pilot interviews, 22 interview transcripts (that included the valid pilot interviews) were coded. Nearly 700 initial codes were created based on constant comparison of the data over several review and analysis cycles. Using an initial coding sheet, which included codes from the pilot interviews and additional codes added after coding each transcript, new codes were compared with existing codes. Line-by-line coding was the preferred coding style but was later expanded to small groups of words (Chun Tie, Birks and Francis, 2019) as a line-based approach failed to generate usable data. The objective of the initial coding phase was to fracture the data into codes to be used to develop categories after an advanced focused coding stage.

Figure 15 is an example of a completed coding template for one of the interviewed engineers.

| | | | | |
|---|---|---|---|---|
| Automation changing the job | Country wide travel | Length of service | Pathway to another role | Shift of skills offshore |
| Age not a factor | Diminishing tasks | Less to learn in the new age | Positive view of company | Skills obsolesence |
| Change of family circumstances changed career decisions. | Ever-changing roles | New for new skills | Role has changed | Experience not valued |
| Changing technology landscape | Less valuable than sales employees | New Opportunity in life | Role is no longer diverse. | Increasing family demands |
| Company reluctant to retrain staff | Happy to learn new skills | Old tasks no longer undertaken | Self-motivated | Hard to progress to consultancy |
| Convenient to remain in role | Lack of new technolgy skills | Passion for technology | Self-Trained | Financial stability / security |
| | | | | |
| **2PH1808** | | | | |

*Figure 15 – Coding template example*

Throughout the coding process, in-vivo or verbatim (Saldana, 2016) codes were created to capture specific terms or phrases used by the IT field engineers and given additional consideration for use as focused codes or categories. The following quotation is an example of participant statement that created an initial coding in-vivo code, *engineering mind-set,* to describe engineers with an innate awareness of technology with the ability to understand install and repair technology systems often with no prior training.

> "As long as you've got documentation and some manuals, you can work out the rest, but there's a lot of the younger engineers who are like I'm not touching that. I think it's an engineering mindset thing".
> Participant: 2PH1813

Maintaining the activity applied to other initial codes, areas of interest within interview transcripts, or other reflexive viewpoints, theoretical memos similar to Figure 16 were written based on thoughts about the data impact and relationships.

**Memo 14th September 2018 - "Engineering Mind-set**

What is an engineering mind-set, does a standard definition exist? Even without it, the term was mentioned by the majority of interview participant and all seemed to be clear on the meaning. It encapsulates the mind of someone inquisitive about technology but not based only on new functions or features, they also want to break devices and products to try to repair them to understand the inner working. This can be taught and education, training and standardised knowledge transfer may enable a person capable of following listed instructions to facilitate product repairs or upgrades. An engineering mind-set is different and a map of steps is rarely required with common sense, curiosity and an innate logic driven understanding based on working back from a functioning device to determine the intermediate reasons justifying the need for a repair. The engineering mind-set is apparent an effective in situations that may not be aligned with a "broken now repair" outcome.

For tasks requiring installation, troubleshooting or extra circular thinking to complete the task required, an engineering mind-set helps to paint a picture of excitement aligned with the task ahead not fear or confusion. The term was often discussed in a passionate manner with the advantages of thinking on such a plane positively conveyed based on the value delivered and the success in both basic and complex situations vs engineering not equipped in the same way.

To draw parallels with equivalent technology aligned personnel in the modern age, could the modern coder have similar explicit and implicit characteristics and as such lessons can be learned by the common and different activities of the two groups. Of equal interest, could modern coding (which different from the rigour and process aligned programming discipline of old) become a potential career destination for historical engineers with an engineering mind-set leveraging the same inclusive thinking to but dismantling and reassuring code instead of hardware devices? This is will be an area for additional research that may span beyond the objectives of this paper but could still inform it.

*Figure 16 – Theoretical Memo*

The theoretical memo above is an example of the importance of questioning and challenging the data. For example, "how real is an engineering mind-set" which seemed to be clear in the minds of IT field engineers within the industry from an informal definition standpoint but, yet, it is not externally written about. At a first glance, elevating *engineering mind-set* beyond its initial code state was compelling. Revisiting the research objectives and the aim to understand the skills required by mature engineers with the potential to formulate a theory, an *engineering mind-set* was acknowledged as beneficial and valuable but not fundamental or a core to engineers' future success. This code level analysis resulted in no change to *engineering mind-set* with it remaining an initial code.

This second initial coding example discusses the thought processes aligned to data that created the original *age discrimination* code, which was subsequently changed. The primary focus of this research was age-aligned, driven by the need to understand the career and skills development needs of a mature IT engineering workforce. As the participant quotation that follows conveys, the initial coding phase did not convey age-specific impacts in a negative manner with the interview participants consistently citing no employer derived discriminatory practices or workforce issues explicitly aligned with mature workers, which suggested *age discrimination* was an incorrect term.

> "I've never had an issue. Obviously, as you get older, you work with far more younger people than older people".
> Participant 2PH1814

The interview participants, even when probed, were unable to cite examples of employer conceived age-related obstacles negatively affecting mature engineers. The constant comparison process comparing transcript data sections determined nuanced *age affects* beyond a siloed discriminatory view that warranted further investigation over time. The *age discrimination* initial code was subsequently changed to *age consequences,* built from age-related sub-codes to summarise differentiating characteristics between engineers in the mature sample group, the broader organisation and young personnel outside of it where relevant. *Age consequences,* as a broad initial code, captured a wealth of topics aligned with undertaking the engineering role as physical and mental capabilities change with age with could result in detrimental outcomes if steps are not taken to offset age related declines.

The examples above present a selection of the approaches and activities applied to the data collected during the initial coding phase. A comprehensive writeup would prove repetitive however, the previous section delivered an explanation of the steps undertaken, repeated in cyclic manner to create the pool of initial codes.

### 4.2.4 Focused Coding

The use of grounded theory constant comparison was fundamental within this research to remain engaged and intimate with the data and not leaping forward to make non-grounded assumptions. The grounded theory focused or selective coding stage is used to scale up the codes into categories that are important to the research problem (Urquhart, 2013, p. 49). Memoing became a key activity to capture the sheer volume of ideas and new meanings within the data that endlessly appeared, with over 100 memos created. The initial coding stage concluded when no more codes of beneficial value were evident within the data. Nearly 700 initial codes were created and constantly compared with each other and the transcribed interviews. This was done by analysing them through the lens of the research questions.  Coloured Post-it Notes were originally tested as a data recording and sorting medium for use through the coding process. Post-it Notes were rejected in favour of the capability of Microsoft Excel to sort, search, and store data that can be password protected. Figure 17 shows an example of a participant worksheet in an Excel tab.

| | | | |
|---|---|---|---|
| "The gulf between grades" (in vivo) | Hybrid engineering role | Inconsistent role grading | Silo'ed organisation |
| Alignment with upper quartile engineers | Importance of ongoing development | Lack of broad technical skills | Skills hindered by site limitations |
| Benefit of Software engineering skills | Physical concerns with age (lifting) | Line manager stalled development | The "glorified courier" roles |
| Criteria for engineer development | Pioneering engineer | Look out for non-standard thinkers | Utilisation needs |
| Customer services attitude | Problem solving mind-set | On site engineering | Negative engagement intervention |
| Development pathway for all engineers (not just upper quartile) | Role inconsistency | Over qualified engineers with simple tasks | Proactive problem resolution |
| Engineer awareness of companywide opportunities. | Customer relationship management | Reduced workload outside of city locations | Restricted engineer development |
| Engineer flexibility | Engineering background | Selection for development aligned to high performers | Search for new personal qualities |
| Engineering mind-set | Escalation engineer | Self sufficiency useful | Swap out over repair |
| Evolved to project management role | Hybrid engineering role | No support for non-standard development. | Traditional engineering no longer valid. |
| Focus on organic development | Importance of soft skills | Reasonable remuneration | Unsure of value |

**3PH1820**

*Figure 17 – Printed Excel participant coding sheet*

The use of Microsoft Excel worksheets, whilst highly beneficial as a consistent processing and code repository, became challenging to analyse and work with due to the small text size when printed as sheets of nearly 700 initial codes. The next phase of analysis created individual code sheets for each research participant to simplify the constant comparison of codes from different participants. The process shifted away from on-screen analysis in Microsoft Excel to A3 printed paper of Excel participant code sheets, which accelerated the coding process and resulted in an enhanced level of analysis (reducing the impact of data blindness when due to extended periods of laptop screen time). To ensure and retain participant anonymity, each sheet was labelled with the alpha numerical tag, not the full name, corresponding to the engineer in question. Figure 18 is an example of printed engineer coding sheets used to scrutinise and analyse the codes created. Codes with the potential to identify a particular engineer were modified or not used.

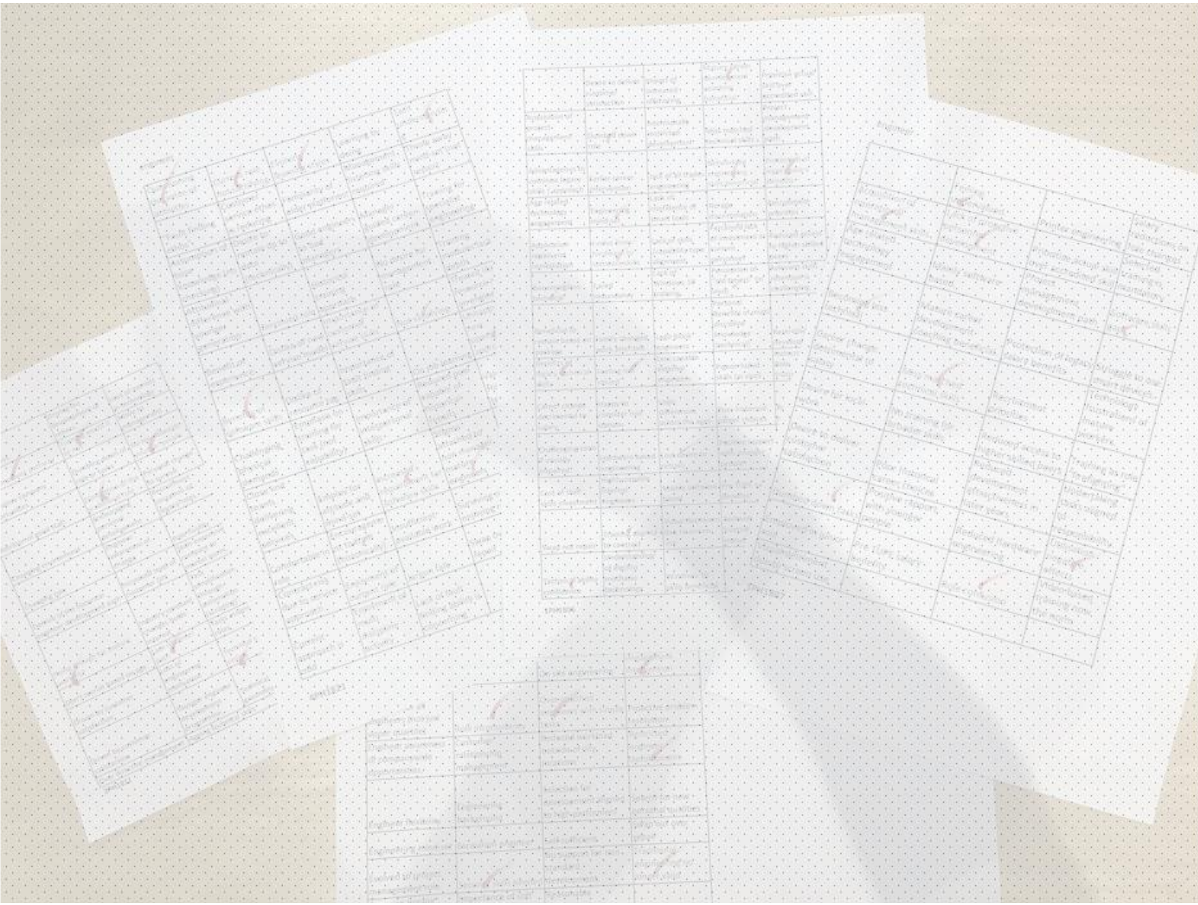

*Figure 18 – Printed engineer A3 coding sheets*

The completed engineer code sheets were printed as A3 documents for ease of review. The codes and participant transcripts were constantly compared with each other to determine the need for wording changes and to understand commonality or differences between the initial codes. Where possible, when transcribing interviews, the same or similar text-based codes were used to describe equivalent fragments of data. A cyclic, multistage code rationalisation approach to reduce the volume of codes was used to sort, group and analyse the initial codes prior to focused code development (Figure 19). The activity was used to eliminate duplicate codes and group similar initial codes to then create 185 final initial codes. Memoing was used to discuss and record important decisions, most notably when a code could have been used as an overall category.

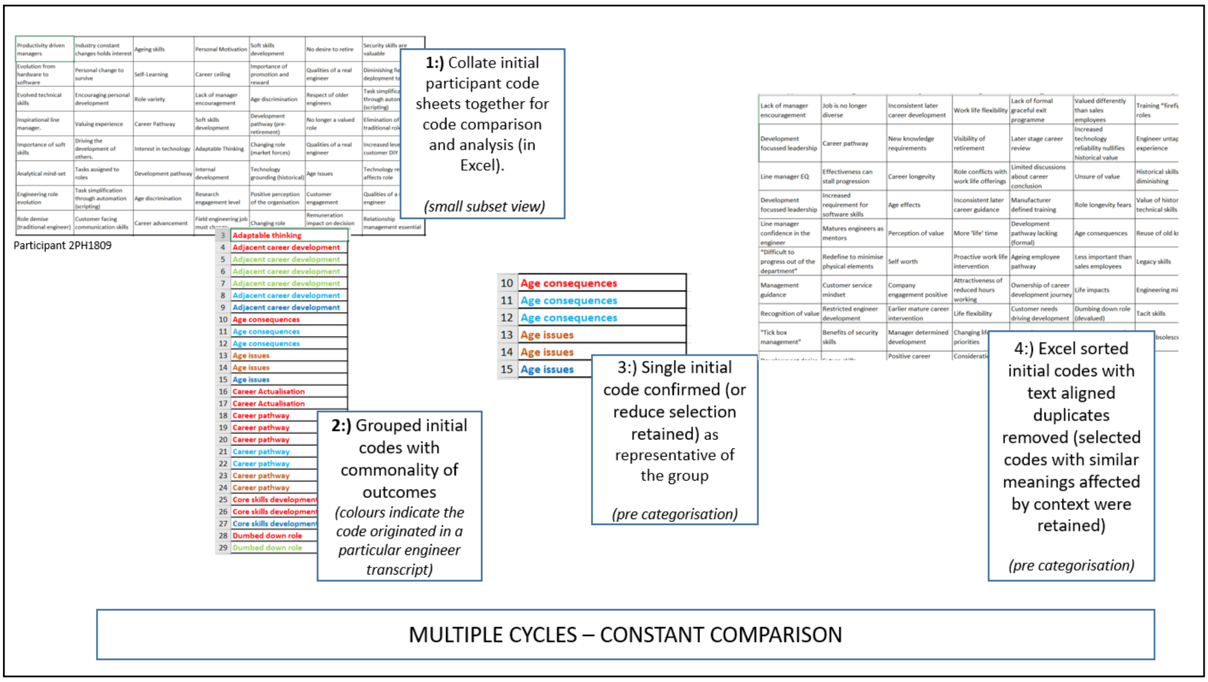


*Figure 19 – Initial to focused coding process*

Constant comparison and rigorous analysis of the single initial codes reduced nearly 700 first pass initial codes to a set of 185 final initial codes; see Figure 20 for a subset added to an Excel tab within a password protected Excel workbook.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Manager support is essential to success | Job is no longer diverse | Inconsistent later career development | Work life flexibility | Lack of formal graceful exit programme | Valued differently than sales employees | Training "firefighting" roles | Grace assist |
| Manager derived development | Career pathway | New knowledge requirements | Visibility of retirement | Later stage career review | Increased technology reliability nullifies historical value | Engineer untapped experience | Young respo |
| Line manager EQ | Effectiveness can stall progression | Career longevity | Role conflicts with work life offerings | Limited discussions about career conclusion | Unsure of value | Historical skills diminishing | Emplo flexib |
| Development focussed leadership | Increased requirement for software skills | Age effects | Inconsistent later career guidance | Manufacturer defined training | Role longevity fears | Value of historical technical skills | Fear c |
| Line manager confidence in the engineer | Matures engineers as mentors | Perception of value | More 'life' time | Development pathway lacking (formal) | Age consequences | Reuse of old knowledge | Future financ mana |
| "Difficult to progress out of the department" | Redefine to minimise physical elements | Self worth | Proactive work life intervention | Ageing employee pathway | Less important than sales employees | Legacy skills | Famil circur caree |
| Management guidance | Customer service mindset | Company engagement positive | Attractiveness of reduced hours working | Ownership of career development journey | Life impacts | Engineering mindset | Repri involv |
| Recognition of value | Restricted engineer development | Earlier mature career intervention | Life flexibility | Customer needs driving development | Dumbing down role (devalued) | Tacit skills | Agein assist |
| "Tick box management" | Benefits of security skills | Manager determined development | Changing life priorities | Pre-retirement career development | Manager perception of value counts | Skills obsolescence | Impac comn |
| Development desire | Future skills | Positive career | Consideration for | Looking forward to | | | Chang |

*Figure 20 – Initial code reduction (A3 summary sheet)*

One hundred eighty-five final initial codes were compared with each other by revisiting the original transcripts to understand the context at the time of the interview. This was then followed by a line-by-line and larger paragraph review to increase understanding and theoretical sensitivity. The objective was to generate a smaller subset of final focused codes to form categories for theoretical analysis. Theoretical sampling techniques were applied based on the interview outputs with the use of constant comparison to probe the data for any possible additional data collection prior to creation of categories. The questioning style used to probe further into the interview discussion topics was guided by a theoretical sampling viewpoint.  Theoretical sampling progressively and systematically tailors data collection to serve the emergent theory, it is purpose-driven with the sample selected for the purpose of explicating and refining the emerging theory (Breckenridge, 2014, p. 118). The researcher's awareness of IT symbolic language resulted in a heightened level of theoretical sensitivity which helped to accelerate the determination of code and category relevance.

The 185 final initial codes were checked for redundancy and commonality, were sorted and analysed, and grouped together based of the potential to be part of a focused category that best described the collective outcome (see Figure 21).

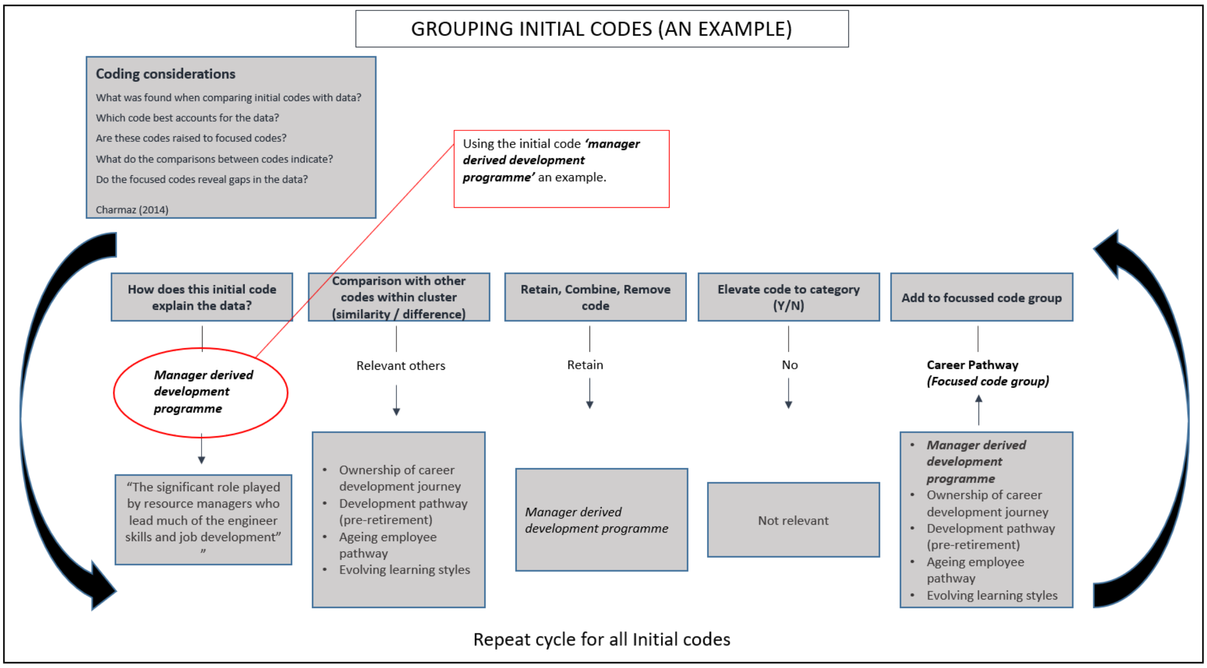


*Figure 21 – Grouping and analysing initial codes*

The focused code phase proved different to the initial coding phase. Focused coding was a continuous cycle of review and breakthrough when a suggested code had more theoretical gravitas than mere description. After this, there was also comparison with other codes based on similarity or relationship with the process, which was then completed by a final decision that explained how the code would be retained. Figure 22 displays a subsection of the final initial codes analysed, compared then grouped together as a family of codes to create 24 preliminary focused codes each used to denote a draft category.

| Initial Codes (Grouped) | Prelimnary Focussed Code |
|---|---|
| Coaching to coach, Management guidance, Recognition of value, "Tick box management", Development desire lacking, Lack of progression if effective in role, Line manager perception affects development, Effectiveness can stall engineer progression, Inspirational line manager, Future focussed skills development, Development focussed leadership, Line manager confidence in the engineer, "Difficult to progress out of the department", Development focussed leadership, Line manager EQ, Lack of manager encouragement, Restricted skills development | **Management Influence** |
| Surviving not enjoying role, Self worth, Dumbing down role (devalued), Manager perception of value counts, Not feeling valued, Prioritising actual skill over accredited skill, Lack of value centric rewards, No longer feeling challenged, Historical evidence based value, Perception of exec leadership (positive), Role longevity fears, Company engagement positive, Less important than sales employees, Increased technology reliability nullifies historical value, Unsure of value, Valued differently than sales employees, Skills obsolescence concerns, Technical products simplification, Sense of self, Value of tenure based rewards, Working on autopilot, Task simplification devalues job | **Self worth** |
| Inconsistent Roles, Customer service mindset, Restricted engineer development, Benefits of security skills, Future skills development, Multi and cross skilled engineering, Revised customer expectations, Hardware to software engineering, Historical tasks diminishing, Increased onsite customer engagement, Increased requirement for software skills, Matures engineers as mentors, Redefine to minimise physical elements, Role demise, Effectiveness can stall progression, Job is no longer diverse | **Job and role design** |
| Manager derived development programme, Ownership of career development journey, Customer needs driving development, Pre-retirement career development, Looking forward to retirement, No urgency to develop new skills, individual learning style, Job boundaries, Job evolving faster than grades, Future focussed skills development, Manufacturer defined training, Development pathway lacking (formal), Ageing employee pathway, Later stage career review, Limited discussions about career conclusion, Lack of formal graceful exit programme, Mature workers as coaches | **Career pathway** |
| No age discrimination, Mature engineer work ethic, Perception of older worker value, No bias towards younger engineers, Physical demands of the job with age, Aged technical skills, Attitude of older workers, Desire for shorter workdays, Mature employees as mentors to younger engineers, Attitudinal difference with younger engineers, Age normalisation, Mentally able but physically constrained, Age consequences, Ageing worker health concerns, Physical wear on the body, Travel to clients (extensive), Younger engineers retention | **Age effects** |

*Figure 22 – Initial to focused codes (examples)*

Figure 23 uses the example of the focused code *age effects* to explain the process followed to create groups of focused codes from the grounded theory cycle of data analysis, merging and constant comparison.

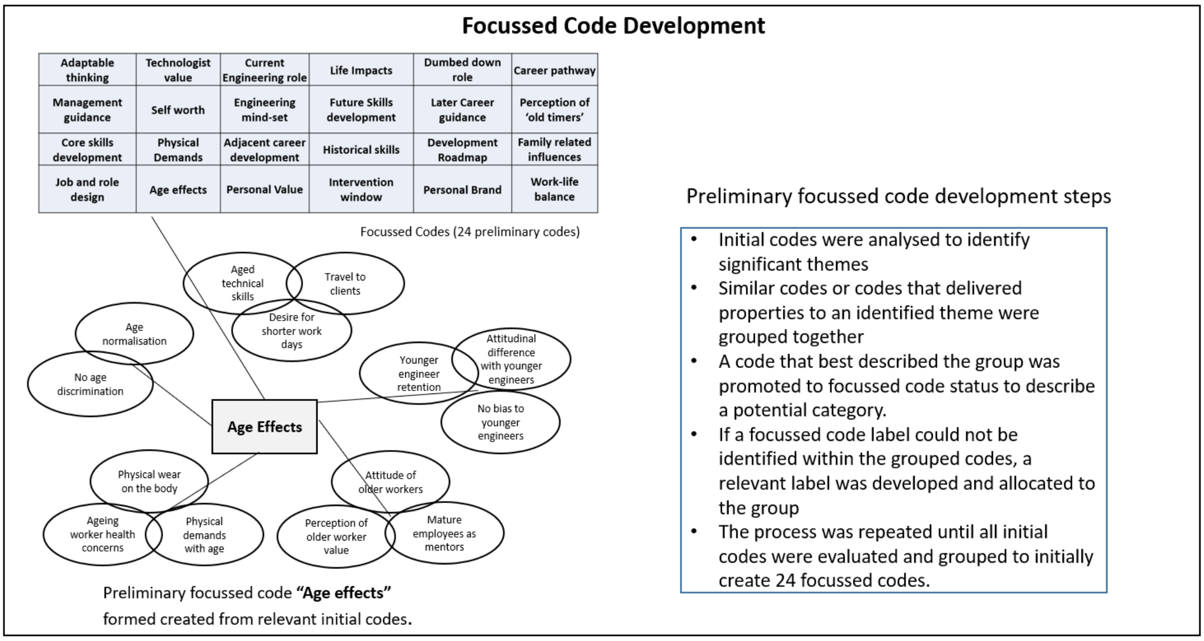


*Figure 23 – Focused code development*

The heavily process driven and repetitive nature of grounded theory research can feel time consuming with data collection and coding happening in tandem and in continuous cycles (Timonen, Foley and Conlon, 2018) and this research was no exception. However, as the research, progressed with seemingly endless the cycles of analysis and comparison becoming the norm, the time required for codes and themes to merge was greatly reduced as relevant theoretical categories were already evident.

A category may subsume common themes and patterns in several codes (Charmaz, 2006, p. 91). The development of categories by the focused use of selected initial codes was a straightforward activity with the groups created by collating relevant initial codes based on relationships also corresponding to possible category headings. Constant comparison continued by re-examining the interview transcripts and comparing them to the 24 focused codes, shown in Figure 24, to select the most impactful codes in order to create theoretical categories aligned to the research objectives.

| | | | | | |
|---|---|---|---|---|---|
| **Adaptable thinking** | **Technologist value** | **Current Engineering role** | **Life Impacts** | **Dumbed down role** | **Career pathway** |
| **Management guidance** | **Self worth** | **Engineering mind-set** | **Future Skills development** | **Later Career guidance** | **Perception of 'old timers'** |
| **Core skills development** | **Physical Demands** | **Adjacent career development** | **Historical skills** | **Development Roadmap** | **Family related influences** |
| **Job and role design** | **Age effects** | **Personal Value** | **Intervention window** | **Personal Brand** | **Work-life balance** |

*Figure 24 – Focused codes (first pass)*

Similar to other grounded theory coding activities, the iterative cycle, reflective code analysis, and constant comparison with existing codes was applied to the 24 preliminary focused codes to create several theoretical categories. A category is a theme or variable that aims to make sense of what the participant has said, is interpreted within the context of the research and other interviews, and the emerging theory (Ford, 2010) is heavily influenced by the theoretical sensitivity of the researcher. This stage required discipline and with every focused code being relevant to some degree, it was, therefore, important to rigorously group closely matched codes together to understand the tentative relationships that existed and potentially combine codes to become properties of a higher order category.

Figure 25 is an example of the development of the *career pathway* category, initially from the *development roadmap, core skills development, and later career guidance* focused codes. The same cyclic process was applied to each of the 24 focused codes with the approach extended where appropriate and used to combine focused codes together to create a theoretical category (Gorra and Kornilaki, 2010).

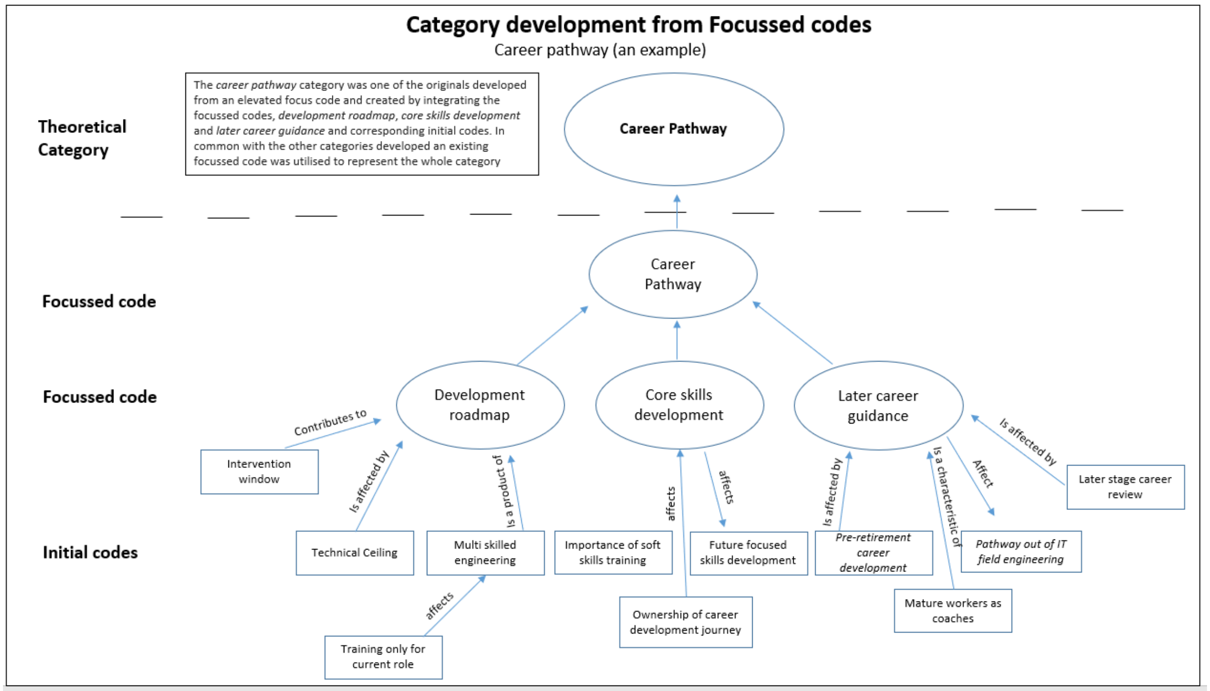


*Figure 25 – Single category development example*

Constant comparison continued with theoretical sensitivity to aid with the category development process; this is an essential step in the grounded theory methodology. Glaser and Strauss (1967, p. 46) explained, “The sociologist should also be sufficiently theoretically sensitive so that he can conceptualize and formulate a theory as it emerges from the data. Once started, theoretical sensitivity is forever in continual development”. The objective was not to create a mass of categories based on forcing the data. Instead, the objective was to create awareness of the broader topic with data driven insight from the coding process used in a theoretically sensitive manner to select emergent categories that earned their place in future theory. Kelle (2007, p. 196) highlighted the challenge of novice researchers who translate the instruction ‘to let categories emerge’ into a demand to transform every idea and concept, making the process insurmountable. The process of constant comparison and analysis led to the creation of 12 categories displayed in Figure 26. These categories, grounded in the data and formed from the defined focused codes, offered a manageable but still representative category outline to be used to for theoretical integration and theory development.

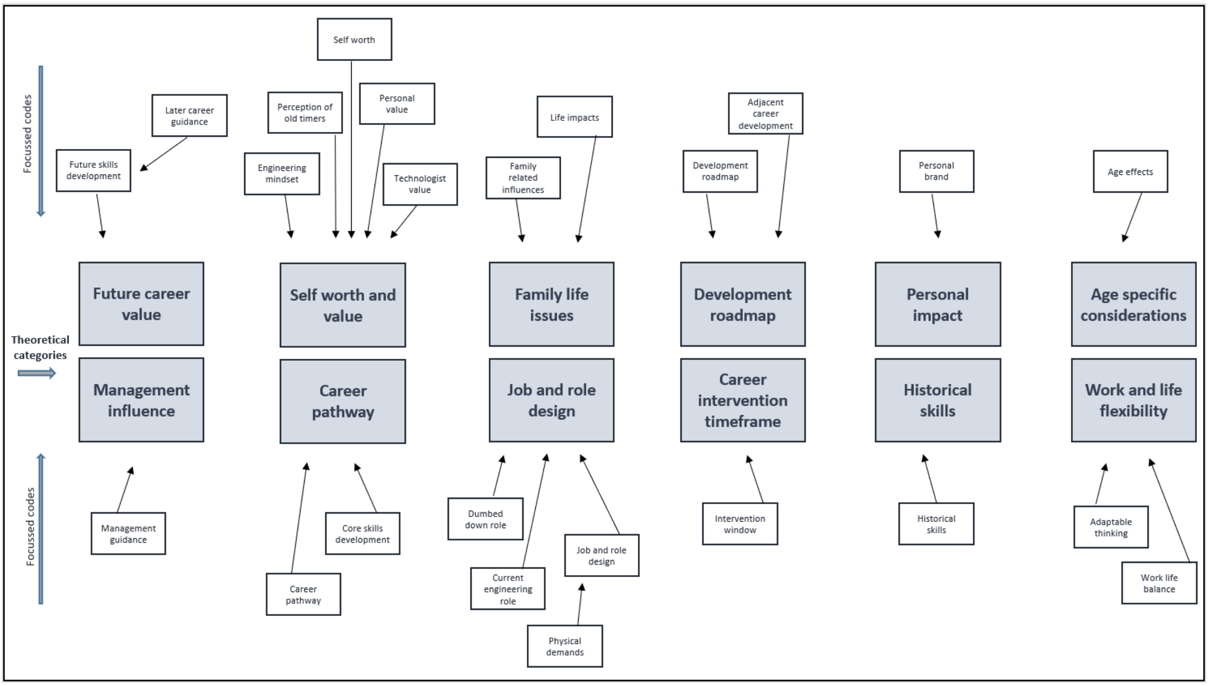


*Figure 26 – Focused codes to categories*

Creation of the theoretical categories changed the research experience. The formulation of the 12 categories, displayed in Figure 26, during this stage of the research did not constitute the development of a grounded theory or a comprehensive generation of conclusive research findings. The use of theoretical coding to finalise the categories and identify a core category to act as the fabric that binds other categories and themes together was key to moving from a descriptive to a theoretical research position.

| | | | | | |
|---|---|---|---|---|---|
| **Future career value** | **Self worth and value** | **Family life issues** | **Development roadmap** | **Personal impact** | **Age specific considerations** |
| **Management influence** | **Career pathway** | **Job and role design** | **Career intervention timeframe** | **Historical skills** | **Work and life flexibility** |

*Figure 27 – Theoretical categories (first iteration)*

Glaser highlighted the importance of a core category that joins other categories and defines the research. According to Glaser and Strauss, “the sociologist should continue to saturate all categories until it is clear which are core categories” (1967, p. 71). Conversely, Charmaz, who’s constructivist grounded theory informed this research, positioned an alternative view that reduces the importance of a core category, instead trusting the data to ensure the researcher focuses of significant aspects. A constructivist approach does not adhere to positivist notions of variable analysis or of finding a single basic process or core category in the studied phenomenon (Charmaz, 2006, p. 132). The search for a core category began based on looking for commonality of words or terms, but the activity yielded few results that could be considered as ‘core’. By relistening to a number of the semi-structured interview recordings, stepping back from the data and allowing areas of importance to emerge, two categories with the potential to be considered as core categories became apparent, pending further analysis. These were *management influence* and *self-worth and value* and were based on a prominence within the transcripts and their strong links to other categories theoretically. At this point, a renewed energy towards the data and the theoretical sensitivity of the researcher towards the topic, based on existing awareness of the IT industry, drove the reappraisal of *management influence* and *self-worth and value* in relation to the other 10 categories using theoretical coding and theoretical sampling to assist with category refinement.

### 4.2.5 Theoretical coding

Theoretical coding, a sophisticated level of coding introduced by Glaser (1978), helps to develop the relationships between the focused codes and the categories created to move the analytical story into a theoretical direction (Charmaz, 2006). A degree of academic confusion exists surrounding the use of theoretical coding when undertaking grounded theory research. Antony Bryant (2017), a highly regarded grounded theory author, mentioned the concept of theoretical coding as crucial but that it can be missing or underdeveloped in published academic work. For this research, a revised approach was followed initially using the categories listed in Figure 28, with theoretical coding used to refine the final categories, relate them to one another, and develop the final theory (Sbaraini *et al*., 2011; Urquhart, 2016).

| | | | | | |
|---|---|---|---|---|---|
| **Future career value** | **Self worth and value** | **Family life issues** | **Development roadmap** | **Personal impact** | **Age specific considerations** |
| **Management influence** | **Career pathway** | **Job and role design** | **Career intervention timeframe** | **Historical skills** | **Work and life flexibility** |

*Figure 28 – Theoretical categories (first iteration)*

Guided by the desire to analyse the data and categories differently, to understand the relationships between them, a storyline based on the work of Birks and Mills (1995) was developed centred on the categories created through the focused coding phase to assist with theoretical integration. The storyline helped to visualise the emerging concepts and deliver clarity between data relationships that may be buried in text. Storylines are a strategy for developing and disseminating grounded theory in a more creative, interesting, and perhaps, authentic manner (Freshwater, 2009, p. 419). The use of a storyline was originally considered at the start of the initial coding stage but was discarded to avoid it seeming like a forced activity (O' Leary, 2004, p. 13) when insufficient levels of data gravity or researcher theoretical sensitivity resulted in there being no story to tell.

Applying a visual storyline to convey the analytical and theoretical perspective of this research initially proved challenging due to the pervasive nature of several categories with relevant codes, reinforcing their prominence and retention. Figure 29 conveys a storyline example explaining the relationship between the initial categories during the data analysis and theoretical coding stages.

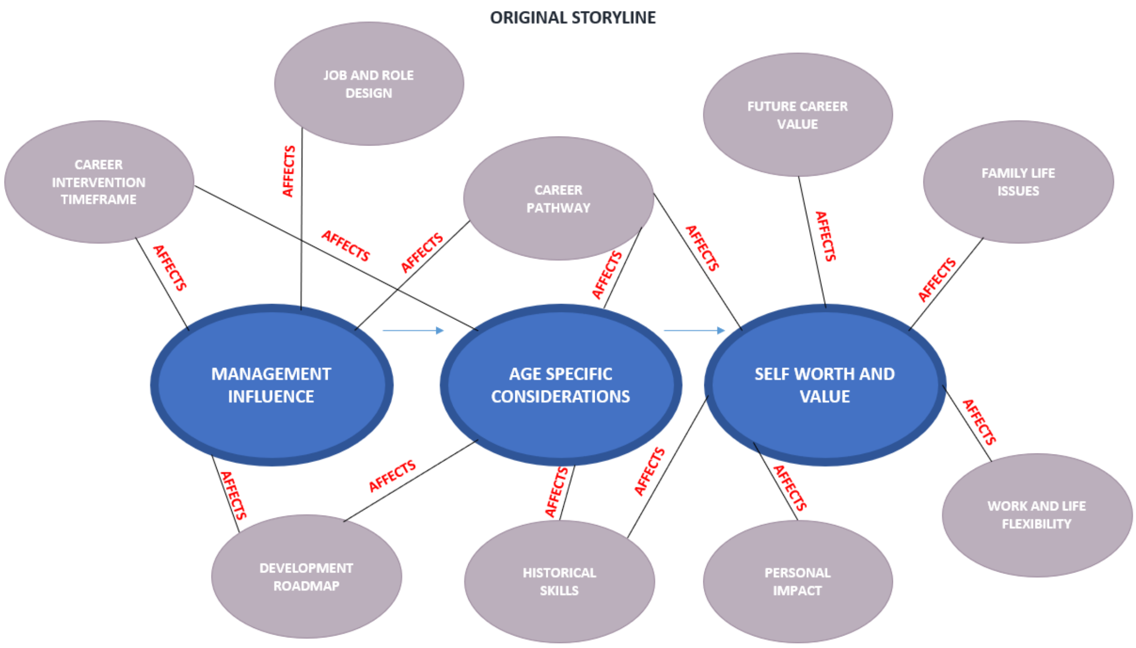


*Figure 29 – Initial storyline*

The research aimed to understand the skills, support and career developmental expectations of mature IT field engineers, which resulted in ongoing discussions with interview participants regarding industry standard IT career derived topics. The storyline above represents the initial analytical viewpoint with *management influence, age specific considerations, and self-worth and value* highlighted as prominent categories generated by the initial and focused coding activities. Charmaz (2006) suggested that constructivist grounded theory research activities may result in the emergence of more than one core category. At this stage of the analysis, three categories were identified with the potential to be considered as core categories, *management influence, age specific considerations and self-worth and value*. However, there were concerns that two of the categories, *management influence and age specific considerations,* may have been convenient selections based on familiarity due to line management already a common, day to day activity that influences field engineers and the 'mature' age scope of the research inferring additional importance by default. The third core category candidate, *self-worth and value,* emerged later on in the analysis with significant core potential but initially the theoretical grounding was questioned until the participant transcripts were revisited. The three categories are discussed briefly in the following theoretical memo (Figure 30).

**Core category or not**

**Theoretical Memo – Jan 2020**

Three categories seem more important than the others based on the role they play stitching are the categories together.

Considering *management influence* initially due to the prominent role of resource managers and the role they perform managing the day to day job allocation and wellbeing of the IT field engineers suggests a relationship by default to all other employee development outcomes. For example, the resource manager as the hiring and IT field engineer line manager will affect *job & role design* and the IT field engineer *development roadmap* to ensure capability is present to perform required tasks. However, as the analysis of the relationship between *management influence* and other codes continued any decision to position it as a core category was considered to be one of convenience rather than theoretical grounding.

*Age specific considerations* as a core category was evident as much to do with the use of age to define the boundaries of the research and therefore affects all aspects of the research by design. Therefore, this suggests the relationships highlighted are a product of the research structure and boundaries instead of research specific characteristics created as a product of coding and analysis.

*Self-worth in value* is the most interesting of the three categories with no visibility of this as an area of inquiry prior to emergence during the coding process. The emergence of this category is potentially exciting because the initial relationships with other categories are guided by topics personal to the IT field engineers and therefore have surfaced directly from the coding outputs. Therefore, at this stage further work is still required guided by examination and constant comparison of coded data and transcripts to identify if any of the three categories or a currently unknown other should be positioned at the core category for this research.

*Figure 30 – Theoretical memo*

Ongoing constant comparison of the data is an essential and invaluable component of the grounded theory methodology. However, continued review of the same or similar data within this research led to periods of 'code blindness', with concerns that this could lead to the researcher only seeing what they wanted to see. This prompted the use of an additional grounded theory analytical framework, titled using the mnemonic TALES, developed by Birks and Mills (2015, p. 114). TALES can be used to stimulate alternative thinking to analyse and evaluate the theoretical storyline already present within the data. The five guiding principles of TALES are listed in figure 31.

| Guiding principles for writing a storyline |
| --- |
| T – Theory takes preference<br>A – Allow for variations<br>L – Limits gaps<br>E – Evidence is grounded<br>S – Style is appropriate |

Birks and Mills, 2009

*Figure 31 – The TALES framework*

The **TALES** framework used evaluate storylines in this study.

| | | |
| --- | --- | --- |
| **T** | Theory takes precedence | Initial categories and theories emerging from the research were overly descriptive and failed to explain the processes explicated by the data. *Development roadmap* was considered an important concept, but it was unclear whether the data truly suggested this or whether this was based on standard employee development principles. *Career pathway* was considered too broad and descriptive as a core category and |

| | | |
|---|---|---|
| | | lacked inductive grounding. Revisiting the interview transcripts and rereading them in the context of the initial storyline led to data driven realisation that the descriptive terms were signs of causality, but the effects were missed. This resulted in *age specific considerations*, *management influence* and *self-worth and value* featuring significantly within data comparison activities. However, the use of constant comparison and an onus on data 'earning its position' within the research resulted in reduced emphasis on *development roadmap, age specific considerations* and *career pathway.* But instead the analytic and theoretical focus being shifted to *management influence* and *self-worth and value* as core concepts at the heart of the developmental needs of maturing IT field engineers. |
| **A** | Allows for variation | The storyline continued to change as constant comparison and ongoing analysis highlighted different categories. The variation highlighted when creating the storyline reinforced the emergence, after numerous storyline outlines, of *self-worth and value* as the significant core category. With no hypothesis to test, the need to categorise data as negative or positive was reduced with all data sets being valuable to creation of codes and categories. The participants cited examples of *management influence* and the |

| | | |
|---|---|---|
| | | benefits to *career development,* the support and guidance delivered with increased emphasis on the IT field engineer *development pathway* enabled by positive *management influence*. However, the core concept unveiled by constant comparison was the mature IT field engineers' feelings of the value of line management interaction, a sense of untapped value, external forces and belief in underused personal skills. |
| **L** | Limits gaps | The storyline suggested gaps that were apparent in the research, but such gaps were in keeping with the stage in the research the storyline presented. The analytical activity of comparing codes and categories to develop the storyline during the focused coding stage helped to deliver coherence based on the relationships between the categories and initial theories considered. Most notably, the emergence of mature IT field engineer *self-worth and value* became apparent when attempts at the initial storyline creation failed to deliver the analytical rationale of existing prominent codes and concepts. |
| **E** | Evidence is grounded | Revisiting codes, raw data sources and constant comparisons helped to evolve descriptive concepts into analytical concepts, i.e., grounded theoretical categories (Birks and Mills, 2015). This helped with 'what if' and out of the box thinking. The notable example of this was the emergence of *self-worth and value* as a core |

| | | |
|---|---|---|
| | | category that was significantly affected by other categories, grounded in the data and not a prior research assumption. Without additional contributions from external data sources, the storyline helped to challenge the data and to remain theoretically sensitive to the concepts and relationships between categories. |
| **S** | Style is appropriate. | Birks and Mills (2015) discussed the style and presentation of a storyline and the importance of entrenching it in the narrative to enhance cohesion. The storyline was considered as a point-in-time representation due to the iterative nature of the coding and constant comparison process. PowerPoint was used to convey the story line thread that could have been lost in the narrative text only. The storyline does not aim to comprehensively convey all concepts and categories created or the final grounded theory but, instead, to act as a valuable analytical tool to guide researcher analysis and deliver clarity to subsequent readers. |

The creation of a storyline required a constant comparison of codes and categories with a review of participant transcripts as a powerful contributor to the analysis of the data. The evolved storyline, shown in Figure 32, displays the changes to the original conceptual view generated by constant comparison of the created codes and theoretical categories as the storyline evolved.

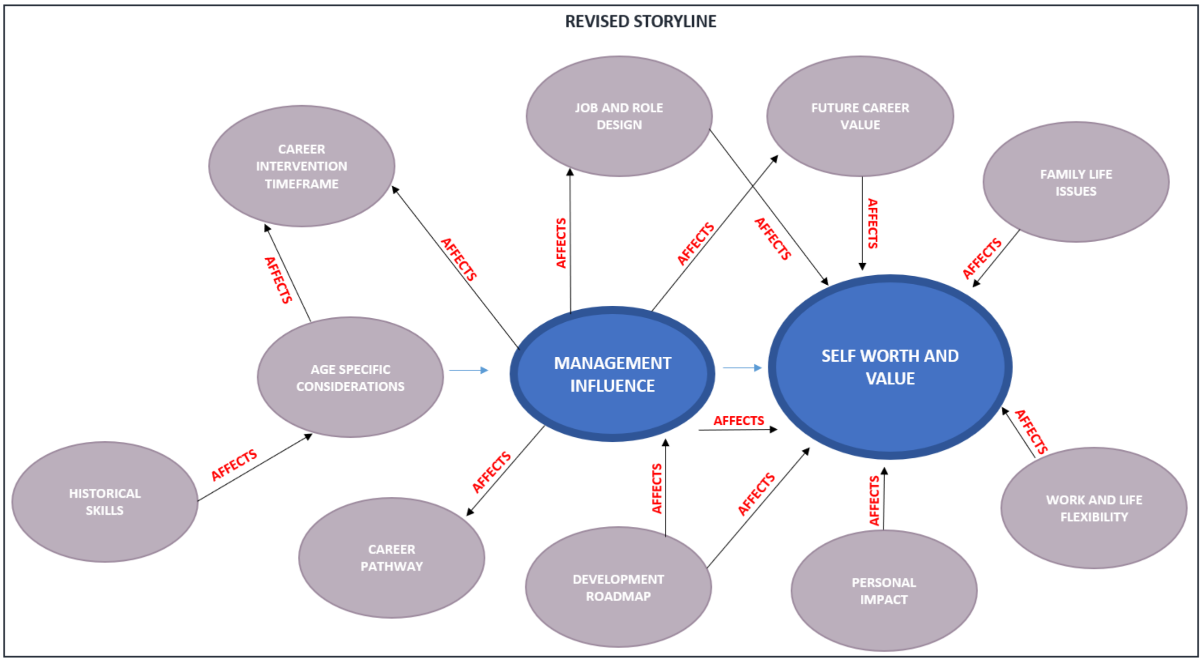


*Figure 32 – Storyline (evolved)*

The emergence of *self-worth and value* as a core category was stimulated by the other two potential core categories in original storyline lacking "grab" which is a concept coined by Glaser (1978) to suggest the emergence of a core category truly illuminating the research, but the *self-worth and value* category 'felt' different. Given (2008, p. 131) summarised the core category as the main theme, storyline, or process that subsumes and integrates all lower-level categories in a grounded theory. Revisiting participant transcripts and codes proved valuable at this stage to further understanding and dilute any efforts to simply force the categories to become core categories guided by the desire to complete research. Whilst the storyline in figure 32 positions *self-worth and value* as a dominant category adjacent to *management influence*, constant comparison of data and transcripts suggested that the IT field engineers' perception of *self-worth and value* is also affected by the other 11 theoretical categories created. Douglas (2003) suggested the core category must appear frequently in the data, suggesting that it becomes increasingly related to other categories and that this should not be forced. However, this research challenges that viewpoint and emphasises the importance of looking beyond a simplistic count of codes to signify importance and instead, truly question what the data is portraying. The creation of a storyline was beneficial to this research and assisted the analytical process within this research by guiding theoretical sampling and coding based on the emergent data (Urquhart and Fernández, 2013).

### 4.3 Core Category – Self-worth and value

The discovery of a core category for this research was unexpected, with other codes and concepts considered obvious candidates prior to data analysis. A core category is a concept or theme that is highly pervasive and links other categories. Glaser explains it as any type of theoretical code with the primary function of “integrating the theory and rendering it dense and saturated” (Glaser and Holton, 2004: p.15). The theoretical memo that follows in figure 33, describes the emergence of *self-worth and value* as a core category by intentionally deciding not to search for one for fear of selecting a category based on convenience or by force. The Charmaz constructivist grounded theory approach places a reduced emphasis on the core category not aligning with the positivist view of a single basic process or core category but, instead, recognises the world as ever changing with multiple realities (Charmaz, 2006, p. 132). Within this research follows Charmaz grounded theory principles, the emergence of *self-worth and value* as the core research category was considered a significant research finding to underpin the relationships between the other categories.

Theoretical memo: Self-worth and value – Core Category

The emergence and subsequent identification of a core category is essential to the integration of other categories into a grounded theory (Hallberg, 2006). There was no attempt to actively seek out the core category amongst the others developed for fear of forcing a concept to become a central based on an unjustified theme within research. Definitions of what constitutes a core category in grounded theory literature initially felt unclear with any category having the potential to be considered core by justifying it with data or the interpretation of a relationship with other categories through the coding process.

A number of categories were initially prominent based on text based visibility within transcripts with *age specific considerations* and *management influence* deemed interesting and substantive categories at the heart of the research objectives. However, ongoing constant comparison and analysis of transcript data and using box diagrams and arrows to sketch relationships with other categories led to the results feeling convenient rather than grounded in theory. The research was initiated guided by an age segmented cohort therefore age was already a "designed in" concept for the research and additionally management interaction or influence is an inherent element of the day to day employment existence of an IT field engineer.

However, when the *self-worth and value* category emerged from the data as a core category as theoretical sensitivity increased the level of 'intimacy;' with the data, it was initially a surprise due to the significant number of literal value related mentions within both categories and codes that were originally not acknowledged as significant potentially clouded by age and management concepts.

The IT field engineers made numerous self-worth and value statements based on perception with their feelings and outcomes affected by the other categories created that documented the lived experience of a CompanyX IT field engineer. The IT field engineers personal sense of *self-worth and value* is highly important to the research due to it emerging as key to feelings of relevance and the valued contribution of the skills they possess. Using the *management influence* category as an example, the relationship and engagement between engineer and resource manager and how that interaction influences the assignment of jobs and acquisition of skills is contributory to the IT field engineers personal perception *of self-worth and value* to increase job related worth, relevance and reduce skills obsolescence.

*Self-worth and value* was definitely considered to have the almost magical." grab" mentioned by Glaser (1998) which resulted in the category, simply feeling right in addition to the data and theoretical relationship based indicators. Potentially a major benefit of the emergence of *self-worth and value* as a core category is the added value it offers to limit further activities to collect data by acting as a central concept to be used to explore existing categories and codes.

*Figure 33 – Theoretical memo (searching for a core category)*

The category *self-worth and value* describes, implicitly or explicitly, the personal feelings of the engineers based on their perception of the worthiness of their contributions. Constant comparison and code and category analysis continued to position *self-worth and value* as a unifier of other categories, exhibiting 'grab' with no forced categorisation required. Simmons (2010) suggested that valuable grounded theory concepts should have imagery, 'grab', and fit with the core category based on radiating the highest interest levels in those areas. The category *self-worth and value* emerged as a core category that describes the powerful, personal emotional feelings of the mature IT field engineers as a result of management decisions, career development activities and future job relevance. This core category also affects and is affected by the other theoretical codes and categories, displayed in Figure 25. The graphic presents the foundational role of the 12 categories created in Chapter 5 with *self-worth and value* elevated to a core category (Figure 34).

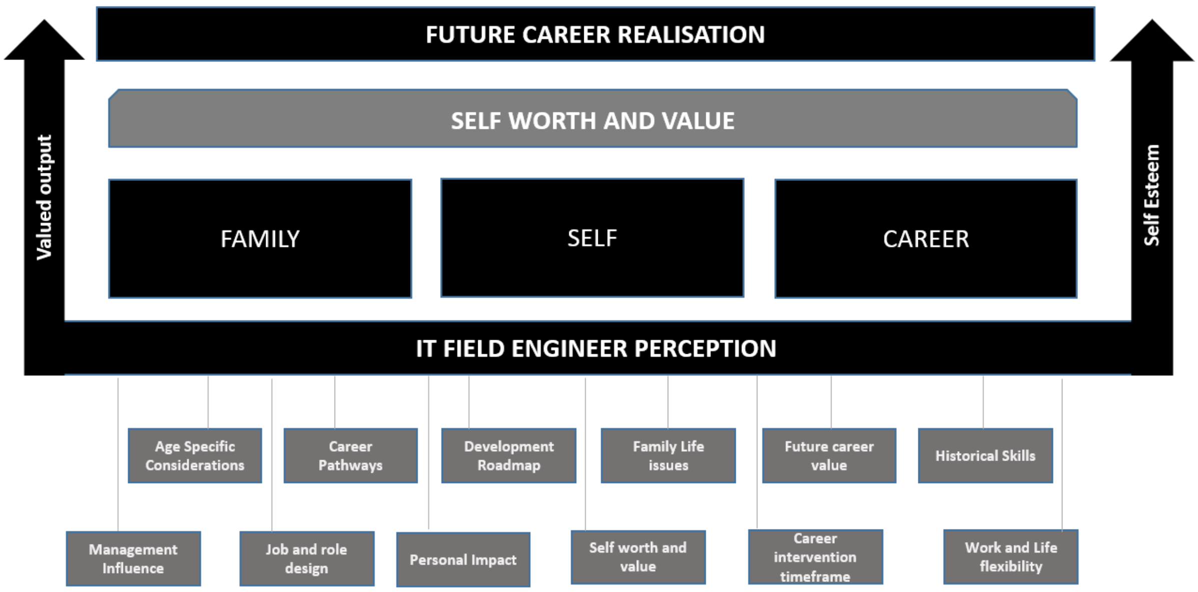


*Figure 34 – Theoretical categories (relationships)*

Figure 34 also displays the contributory roles of employee self or personal value, work and life factors conducive to the career and skills development of mature IT field engineers that can be affected to modify feelings of *self-worth and value*. Observing a core category emerge truly illuminates the power of grounded theory because it builds confidence when the analysis and emerging theory become clear. The table that follows summarises and additional analytical activity to evaluate *Self-worth and value* as a viable core category.

| **SELF WORTH AND VALUE** | |
|---|---|
| **Value examples** | **Value Attributes** |
| Value erosion | Historical skills less attractive (previously highly valuable to both the engineer and the organisation).<br>The validity of selected historically significant skills has declined over time (it did not happen suddenly).<br>On reflection, the organisation could have done more to evolve legacy skills.<br>On reflection, the engineers could have done more to demand the development of future ready skills.<br>Technology simplification has reduced the value of tacit human engineering skills where system complexity is removed.<br>Enhanced technology device reliability has reduced the need for mature IT field engineer intervention.<br>Technology device simplification has reduced the need for previously advanced but now legacy skills |
| Value displacement | Elements of the historical mature IT field engineer skillset have moved to intelligent technology devices. (Simplified and guided by automation).<br>Multi-skilled IT field engineer jobs have reduced the need for specific siloed technical skills. |

| | |
|---|---|
| | Selected historical technical field engineering activities and outcomes are obsolete (hardware functions moved to software). |
| Self-worth | Mature IT field engineers fear an uncertain career future.<br>Mature IT field engineers, once highly regarded, may be forgotten (obsolete skills).<br>Concerns that it may be too late to create new skills based on value and worth.<br>Emotional concerns about the external perception of mature IT field engineers.<br>Recognition frameworks do not reward experience (aligned with output). |
| Personal value | Technical complexity reduction devalues historical skills.<br>The market need for emerging skills can bypass experienced but under-skilled existing engineers.<br>Concerns of career or skills relevance due to industry evolution and changes. |
| Professional value erosion | The changing IT industry is seeking new skills for new outcomes.<br>Productivity centric IT field engineering teams are only utilised based on relevant value.<br>Legacy technology manufacturer skills and certification is less useful when market needs change. |
| Value void | Feelings of emptiness.<br>Feelings of fear.<br>Confusion of what to do next.<br>Paralysed in current role. |

| | |
|---|---|
| | Hiding until found (keep doing the job and keep your head down).<br>Stimulus issues because current tasks do not have the engineering excitement of past work.<br>Troubleshooting skills and senses remain active but are nullified by the role. |

As an insider researcher, remaining theoretically sensitive during the data creation and analysis process was fundamental to research quality and transparency. This research followed the Charmaz constructivist grounded theory approach and concurred with the viewpoint of that the use of rigid coding families may prove overly restrictive and encourage the data to be forced within coding families to possibly achieve a state of manufactured research completeness. Charmaz (2006, p. 151) explained this by describing her own research activities, “I made no attempt to integrate my focussed codes through theoretical coding. Instead, the direction of the analysis emerged from the participants statements and their subsequent coding”.

The same approach was utilised within this research with theoretical sensitivity becoming highly tuned as the research progressed and there was a continual review of the data to determine relevance and fit. Continuing to ask ‘why this’, ‘why now’, and ‘what if’ questions, amongst others, proved invaluable throughout the research and valuable during the theoretical coding and integration in order to thoroughly challenge the data and reject assumptions. Asking questions is a useful strategy at every stage of the research, from the beginning to the final writing stage (Strauss and Corbin, 2014, p. 91).

Questioning the data helped with viewing the categories from an alternative perspective to consider the theoretical inference of the categories. The theoretical categories described within this section were reviewed further, examined in the following section, with participant evaluation leveraged to revisit data for further theoretical sampling, if required for theoretical integration.

## 4.4 Theoretical category review

Theoretical sampling is a form of qualitative sampling not bound by *a priori* selection of data but, instead, it is the activity of jointly collecting and analysing data to determine what data to collect next (Conlon *et al*., 2020). In grounded theory, theoretical sampling performs an important role to assist with the achievement of theoretical saturation, i.e., a point where no new similarities or differences indicating that data collection can end (Aldiabat and Le Navenec, 2018). Theoretical sampling was used in data analysis to guide the selection of additional data but, however, was used differently at this stage. A theoretical category review activity to shift the research from descriptive conceptual groupings to the beginning of a theory was undertaken to challenge the scope and relevance of the 12 categories created during focused coding. Charmaz and Bryant (2007, p. 410) describe theoretical sampling as the strategy that grounded theorists use after developing tentative conceptual categories. The following theoretical categories, listed in Figure 35, formed the basis of this activity.

**Theoretical Categories**

Pre-Theoretical category review

| | | | | | |
|---|---|---|---|---|---|
| **Future career value** | **Self-worth and value** | **Family Life issues** | **Development roadmap** | **Personal impact** | **Age specific considerations** |
| **Management Influence** | **Career Pathway** | **Job and role design** | **Career intervention timeframe** | **Historical skills** | **Work / Life flexibility** |

**Primary Research Objective**

"To determine the skills, support and development required by mature IT field engineers remain effective in the future"

Mature is defined as aged 45 years old and over.

**Interview Questions (the categories above will be discussed)**

- Do the categories capture your experience as a mature IT field engineer?
- Which categories warrant the highest priority or further analysis and why?
- Do you have other categories not currently in this group to add?
- Should any categories be discarded and why?
- Do you have anything to ask me?

*Figure 35 – Theoretical category review*

Four participants were interviewed using the participant interview process (outlined in Appendix 4), which aligned to a theoretical category review activity (outlined in Appendix 11 & 12). The objective was to obtain participant perspectives on the theoretical categories created to determine if they reflected the participant experience. This differed from a member checking activity, normally undertaken earlier in the research which has a closer alignment to a quality evaluation. Member checking involves gathering participants together as a group, after rounds of interviews, and describing the coding and thematic analysis and then using the reactions in the interpretation of the data to support the credibility of the analysis (Winkel *et al*., 2019). This process determined whether the theoretical codes earned the right to be the main data source guiding the main literature search, implementing theory integration in the development of the research findings.

### 4.4.1 Theoretical category review of the interview output

The four theoretical category review interview candidates, displayed in table 1, were selected based on their knowledge of CompanyX engineering practices, their roles as IT field engineers, their experiences of engineer development, and the potential to create the richest level of insight during the analytical stage of the research. The participants included a manager with IT field engineer line management responsibility and male and female mature IT field engineers to include a broad spectrum of participants capable of critically appraising the theoretical categories.

| Participant Code | Participant Job | Original coding Interview completed | Theoretical Sampling Interview | Gender | Average length of service | Particpant age range |
|---|---|---|---|---|---|---|
| **3PH1819** | Engineer | Main | Y | M | 14 | Between 45 and 65 |
| **6PH1823** | Engineer | Main | Y | F | 14 | Between 45 and 65 |
| **8PH1823** | Manager | None | Y | M | 14 | Between 45 and 65 |
| **7PH1823** | Engineer | Main | Y | M | 14 | Between 45 and 65 |

*Table 1- Theoretical category review participants*

The challenge of a managed career advancement to a job outside of the IT field engineering team to other technology roles within CompanyX was identified in the transcripts and codes, therefore insight from engineers successfully achieving such a transition was considered valuable at this stage.

It was envisaged that the category names and definitions would not be finalised until the completion of theoretical category review process with the potential to change, combine or remove categories. Interviews were scheduled with the engineering participants to understand the relevance and dimensions of the categories from the perspective of the participants, with semi-structured questions posed to ensure consistency of interaction across all participants. An interview preparation sheet (Appendix 11) was used and was based on the original participant interview sheet for consistency and was augmented with five questions related to the created categories. Other areas of discussion by the IT field engineers relevant to the research were also encouraged and noted. With three participants previously interviewed, a check to determine their understanding of the process was made. For participants being interviewed for the first time, an information sheet outlining the research objectives with frequently asked questions and an informed consent form was sent by email for perusal and completion prior to the commencement of the interviews. The three out of the four participants were part of the first interview process during the data collection phase with the resource manager added to deliver a triangulated view.

The five questions posed to the theoretical category review participants were:

- Do the categories capture your experience as a mature IT field engineer?
- Which categories warrant the highest priority or further analysis and why?
- Do you have other categories not currently in this group to add?
- Should any categories be discarded and why?
- Do you have anything to ask me?

#### *4.4.1.1 Do the categories capture your experience as a mature IT field engineer?*

The summarised views collated from the theoretical category review participants suggested that the categories were representative of the IT field engineer career and skills development expectations. Significantly, the published table displayed in figure 35 and appendix 11 helped the theoretical category review participants to gain clarity based on seeing the topics documented. The following quote from participant 7PH1823 indicated they found the presented categories relevant.

> "All of those categories make sense when you see them as clear as that. Yeah, yeah, personal impact, self-worth. Yeah, yeah, yeah. I mean, I can see, I'm going to say, all those boxes have value." Participant 7PH1823

The quotation below is from one of two participants who sought an explanation of the *career development timeframe* category but once explained, they not only acknowledged the value of it, they also concurred that a mid-40s time horizon as a valid career intervention point for mid-life focused career discussions.

> "I like the way the categories are laid out and they all make sense to me apart from one which is *career intervention timeframe.* What does this mean?" Participant 6PH1823

Clarification was requested on the positionality of the *management influence* category to ensure it described the role of resource managers as part of an engineer career development journey and not line management as a career destination. Changing the category to management impact was discussed but *management influence* was agreed to be a more accommodating title. All participants were encouraged to consider if further categories were required, with no other suggestions forthcoming. Instead, the participants were positive about the span of categories presented and highlighted they had not realised that there were so many areas that should be considered and, thus found the outline valuable for future use.

#### *4.4.1.2 Which categories warrant the highest priority or further analysis and why?*

The interview participants were asked to highlight the categories that should be prioritised for further analysis. The categories considered highest in priority by the participants were *self-worth and value* (participants 3PH1819, 6PH1823, 7PH1823) followed by *management influence* and *career pathway* (participants 8PH1823, 6PH1823), *development roadmap* and *career intervention timeframe* (participants 6PH1823, 7PH1823). *Work and life flexibility* was selected as a priority by a single participant (3PH1819) with the view this should be more important in the minds of IT field engineers and that the current focus is on ensuring they have the right skills for work. Two participants (6PH1823, 7PH1823) suggested the benefits of combining *development roadmap* and *career intervention timeframe* due to both occurring in tandem. They also held the view that the career intervention timeframe should be at the start of the roadmap discussion. The researcher explained that the *career intervention timeframe* was a new concept defining a time span for action and, therefore, was originally a standalone category created by the research data. Whilst all were acknowledged as relevant, a number of categories resulted in no preference from any of the review candidates and, as such, did not need to move up higher the priority list. Those categories included personal impact which was considered too similar to *self-worth and value* (participant 7PH1823), *age specific considerations* was said to be assumed by the objectives of the research (participant 8PH1823), and *development roadmap* which was considered to be part of a *career pathway* (participant 3PH1819).

*4.4.1.3 Do you have other categories not currently in this group to add?*

The participants were asked if additional content or categories needed be added or if there were any missing from the summary list. No further categories were suggested, with all participants indicating the categories were relevant when considering their lived experiences of the IT field engineering role aligned to the research aims and objectives. Participant 7PH1823 reflected in relation to the theoretical categories discussed:

> "The categories certainly reflect the opportunities and areas I will need to address to achieve my goals until retirement".
> Participant 7PH1823.

Additionally, the benefit of combining the categories *career intervention timeframe* and *development roadmap* based on synergy and similarity of coded outcomes was discussed by two participants (participants 6PH1823, 7PH1823), which also helped the overall meaning of the categories to be easier understood. This assisted with the decision to incorporate the categories *career intervention timeframe* (the intervention activity) and *development roadmap* (due to similarity of coded outcomes and terminology with career pathway) into the *career pathway* category with no detriment to the outcomes presented.

*Job and role design* was established as an explanatory category that should be retained. Therefore, the incorporation of the *historical skills* category with *job and role design* was deemed beneficial with the view that it would be discussed in the research with the *job and role design* findings. In a similar mode, the *personal impact* category was incorporated into *self-worth and value* based on the participants' positioning it as an element for consideration when determining *self-*

*worth and value,* in addition to *future career value* which was considered *a self-worth and value* measure. The removal of *age specific considerations* was not suggested, however the discussions indicated a standalone position was not justified leading to its integration with the *job and role design* category to acknowledge how the life and physical impacts of age affect the IT field engineer job and career development. Finally, the standalone *family* life issues category was integrated into the *work and life flexibility* to saturate it with non-work family related factors.

Reward frameworks were mentioned by one participant as a potential additional separate category but this was discussed as already coded in a number of categories including *management influence*, *self-worth and value* and *career pathway.*

*4.4.1.4 Should any categories be discarded and why?*

The participants reinforced the viewpoint that the 12 theoretical categories were relevant to their lived experiences and career considerations that stimulated the need for this research. However, when questioned to determine if any categories should be discarded, the participants were consistent in the view that selected categories could be combined with no loss of meaning. Integration, simplification and reduction of the original theoretical categories described in the previous sections resulted in an overall reduction from 12 categories to five, detailed in the following section.

### 4.4.2 Theoretical sampling value

Theoretical sampling continued through the theoretical category review stage to determine if further data collection was required or if theoretical saturation had been achieved and no new insights were revealed (Charmaz, 2006). Two of Glaser's (1998) tests for qualitative research analysis, 'what category does the incident indicate' and 'what property of what category does this incident indicate' were used after the review of the categories and are discussed in the summary in table 2 below.

| **Current category** | **What category does the incident indicate?** | **What property of what category does this incident indicate** | **Contributory codes (sample)** | **Participant feedback from theoretical category review** | **Concluding outcome** |
|---|---|---|---|---|---|
| **Historical skills** | Category based on codes explaining the current state of skills developed over long career. | This category is well positioned as a property of a broader role or job category | *Tacit skills*<br><br>*Role demise*<br><br>*Reuse of old knowledge*<br><br>*Failure to maximise experience* | No recommendation to remain a standalone category. Combine within an appropriate category as long as it is retained as a property. | Incorporate historical skills category into the Job and role design category. |
| **Family life issues** | Category created to highlight home and family activities that must be balanced against the demands of the IT field engineer job. | This category can be incorporated into the work life flexibility category | *Ageing family assistance*<br><br>*Reprioritising family involvement*<br><br>*Life / work priorities (switch of focus)* | No recommendation to remain a standalone category. Work life flexibility was assumed to including it. | Incorporate the family life issues category into the work life flexibility category. |
| **Age specific considerations** | Category to convey age related considerations of mature CompanyX IT field engineers. | Age related factors are important throughout this research. However, the impact on job and life activities suggests this should be used to saturate the work life category. | *Age not a factor*<br><br>*Desire for shorter workdays*<br><br>*Perception of older worker value*<br><br>*Seeking more 'life time'* | No recommendation to remain a standalone category. This is considered a sub conversation that was more of an altitudinal consideration. Combine within an appropriate category as long | Incorporate the age-specific considerations category into job and role design category. |

| | | | | | |
|---|---|---|---|---|---|
| | | | | as it is retained as a property. | |
| **Development roadmap** | This is a broad category coded to describe the IT field engineer skill and role development over a specific timeframe. | One of a number of categories with similar outcomes describing career or development roadmaps. | *Technical ceiling*<br><br>*Adjacent career development*<br><br>*Need for software skills*<br>*Pathway out of IT field engineering* | No recommendation to remain a standalone category. Discussion on the category title and whether development roadmap or career pathway should be retained. Career pathway was considered viable based on development roadmap too general as a designation. | Incorporate the development roadmap category into the career pathway category and remove the development roadmap standalone category. |
| **Future career value** | A category discussing the type of future IT career and validity in a changing world. | This category was based on a limited group of codes to describe the engineer perception of their value in the future. | *Later career guidance*<br><br>*Value of legacy knowledge*<br><br>*New knowledge requirements*<br><br>*Perception of value* | No recommendation to remain a standalone category.<br>This category was the result of emotive and perception-based discussions. | Incorporate the future career value category into the self-worth and value category. |
| **Personal impact** | An early category coded to outline the value IT field engineers believed they deliver, both inside and outside of work. | On reflection, this was a limited category before self-worth and value emerged and serves a greater purpose saturating it. | *Role demands*<br><br>*Success measures*<br><br>*Perception of 'old timers'*<br><br>*Life impacts*<br>*Technical value* | This category as a topic was valid but will benefit from integration due to alignment and the benefit of saturation of the self-worth and value category. | Incorporate the personal impact category into the self-worth and value. |

| | | | | | |
|---|---|---|---|---|---|
| **Career Intervention timeframe** | The career intervention timeframe category was a created based on data within transcripts, discussing the right time to interact for mature or older worker development discussions | Describes a mid 40s age timeframe with support within existing literature that may act as a consistent initial engagement point, mindful that chronological age is not the only factor | *Earlier mature career intervention*<br><br>*Mid life development appraisal*<br><br>*Inconsistent later career development* | The category was initially confusing to the review candidates, but once explained it gained, support and acknowledgeme nt | Incorporate the category into career pathway as an attribute to assist with career navigation |

*Table 2 - Results of Glaser's tests for qualitative research*

The category review guided by theoretical sampling maximised the emergent nature of grounded theory research by encouraging open and transparent interactions between the researcher and participants when discussing and proposing modifications to the categories, negating the need for further data collection. However, this required additional thought, described in the following memo (figure 36), to clarify the overlapping terminology describing the use of theoretical sampling earlier on in the research stage, which differs in outcome from its use at a later theoretical stage.

**Theoretical Memo – Jan 2020 (after participant 6PH1823 interview)**

The theoretical sampling stage is without doubt is one of the most important and impactful stages through this research. The categories created via comparison and data analysis to date seem clear with the challenge to keep the category list to fourteen because many equally seem to be valid for future discussion. In fact, my concern at this stage is the fact it all seems too clear with the worry the categories were a convenient outline and insufficient comparison and analysis had not been undertaken (not the case, but food for thought).

The grounded theory terminology continues to confuse me and whilst theoretical sampling is being used as the heading to describe the review of the final categories activity, I had considered theoretical concept evaluation as a more appropriate title to describe an in-depth appraisal of categories to validate suitability for the research. Different authors describe theoretical sampling in different ways with many grounded theory authors discussing theoretical sampling as something undertaken throughout the research, however the Charmaz description makes more sense with earlier sampling activities to expand on the data collected in the intentional manner or purposeful sampling even though documentation still calls it theoretical. Charmaz (2008) explains "researchers who subscribe to the grounded theory method conduct theoretical sampling only after they have tentative categories to develop or refine". Charmaz summarises the importance and benefits of theoretical sampling when a theoretical base of categories exists which makes a lot of sense however this is another playful use of terminology. Theoretical sampling of any form by definition must also be intentional therefore aligned to a purpose (therefore is also purposeful).

Theoretical sensitivity is the real engine behind the ongoing analysis, driving both theoretical sampling and reflexively. The concepts of theoretical sensitivity is potentially the hidden jewel in grounded theory and has reshaped my approach to this research in a highly positive way. To quote Glaser and Strauss (1967), "Once started, theoretical sensitivity is forever· in continual development as he queries many different theories on such questions as - What does the theory do? How is it conceived? What is its general position? What kinds of models does it use?." Theoretical sensitivity as it has increased through the research has continued to mobilise "why" and "what does this mean" questioning that reduces the likelihood of the researcher shifting from active participation to overactive participation. Its hard to explain how impactful awareness of this concept has been.

The theoretical sampling activity at this stage of the research was undertaken for a specific purpose, to gain insight from the participants to determine if the theoretical categories described the engineer experiences and future viewpoint. The participants were engaging, and the output of the interaction was valuable. The participants conveyed the theoretical categories developed were considered clear and a valid interpretation of the engineer viewpoint and experiences. The participants expressed the categories delivered a picture of their experiences in a manner they had never previously seen. Participant 6PH1823 explained "this is perfectly timed because it shows me areas, I should be considering I have previously thought of and will use at my next appraisal".

The questions posed included an opinion on the benefits of collapsing categories and including new categories for glaring omissions. Surprisingly there was no request to add further categories with the view the theoretical category template was a good representation. Based on participant feedback changes will be made to the categories to combine similar, confusing or redundant categories but retain the properties indicated even it a category is removed.

This theoretical sampling activity was not intended to be a research quality check but more of an early theoretical category integrity check to ensure integration activities and a literature search were guided by the participant views and the data created by the interviews. This activity has helped to deliver additional confidence in the research with data and participant interaction intentionally guiding the research and findings.

Jan 23rd 2020.

*Figure 36 - Theoretical memo*

Positive reinforcement of the relevance of the created theoretical categories from the interviewed participants suggested the data was well placed to generate research findings but that further integration and consolidation of the categories would deliver focus and help with understanding. Figure 37 outlines the final five categories and supporting seven subcategories that were guided by the category review and theoretical sampling process.

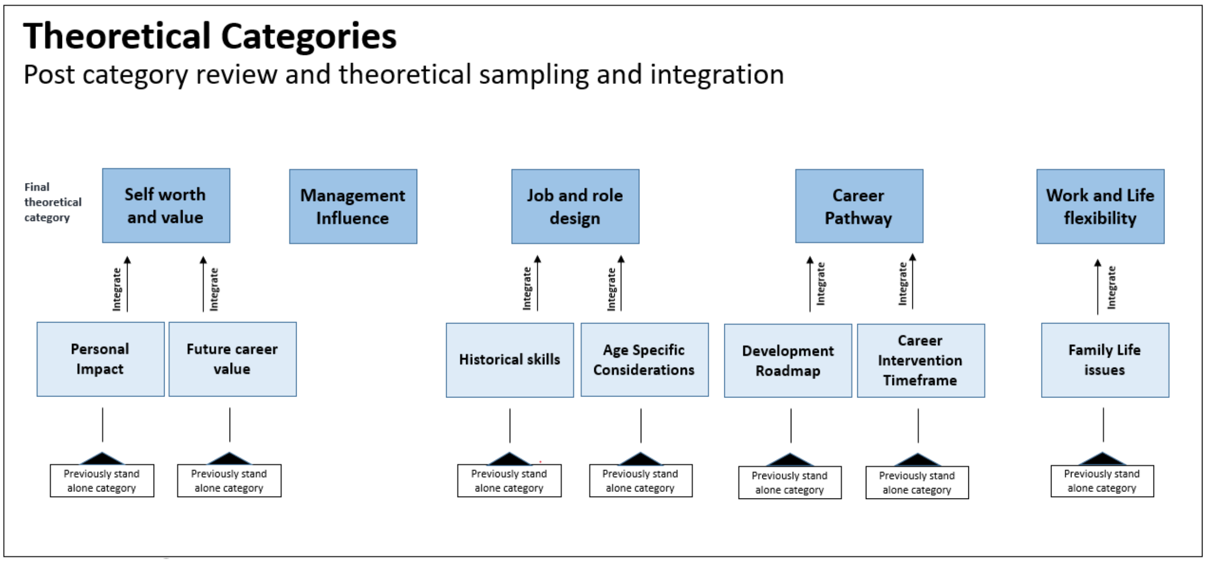


*Figure 37 - Theoretical categories (Final)*

The final five theoretical categories created as a result of the theoretical category review stage included:

- Management influence
- Job and role design
- Work and life flexibility
- Career pathways
- Self-worth and value (core category)

The literature search that follows in Chapter 5 will be informed by the five revised theoretical categories with further constant companion and analysis to consider if the external literature suggests further expansion of the theoretical category list.

## 4.5 Chapter summary

This chapter described the results of the coding process used to analyse the semi-structured interview transcripts of twenty two mature IT field engineers to create codes and theoretical categories. Twelve theoretical categories were created from the focused codes generated, with *self-worth and value* emerging as a core category theoretically linked to the others. A follow on activity reviewed the created categories that were underpinned by theoretical sampling and selected additional research participants to evaluate these twelve categories for relevance and completeness.

The review of the twelve theoretical categories determined no further data collection was required, with theoretical saturation achieved by integrating seven of the existing categories as sub-categories and codes into five, data saturated final theoretical categories. The final five theoretical categories, *management influence, job and role design, work and life flexibility, career pathway* and, the core category, *self-worth and value,* will form the basis of the research findings that will be discussed and integrated with existing literature, where appropriate, in the chapters that follow.

# Chapter 5: Literature Review

## 5.1 Introduction

This chapter presents the main literature review undertaken to achieve a balanced view of the collective knowledge available on the research topic (Winchester and Salji, 2016). This main literature review was guided by the theoretical categories *management influence, job and role design, work and life flexibility, career pathway and the core category, self-worth and value* created in Chapter 4. A preliminary literature review, documented in Chapter 2, was undertaken to position this research in the context of existing academic work aligned to similar topics and ensure participant interviews were not commenced with insufficient background knowledge (Allan, 2003). Limited literature explicitly discussing the topic of mature or older IT field engineers and their career related development needs was found during the preliminary review which highlighted a gap in knowledge.

## 5.2 The search of extant literature

The main literature review, in this chapter was conducted to build on the preliminary literature search summarised in Chapter 2, guided by seminal grounded theory principles that advised the main literature review should be undertaken after the creation of the research data (Glaser and Strauss, 1967). This meant that the research codes and categories were inductively created from the data generated from the participant interviews and not initially influenced by concepts from the extant literature (Urquhart, 2002). This research focuses on the skills and capabilities needed for mature IT field engineers to remain effective in CompanyX, therefore the sections that follow will summarise the main literature search outputs based on the codes and categories created in Chapter 4 listed below.

- Management influence

- Job and role design
- Work and life flexibility
- Career pathways
- Self-worth and value

In addition to the categories above, professional identity literature focussed on information technology workers relevant to the five research categories is also summarised throughout this chapter. The consideration of professional identity, which describes the influence of several factors including skills, experiences, job and how they contribute to an individual's identification with a profession (Schein, 1978; Ibarra, 1999; Brooks et al., 2011; Smith, 2016) was highlighted as an area of inquiry influenced by the Chapter 2 literature search.

The research categories above and similar variations along with professional identity, were used as search terms in University of Worcester library, Google Scholar and academic literature search platforms, and included additional calibrating search terms to guide the retrieval of relevant content. Appendix 14 presents an example of the literature search approach used to combine search string examples, in different ways guided by the research categories with "AND" and "NEAR" logical operators to refine search results.

## 5.3 Management Influence

CompanyX resource managers perform an important IT field engineer line management role. This section was guided by the *management influence* theoretical category developed within this study but, due to the lack of specific research discussing the management of mature IT field engineers, also explores broader people and ageing employee management theories.

The term 'managers' can be used to define individuals undertaking the role across a number of levels. However, for this research, the middle manager category is best suited to align with skills and capabilities discussed within this research. Harding *et al*., (2014) explained why the managers occupy a central role in the organisational hierarchy as they are responsible for implementing management plans and ensure junior staff fulfil their roles. This definition is expanded by Rezvani (2017) who described middle managers as experienced employees who undertake both technical and managerial activities that include budgeting, scheduling hiring, and firing as well as being equipped with knowledge about technical activities within their practice. Managers also have a significant impact on the sense of belonging (Tsakissiris, 2015) of the technical workers within their teams, which may lead to employees choosing to present a positive professional identity to the manager (Wiles, 2013) with the objective of being viewed favorably.

It should also be noted no single management style is optimal for all situations, and the manager or leader should possess the skills to adapt appropriately (Mosadeghrad and Yarmohammadian, 2006; Namiq, 2018). Mosadeghrad (2003) summarised several leadership approaches exist including autocratic, bureaucratic, laissez-faire, charismatic, democratic, participative, situational, transactional, and transformational during a study of leadership style and job satisfaction. However, three common styles, autocratic, democratic and laissez-faire explored by Lewin, Lippitt and White (1939), were identified by the first major study of leadership styles by Kurt Lewin and a team of management theorists in 1930s (Bhargavi and Yaseen, 2016). Autocratic management which focussed on central control and efficiency (Khan, Wahab and Bhatti, 2021) originated in 19th century, according to classical management theory, at a time when factory productivity and employee output was considered fundamental. The scientific management approach of Frederick Taylor (Taylor, 1911) that focussed on top down, central control and efficiency is an important example of an autocratic management style.

Whilst autocratic management benefits have been argued to benefit from quick and efficient decision-making due to the lack of additional input solicited from the employees (Amanchukwu *et al*., 2015), the disadvantages of authoritarian or dominant management styles have been said to include the creation of weak employee-manager relationships and the need for constant monitoring of the employee (Ghaziasgar, 2021). The opposite approach to an autocratic style is democratic with managers involving employees in decisions and seeking consensus where possible (Dyczkowska and Dyczkowski, 2018), which can lead to high team spirit and morale due to increased understanding (Sharma and Singh, 2013) and positive performance (Ego and Madubueze, 2019). However, a democratic management style can lead slow decision-making and procrastination (Yang and Zhu, 2022), with managers also struggling to find optimal solutions due to the consensus nature of decision-making (Khan *et al*., 2015). A laissez-faire management is hands off in style giving employees freedom (Iqbal *et al*., 2021; Yang, 2015) to determine their own goals, embark on decision-making, and resolve issues (Sharma and Singh, 2013). However, a laissez-faire management style can also be counter-productive and detrimental when a build-up of workplace stressors and interpersonal issues are not tackled (Skogstad *et al*., 2007).

Mintzberg (1973) positioned managers as individuals who perform both leadership and management activities by adopting ten different roles or personas by adapting their behaviour according to the situation (Calarco, 2020). The CompanyX resource managers as the primary authority for the IT field engineers' well-being, task and job allocation, and rewards and recognition, perform the majority of the personas described by Mintzberg. The administrative management style of Fayol (1916), with an emphasis on planning and control in addition to Taylor's scientific management style (Taylor, 1911), based on observation to drive productivity remains evident within the task centric realm of IT field engineering performance management. Managers use employee performance management to understand and manage the job performance of subordinates (Gruman and Saks, 2011). Research by Maley, Marina and Moeller (2021) indicated that employee performance management remains challenging but, with clarity of the purpose of the approach and employees' understanding of the expected behaviours and rewards, it will be a worthwhile activity. Performance goals and targets are a key element of employee performance management, but they must be carefully implemented due to the link to employee rewards. Latham and Locke (2006) also warned against managers focusing primarily on goal-driven employee performance management due to the associated sense of failure of not meeting the goal and the possibility of detrimental effects to self-esteem, however, where managers stimulate a team culture guided by shared goals and objectives, the approach may contribute to a positive sense of professional identity (Kamara and Mould, 2020). Chew (1998) concurred by explaining that managers should be careful about how they use productivity measures and ensure they focus on overall employee capabilities as part of a blended approach to understanding output due to the connection to bonuses and promotions. Misterek, Dooley and Anderson (1992) also discussed that managers, examining the measurement of productivity, must also consider human behaviour because productivity measures alone do not take qualitative aspects impacting productivity into account. The drive for data driven insights to determine productivity and output can lead to 'metric fixation', where the benefits of productivity metrics have been oversold and experience centric judgements replaced with standardised measurements that ultimately determine reward or punishment (Muller, 2021). The challenge faced by managers to understand, manage and reward performance and productivity also affects engineering workers. For most employees, feeling valued meant having feelings of belonging, contributing, and feeling supported and empowered by their leaders and managers (Crestani, 2018).

Engineers are knowledge workers who deliver worker productivity through the use of technology to solve problems (Varghese, 2011) and therefore productivity should not be determined by factory worker style efficiency metrics but instead by the effectiveness of the engineer (Petroni, 2000). Engineers may present an additional management problem by blending manual work with technical knowledge-based competence to deliver their contribution, compounding the measurement difficulty. Drucker (1999) expanded this point by citing knowledge worker productivity as one of the biggest 21st-century management challenges partially because increasing productivity requires a change of attitude from both the organisation and the worker, whereas a performance enhancement of manual worker can be achieved by simply doing more of the requested task. Information technology employees, as knowledge workers possess knowledge capital in their minds, used as a key component of their contribution which makes quantified work performance challenging (Zhan *et al*. 2013), in addition to this the potentially arbitrary evaluations and opinions of others can lead to knowledge workers struggling to maintain their ever-changing professional identities in comparison to workers with competence materially grounded (Alvesson, 2001). Petroni (2000) also found that managers should place greater emphasis on rewarding engineers for their achievements and contributions rather than output measures and that not all rewards need to be purely monetary (Thite, 2004). This was supported by O'Neil and Adya (2007) who found non-monetary, socio-emotional rewards were important to knowledge workers to support their personal psychological contract expectations of delivering value. Lawler's (2002) new pay reward structure addressed this challenge from a different direction by rewarding, skill, and knowledge and by tightly connecting the workers to the organisational outcomes with the clarity gained by all involved encouraging good performance. An alternative management approach positioned by Latham and Locke (2006) suggested the use of coaching and feedback as effective strategies to drive employee performance, with the enhanced communication offering benefits to both the manager and the employee.

Managers perform a key role in the day-to-day task management and well-being of employees from recruitment through to retirement and must position organisational and personnel changes in a manner that maintains employee commitment (Vandenberghe and Bentein, 2009). With reference to older workers the focus of this research, managers perform an important role engaging and retaining employees by facilitating task allocation, job design and day-to-day team guidance (Paullin, 2014). Leisink and Knies (2011), based on research in the Netherlands, found that line managers support older workers by stimulating their personal commitment to a greater degree than they do to the older workers' career development. This is supported by Findsen (2015) who explained managers may feel money spent on older workers for training and development is wasted given the limited time span before retirement. Billet *et al*. (2001) found that managers are not making use of the full extent of the accumulated 'workplace competence' of their older workers (categorised as 45 years and over) who should not be considered as 'last resort' employees but, instead, as a valued resource pool if the relevant investments in skills are made in order to bring their capabilities up to date. Whilst a broad investment in relevant skills is required to upskill the workforce (Barnes, Bimrose and Brown, 2006), when interviewed, managers of IT workers highlighted the development of soft and communications skills as beneficial to the workers they need for the future and are responsible for (Abraham *et al*., 2006; Litecky *et al*., 2009; Kearney and Davidson, 2012).

A key role of the manager is to ensure the teams they are responsible for meet business and performance objectives and create the right relationships to help employees to understand the importance and value of their work (Dorsey and Muller-Hanson, 2017). Managers help to maintain the professional standards that inform the professional identities of the jobs and roles in their profession for the broader team (Briggs, 2007). This requires ongoing engagement between the managers and the subordinates within their teams. An example of such an engagement is, the leader-member exchange (LMX) theory, a four-stage approach for leaders and managers based on the creation and maintenance of high quality dyadic social relationships (Graen and Uhl-Bien, 1995). LMX differs from other leadership and management theories and focuses on the impact that the manager's behaviour has on subordinates in order to understand the dyadic relationship quality between leaders and subordinates (Erdogan and Bauer, 2014). The LMX relationship can be measured using instruments such as the LMX-7 (Graen and Uhl-Bien, 1995; Martin *et al*., 2016) and LMX leadership approaches can be applied in different working contexts. Stephenson (2017) determined the LMX model to be viable within age diverse environments due to the establishment of one-to-one relationships between the leaders and subordinates. Additonally, Vidyarthi *et al*. (2014) adapted and extended the LMX approach to explore subordinates who reported to 'dual leaders' within an IT organisation and found that both individual relationships and dual leader alignment to be important to the overall LMX outcome. LMX may be a popular leadership and management model (Erdogan and Bauer, 2014), but critique of the model highlights the 'in group' or 'out group' separation between group members that can lead to unfairness or perceived inequality (Jha and Jha, 2013) and a dysfunctional environment where low-quality relationships are present (Othman, Fang Ee and Lay Shi, 2010).

The manager has the power to set the team's organisational climate and therefore, has more of an opportunity to motivate employees (London, 1990; Kroth, 2007). Such is the influence of the manager on the teams they care for, they can act as role models offering learning, motivation and career guidance to help with the development of professional identity (Gibson, 2004). The resource manager role in this study has power and influence over employee job allocation, development and remuneration. However, managers should be mindful that their actions and behaviours exert a level of organisational control, potentially shaping the professional identity they want their subordinates to consume (Alvesson and Willmott, 2002). It is important for managers to ensure hygiene factors including money, job advancement and a positive working environment are evident to retain qualified IT professionals. However, these will not be enough if other employee motivational factors are not present (Lockwood and Ansari, 1999; Tripathi *et al*., 2019). Whilst base level employee hygiene factors are considered an organisational norm, personnel management programmes focusing on the motivational factors that positively drive employee satisfaction and commitment (Herzberg, 1964) are often lacking in IT organisations (Smith and McKeen, 2017). Inceoglu *et al*. (2012) concurred with Herzberg's finding that intrinsic motivators (i.e., autonomy, personal principles) have the highest value for mature employees.

Managers use rewards in a motivational manner to fulfil employee social, emotional, and economic needs (Maslow, 1943; Armstrong, 2007). Managers perform a motivational role to the individuals they are responsible for by engaging them in work activities that increase satisfaction and productivity suggesting a link between motivation and the employee's professional identity (Popescu, Bulei and Mihalcioiu, 2014). The types of rewards available include extrinsic rewards such as pay, job, benefits (White and Druker, 2000) and intrinsic rewards such as informal praise, celebratory events, non-monetary recognition, like plaques, and opportunities to feedback ideas for change (Allen and Helms, 2001). Franco-Santos and Gomez-Mejia (2015) cite further examples of intrinsic rewards that include meaningfulness, choice, sense of growth and community and suggests that it is valuable for managers to intentionally combine both reward types to underpin a 'total rewards system'. Total rewards offer a flexible mixture of intrinsic and extrinsic rewards that can be used to meet the needs of both the organisation and the employee (Hoole and Hotz, 2016). Total rewards programmes are guided by the premise that employees work for more than money and also want job satisfaction, development, work-life balance as part of a holistic experience (Silverman and Reilly, 2003). Rumpel and Medcof (2006), researching numerous reward programmes for technical workers, found a total rewards-based approach presented beneficial opportunities to the management of employees in technology environments where value and innovation are important. This view is also supported by Slade *et al*.(2002), based on findings at Microsoft, who found that whilst it was not easy to implement and required substantial levels of input from the employees, total rewards programmes offered a better way for managers to build commitment with their valuable human capital. However, the adoption of a total rewards-based approach by managers and the organisation is not without challenges as there are concerns about the administrative burden of implementation and that employees may struggle to equate the value (Silverman and Reilly, 2003).

The needs of older workers, a focus of this research, may also be served by a tailored rewards approach with Parry (2007) suggesting the use of a tailored total rewards approaches may help with recruitment, retention, and job performance through better employee engagement. When using employee rewards, managers will need to emphasise older workers' involvement in task contributions (inputs) over monetary rewards (Kollmann et al., 2020). The categorisation of the mature IT field engineers in this research as knowledge workers is important due to traditional rewards and management approaches not always motivating knowledge workers who may be willing to sacrifice financial gain to satisfy their personal needs and desires (Harrigan and Dalmia, 1991; Brun and Dugas, 2008). Existing literature indicates this may be due to older workers worrying less about the financial rewards associated with a longer future time horizon (Powers *et al.*, 1992). This view is now challenged in the current economic climate, with the UK retirement age increased leading to extended employment tenures (Leithman, 2016). The type of rewards used by managers and the subsequent outcomes may change and be closer aligned to employee life stage and with job satisfaction with research by Kalleberg and Loscoco (1983) finding that the levels of intrinsic rewards appearing to increase up to age 40, remained flat until after 61, then increased again. This may again illuminate the benefits of a total rewards based approach due to the flexibility it facilitates across the age spectrum (Parry, 2007).

Managers trained to emphasise age-aware employee considerations can develop the skills required to maintain, motivate and develop a mature workplace (Altmann, 2015; Beck and Williams, 2016). Armstrong-Stassen (2008), in a pilot study based on input from older workers to determine relevant HR practices found in addition to areas highlighted such as job design and training for the mature workers, training the managers of mature workers to help them to serve the workers' needs better was emphasised. Negative age stereotyping is an example of an age aware consideration that can exist amongst managers when considering the abilities, learning capabilities and flexibility of mature employees compared to their younger counterparts (Cheung *et al*., 2011; Tishman *et al*., 2012; Vasconcelos, 2018). Older workers are frequently negatively stereotyped as poorer performers, less motivated less willing to participate in training and career development, more resistant and less willing to change, less trusting, less healthy, and more vulnerable to work-family imbalances (Ng and Feldman, 2012; Fapohunda, 2014).

Managers hold an authoritative role with responsibilities that include task allocation and job design. Hiesinger and Tophoven (2019) summarised older workers are in a multi-disadvantaged workforce group in the working population based on declining health and the impact of a physically demanding job. Therefore, this suggests that such deficiencies can be offset by job redesign and an increased use of digital technologies that make physically demanding work easier. Physical decline is also a focus of Harper and Marcus (2006) who indicated age-related physical or musculoskeletal decline may occur as soon as the mid-40s when bone density begins to decrease, which can lead to strength and balance issues. Therefore, job redesign in the workplace to consider worker capacity issues as a result of age-related physical decline will help older workers to feel safer and remain in the workplace longer. Sharit and Czaja (2012) expanded on the importance the use of job redesign indicating that managers and organisations who employ older workers should tailor tasks and jobs to minimise the impact of physical decline in order to enhance the work experience for the older employees.

Selection, optimisation, and compensation theory (SOC) offers an explanation of how older people manage and optimise their resources to affect their outcomes by selecting activities that best fit, optimise, and adjust to minimise deficiencies to compensate for any age-related declines that may be physical or cognitive (Freund, 2008). It may benefit managers to gain awareness of how older workers potentially use SOC theory behaviours to compensate for age-related decline (Baltes and Baltes, 1990) and may adjust in the workplace to minimise the detrimental effects of ageing on their job and workplace experiences (von Bonsdoorf *et al*., 2018). However, managers' knowledge of how SOC strategies are being applied by older workers in their organisations may be lacking, therefore creating a buffer to a complete understanding of employee needs (Karlsen, Borg and Meng, 2022). This indicates development may be required to ensure managers are equipped with additional capabilities to be aware of age-aware management and developmental needs of older workers.

Leisink and Knies (2011) suggested that providing managers with training to acquire additional people development and coaching skills will increase the effectiveness of mature employee management. Managers also realise engagement benefits with older workers based on the value of a 'leader coaching' style (Dello Russo, Miraglia and Borgogni, 2016), helping to diffuse manager to employee conflict due to the collaborative nature of the interaction (Tjosvold *et al*., 1991). The value of managers exhibiting coaching skills is further reinforced by Luthans, Hodgetts, and Rosenkrantz (1988) who suggested that both the employee and the broader organisation are more likely to view managers with coaching behaviours as more effective leaders. In addition to this, Watola and Woycheshin (2016) positions additional benefits to managers and leaders who can benefit from coaching outcomes due to the self-reflection coaching stimulates with opportunities for employees to offer managers feedback. Positive results can be achieved with organisational support from the senior leadership to develop a 'culture of coaching' in the company with systems and structures to reinforce the capability and value of managers coaching employees (Lindbom, 2007). However, the introduction of a coaching-based management approach is not without its own challenges with existing research indicating the knowledge and behaviours may not be universally accepted, with some managers fearing the collaborative nature may result in a loss of power and control (Foegen, 1998). This is reinforced by Ladyshewsky (2010) who determined the manager as a coach (MAC) role can be complex and, if it is not undertaken correctly with trust built between managers and subordinates, the result can be counterproductive, leading to a loss of employee engagement.

### 5.4 Job and role design

The *job and role design* research finding indicated the mature IT field engineers' jobs were affected by changing technical and services expectations in the IT industry, reducing the relevance of existing tasks and highlighting the need for new jobs and skills. The literature search indicated a lack of job and role design extant literature aligned to mature IT engineers who undertake technical roles in an industry in which they may have a multidecade tenure. This section will explore a number of relevant development initiatives that affect the job and role designs of older workers therefore may be equally applicable to mature IT engineers.

Job design is the specification of the contents, methods, and relationships of tasks to deliver outputs that satisfy technological and organisational requirements as well as the social and personal requirements of the job holder (Davis, 1966; Cordery and Parker, 2012; Belias and Sklikas, 2013). Job design considers the behaviour and outcomes enabled by the person undertaking a group of tasks to deliver a job which is facilitated by the role they perform (Armstrong-Stassen, 2006). Poor job design can lead to narrow, repetitive, and boring work (Froy *et al*., 2012). Existing literature indicated professional employees are likely to resist changes to job design when it is initially tabled due to the potential change to their work or professional identity (Chen and Reay, 2021; Currie et al., 2012). However, redesigning jobs to align with an employee's personal values may help them to find their purpose and enhance their professional identity (Baczor and Zheltoukhova, 2017).

Modern job design activities have evolved from the simplistic Frederick Taylor "scientific management" approach (Taylor, 1911), which is based on manager-defined manual repetitive tasks, to a job design with a greater onus on workforce behaviour and motivation (Clegg, 1984). An important influence on job design was Herzberg's two-factor theory which found that when intrinsic work features were built into the job, such as recognition, they served as motivators that drove employee satisfaction and that extrinsic hygiene factors, such as pay, can be the cause of dissatisfaction (Herzberg *et al*., 1957). However, Herzberg's two-factor theory, whilst the catalyst for large amounts of research and evidence of successful work redesign projects (Hackman and Oldman, 1976), has been discredited by a number of authors due to methodological issues, a lack of consistency with existing evidence (House and Wigdor, 1967), and inconsistent categorisation (Malinovsky and Barry, 1965), to name a few areas of concern.

The 1950s also saw the emergence of a different job design approach based on socio-technical systems theory (STST), which considers the interplay between the technical components of work and the social environment where the work is undertaken (Walker *et al*., 2008). Trist and Bamford (1951), based on research in the coal mining industry, found the miners were affected by increased mental and physical stress, when the job shifted from traditional hand-based work to a technology driven 'longwall' mining approach because the impact of social and technology change on well-being was not considered prior to the introduction of the new technology. The theory determined it is important to optimise both social and technical aspects, considering task significance, meaningfulness, identity and autonomous work groups, and how they affect the workers when introducing new systems (Trist, 1981). Whilst STST has its proponents, for example when used to develop systems for smart working (Bednar and Welch, 2019) or system design (Clegg, 2000), existing literature also conveys limitations that include a lack of clarity on how to determine how the work and social surrounding affect each other (Hackman and Oldman, 1976). Adding to this, the recent use of the theory is predominantly associated with IT systems (Davis, 2019) or industrial machine implementation (Mumford, 2006), which may reduce the applicability of STST in this research of CompanyX IT field engineers due to its people centric nature.

Existing literature suggests how a job is redesigned and the associated work outcomes, plays an important role in the motivation of an employee which affects their personal and professional identity (Zamolo, 2020). Job characteristics theory was based on the work of Turner and Laurence (1965) and Hackman and Oldman (1974) who created attributes to measure the relationship between jobs and worker motivation, satisfaction, and performance (Lee-Ross and Lashley, 2003). Turner and Laurence (1965), based on a study of 470 workers in 47 different jobs, discovered that sociocultural factors were important to understanding the work environment, which later led to the creation of the requisite task attribute index (RTA). Their research identified six attributes including variety, autonomy, interaction, knowledge, skill, and responsibility, which were shown to be related to worker job satisfaction and performance. Hackman and Lawler (1971), built on the work of Turner and Laurence (1965) using their research of telephone company workers and found those workers with a higher desire for job satisfaction, when undertaking jobs with the core dimensions of skill variety, autonomy, task identity, significance and feedback, tended to have increased job satisfaction, motivation, and reduced absenteeism (Hackman and Lawler, 1971). Following Hackman and Lawler (1971), Hackman and Oldman (1976) developed the job characteristics model (JCM) that comprised five core job characteristics, of skill variety, task identity, task significance, autonomy, and feedback which were found to affect three critical worker psychological states, meaningfulness, responsibility and knowledge. Fried and Ferris (1987) undertook a comprehensive meta-analysis of nearly 200 studies using the JCM model and found that there was support for the core elements but with variance in selected areas. The JCM and its associated job diagnostics survey instrument (Hackman and Oldman, 1974) have become a well-established framework used to evaluate modern day job and work design requirements (Hackman and Oldham, 1976; Guise, 1988; Boonzaier et al., 2001; Morgeson and Humphrey, 2008; Mehrgan, 2012).

The definition of information technology (IT) jobs suffer from ambiguity and imprecise descriptions and consists of multiple subdisciplines in the IT and engineering arenas (Freeman and Aspray, 1999), which has historically resulted in many areas for potential employment. Until recently, an individual working in the IT field would not have had great difficulties in getting established into the occupation and would not have had the fear of becoming obsolete. The personal computer (PC) based, information technology industry discussed in Chapter 1, has remained consistent for many decades which helped to cultivate the mindset and thought processes of technical and scientific workers in the field. Udwadia (1986) described an engineering mindset in simplistic terms aligning it to a problem-solving thought process applied by some scientific and engineering individuals who intellectually dismantle and understand the core components of a challenge to isolate and replace problematic elements to understand how the working environment may operate. The engineering mindset concepts were extended by (Laato and Sutinen, 2020) building on Udwadia's findings and suggesting the engineering mindset to be narrow and helped to formulate the epistemic toolkit for engineering students, incorporating theology to reshape their thinking to ensure they are intellectually capable of solving increasingly complex problems in the future. However, technical experience and mindset alone have been shown to be insufficient, with technological breakthroughs and business dynamics resulting in employment difficulties highlighted by mature workers (Vasconcelos, 2015a).

The accelerated industry change and new technology developments have resulted in a historically skilled workforce, potentially with outdated skills for the changing times (Cappelli, 2000). Technology obsolescence has accelerated as a result of increased levels of digitalisation facilitated by the use of digital technologies and process automation changing or replacing physical service jobs with technology or data driven operational systems (Kudryavtseva *et al*., 2019). This has led to changes in IT engineering job roles with the need for physical hardware installation reducing (Goles, Hawk and Kaiser, 2008) but an increase in the need for new skills aligned to software, systems design and integration (Alt *et al*., 2020), security and automation (Litecky *et al*., 2009; Hawk *et al*., 2012; Jones *et al*., 2018). Many IT professionals realise, due to the constant industry change, and deskilling as a result of industry simplification (Frey and Osbourne, 2013), that they must continually change jobs or retrain to reduce the threat of professional obsolescence (Fu, 2010). The ability to demonstrate technical job competence, work without supervision and be viewed by others as proficient are important elements of establishing a revised professional identity (Katz, 2005). However, there are positive outcomes associated with the accelerated technological changes that affect the IT industry. Job growth in the IT industry exceeds the production of skilled employees (Mitchell, 1999). For example, emerging technology areas such as cyber security influenced by digitisation increasing the attack surface (DeZan, 2019) are reaching crisis proportions (Smith, 2018), with shortfalls of skilled employees, in both the USA and UK, that may take decades to be addressed (Christiansen and Piekarz, 2018). This suggests development of relevant skills in emerging information technology areas will benefit both employees and organisations due to the potential to impact employee shortages in identified domains.

Information technology employees who possess experience and multiple technical skills or categories of skills can increase their value and marketability (Koong and Liu, 2002). The skills framework for the information age (SFIA) is a global technology competency framework that offers a consistent and measurable approach available to organisations and governments to develop technical personnel (SFIA, 2021). The SFIA framework has been adopted by the UK government digital, data and technology function who also assisted with the development of it (HM Government, 2011b). Non-technical, meta or soft skills, including rapport building, oral communication, team-working, problem solving (Sunarto, 2015), are increasingly important to employers and are valuable in IT environments due to engineering jobs being shifted from data centres to direct engagement with system users in office environments (Hurrell, 2016). The term meta-skills, which describes reusable high order skills adjusted and applied differently include adaptability, flexibility, resilience, decision making (Santiteerakul *et al*., 2019; Schultheiss and Backes-Gellner, 2022), are valuable for engineers to cultivate so that they can be equipped for an ever-changing future. Older workers who develop soft skills may benefit from continued employment due to the skills development facilitating and encouraging lifelong learning (Yang, 2022). Adaptability, and the ability to self-design or redesign professional identity to respond to new careers and realise psychological success, is considered a valuable additional meta-skill for mature workers (Mirvis and Hall, 1994; Lahn, 2003).

Job and role designs that include variety and utilise old and new skills will deliver value to the older population (Rineer, 2012). This increases the potential for older workers to maximise historical skills. However, changes employees face due to job redesign can threaten key elements of their historical persona such as autonomy which may subsequently damage their professional identity (Johns, 2010). Managers can play an important role, helping employees to embrace job and role changes. Chen and Reay (2021), found, when encouraged by managers, employees can park their previous professional identity to give them mental space to learn new tasks required for new jobs, helping them to adapt to change and then revisit it.

Kubeck *et al*. (1996) presented a perspective that may increase the emphasis on job design and explained that mature workers due to cognitive decline, may have less mastery at the end of training and may take longer to a task. Kanfer and Ackerman (2004) noted that the mature worker perception of lower cognitive abilities and fear of compromising their own self-concept may be the reason for them avoiding development activities. Whilst the continual change of the brain over time does result in a reduction in cognitive processing speed or storage (Ackerman, 1996; Salthouse, 2004), crystallised or knowledge-based intelligence remains stable well into post-retirement age (Peeters and Emmerik, 2008; Beard *et al*., 2012). IBM, one of the world's most important information technical companies intentionally used job redesign and reaccreditation to motivate mature or older engineers to encourage them to proactively enrol in educational training and apply for new and challenging tasks (IBM, 1978). Older workers gain mastery by on-the-job activities, thus highlighting the importance of training developed for mature employees and effective job design (IBM, 1978; Zwick, 2015). Warr (1993) added that rather than allowing stereotypes to perpetuate, organisations should provide training tailored specific to the requirements of older employees. Existing research has also suggested the use self-directed learning (SDL) or autodidactic learning as it has been found to be beneficial for mature workers to process information, to take on new skills and maintain their personal development activities (Knowles, 1975; Candy, 1991; Schalk, 2011; Šatienė, 2017; Šatienė, 2020). With technical knowledge at the heart of the professional identity of IT specialists, organisations that encourage flexibility within the work environment will improve balance and empower employees to become agents of their own professional interests (Loogma, Umarik and Vilu, 2004).

Adams *et al.,* 2017) summarised older workers are a valuable and loyal community who can be retained in the workforce via the provision of flexible working as part of job redesign if it can be accommodated by the role. Such job and role design modifications can include career breaks, part time work and flexi-place (location) working to retain mature workers (Beard *et al*., 2012). Reducing or eliminating the physical demands of the role for mature employees (Christensen, 1955) to compensate for their physical decline by modifying equipment or changing workflow can increase employee effectiveness and reduce stress (Rothberg, 1967;

Walker, 1998; Parker *et al*., 2017; Sousa, Ramos and Carvalho, 2019). Investments by an organisation in future skills for mature employees, where there is no emphasis on physical tasks, is not wasted with research showing that an older employee may have a better job experience than a younger employee because of the positive link between experience and level of job knowledge (Warr, 2001).

The term 'work design' also appears in existing research and is used in a similar manner to job design, but theoretically suggests a broader perspective that not only includes assigned tasks, organisational outcomes and responsibilities, but also activities that the individual or group might have self-selected or 'crafted', or that have emerged through informal or social processes (Grant and Parker, 2009; Parker *et al*., 2017). Job crafters may be considered as those employees who maximize their work environment by introducing changes in work tasks and relationships and attributing personal meaning and professional identity to their jobs (Zamolo, 2020). Wrzewsniewski and Dutton (2001) summarise, job crafting differs from job design in that the former may be considered a dynamic process which emphasizes individual's agency role, whereas the second is characterized by more static elements (Zamolo, 2020. However, the employee flexibility offered by the dynamic approaches such as job crafting which enables greater autonomy to define work tasks and roles can lead to employee stress or burnout (Bredehöft *et al*., 2015).

The concept of meaningful work, whilst described via a mass of definitions and philosophical perspectives, is mentioned favourably in older worker job and role design research due to employees feeling motivated based on awareness the tasks undertaken and their contribution makes a positive difference (Hackman and Oldman, 1976; Smith, Crafford and Schurink, 2015; Bailey et al., 2019). Research by Chalofsky (2003) explained meaningful work as more than tasks, but as way of life defined by a sense of self, the work undertaken and the worker feeling a sense of balance.

Job roles that enable older workers to use their experience to mentor younger workers are explicitly valuable to organisations (Brooke and Taylor, 2005). Existing research suggests that older or mature aged people are best trained with younger learners, with older workers considered to be good trainers and workplace coaches for younger staff (Smith *et al.,* 2010). Ng and Feldman (2008), via a comprehensive meta-analysis of 380 empirical studies considering job performance, found that organisations should spend time training older workers on mentoring skills but controversially also indicated that less time should be spent training older workers on technical skills due to younger workers faring better in this area. Sanders (2009), also researching job design to support the successful ageing for older worker, indicated organisations should consider job design characteristics that offer mentoring for older workers due to the importance of skill variety and co-worker support.

The relationship between mentoring and job design is also positioned by Beier (2015) who explained that organisations should offer older workers input into job design, which will enable them to design new roles aligned to their skills and interests such as mentoring. However, it should be noted a professional identity threat may be evident within workers where tasks that previously existed in a prior job that helped to define it are absent in the new role (Chen, Currie and McGivern, 2022). Zacher *et al*. (2017), researching active ageing at work, found that, on average, older workers flourish in jobs that include mentoring and other citizenship behaviour within organisations. This is finding is also supported by Marvel and Cox (2017) based on research of 41 studies of ageing employees and found that older workers value mentoring others, which acts as a factor to support positive work-life balance and promote self-esteem. Den Boer *et al*. (2021) reinforced mentoring, in both informal and structured manners, as a high-ranking key job characteristic valued by older workers older workers. In addition to mentoring, job design activities that support older workers aligning their personal aspirations, job roles and organisational objectives will deliver significant rewards to mature employees (Marvell and Cox, 2017). Intrinsically rewarding and self-concept affirming job features, such as personal principles, having the freedom to decide how to do one's work, and not being constrained by pre-defined structures (i.e., having high flexibility) are predicted to be more motivating for older age groups (Inceoglu *et al*., 2012).

## 5.5 Work and life flexibility

*Work and life flexibility* was described by all interview participants and was aligned to the need for mature IT field engineers to have greater control over work and family activities, to improve their life experiences, and their personal belief of needing to deliver value in both areas. Whilst the theoretical and academic concepts of work-life flexibility were explored, the broader work-life balance concept was also considered due to the potential to utilise work-life balance options to increase flexibility within both work and external life / family situations.

Work and life flexibility in the workplace can be described as organisational policies and scheduling practices designed to give employees greater control of when, where, and how work is undertaken in relation to the job and tasks required by the organization (Kossek and Lautcsh, 2017). However, this study is better served by the perspective of Hill *et al*. (2008) who explained that workers have essential life needs outside of work, therefore if workplace flexibility helps them to meet those needs, they will be more motivated and loyal in the workplace. Family and home life considerations at different stages of an employee's career impacts their workplace professional identity (Smith, 2016). Whilst historically considered as work programmes and policies in the workplace to help women who may have family needs (Hill *et al*., 2008), workplace flexibility is now viewed as a key work-life strategy for both men and women across all life stages (Hill, Jackson and Martinengo, 2006). However, work life flexibility prioritisation differs across the sexes, with existing work life literature suggesting work is a dominant life interest that shapes a man's professional identity and self-esteem with fatherhood considered a distant obligation (Hearn, 1999).

Early work from Kanter about work-life balance highlighted that, despite agreement that family and the economy are broadly linked, the specific intersections and transactions between work and family as connected organisers of experiences and social relations were virtually ignored (Kanter, 1977; Kossek and Groggins, 2015).  Many employees, have a desire to protect and retain the workaholic professional identity that has served them well for many years to avoid the fear of what a more balanced one may look like with more space set aside for family and meaningful activities (Russo and Morandin, 2019). Work-life balance describes a mutual outcome with organisations maintaining a work environment supportive of its employees who are equally satisfied with the balance of their work role and family role, which can include dimensions of work-family time, leisure, involvement, community, and satisfaction (Greenhaus *et al*., 2003; Ahmad, 2013; Dhas, 2015).

The period of mid-life loosely spanning from mid 30s to mid-40s can be turbulent, with the self-reflection leading to the development of new motives, needs and values and increasing the focus on work and life considerations (Buonocore, 1992; Polden, 2002). Older workers, over 50 years old, may continue to feel active but need to wrestle with competing demands that include leisurely pursuits, changing family roles or volunteering (Yeandle *et al.* 2002). As older workers they may hold a 'nostalgic' professional identity that shapes their commitment to the balance work and lifestyle activities which may differ from more recent generations (Cruess *et al.,* 2015). Flexibility or balance within work and family activities are essential for employees with neither domain separate. This results in organisational elements spilling into the home and domestic responsibilities crossing into the work domain (Kanter, 1977; Halford *et al*., 2006). Pandu *et al*. (2013), via researching IT professionals, found increased work-life imbalance is more pronounced among workers in large organisations, compared to medium-sized and small organisations.

Existing literature indicates flexibility options in the workplace are often associated with work-life balance options including, but not limited to, flexitime, on-site childcare, and telecommuting (Hartel *et al*., 2007; Beauregard and Henry, 2009). Work-life flexibility options vary across extant literature with research by Dhas (2015) also citing an increased availability of employee well-being and work-life balance options while highlighting gym membership, fitness training, yoga, counselling, and healthy eating. However, Barnes *et al*. (2009) indicated that overtime was also an attractive option with older workers considering it important to maximise income pre-retirement, therefore a reduction in working hours was not seen as an employee priority. Kodz, Harper and Dench (2002) also indicated that employers needed to rethink their views on age with many older people needing to work for financial reasons to maintain an income due to extended employment. Yeandle (2005), researching older workers and their motivations to continue working rather than face retirement, highlighted the value of work and balance policies that include flexible employment, career breaks, access to social care, vocational guidance and pension information and suggested that seeking clarity (about these options) from the employees during regular reviews is important.

However, Grawitch and Barber (2010) found that there is a reduced amount of literature on non-work or life support options, such as time off, for dependent care. The employee usage of options to assist with work-life flexibility has indicated differences across gender, with women more likely to utilise dependent care options. Beauregard and Henry (2009), based on a meta-review of the way work-life balance influences organisational effectiveness, determined workplace flexibility is greater than a handful of options, but instead trust and optimal control over one's job and working conditions in addition to work-life practices are still predominantly used by women, with men continuing to perceive that they will be viewed negatively for using them. However, they also highlighted the value of such options using business cases, but their appeal may be limited due to much of the existing academic ROI evidence stemming from non-generalisable case studies (Beauregard and Henry, 2009).

Hill *et al*. (2008) proposed an alternative model offering a conceptual workplace flexibility model that builds on the options described in existing literature and includes the individual, home and family, and workplace and community characteristics as antecedents. Existing literature indicates a change of approach may be required to present options to improve employee work and life flexibility. Lazar, Osoian and Ratu (2010) argued that availability and the use of work-life practices can reduce conflict and increase the employee's positive perception of the organisation, however work is required to build a long-term organisational culture that changes the way people think and talk about work-life balance so that it becomes accepted as the norm.

Work-life flexibility was a finding of this research with the mature IT field engineers whilst aware the contacted nature of their jobs made full time flexibility challenging, keen to shift the balance of work vs non work time. Where the time or hours of work are customer-driven, employee flexibility is inherently limited (Lazar, Osoian and Ratu, 2010). Kossek and Lautsch (2017) emphasised the importance of time in their conceptualisation of work-life flexibility by positioning time, timing and place of work as important to individual and group performance affecting employees across the life span. The popularity of flexitime may be due to positive support from both men and women across all life stages (Moen *et al*., 2011), and the lower cost of implementing such a policy means that little change is required to show a return on investment (Christensen and Staines, 1990; Galinsky, 1992). Hill *et al*. (2001), examining the influence of the job 'flexitime' and 'flexiplace' on family work and family balance, found the perceived flexibility facilitated by the opportunity to improve the harmony between work and life activities was positive to both personal and business outcomes. In addition to this, McDonald *et al*. (2005) indicated that increased time flexibility may involve reciprocal behaviour, with employees working during times deemed beneficial to the organisation in exchange for the ability to tailor time for personal needs. However, an alternative perspective is shared by Januszkiewicz (2019) who suggested that too much time flexibility in the workplace can come at a cost by affecting the employee's natural daily rhythm of work.

The realisation of work and life flexibility has an important role to play in conflict management between work and family. Meta analysis of work-life conflict and satisfaction by Kossek and Ozeki (1998) found that existing research has overlooked the joint assessment of work and family conflict in addition to the support offered by the organisation. Their research also found that there is a relationship between access to work and family policies, especially those supporting job flexibility and worker life satisfaction. Kossek, Perringo and Gounden Rock (2021) suggested employees are seeking work life flexibility to balance their integrated home and work professional identities that enables family life to be built jointly with their career. Hill, Jackson and Martinego (2006), based on over 20 years of research on work and family polices at leading IT manufacturer IBM, found that fathers reported less family work conflict than mothers but struggled as much as mothers to prevent work from diminishing their energy at home. In addition to this, they were less likely to use work options to improve work-life harmony.

Managers or supervisors play a key role in employee task management and well-being from recruitment to retirement (Vandenberghe and Bentein, 2009), and they monitor performance for the organisation and their support and vision is key to the success of work-life flexibility programmes (Cegarra Leiva *et al.* 2012). Existing literature indicates the historical manager approach to the employee conflict between work and personal life was to act in a disconnected manner, considering the employees time at work associated with work activities only (Friedman, Christensen and DeGroot, 1998). Support and guidance from managers is important to the effectiveness of work life programmes, with literature indicating work life flexibility may challenge an employee's existing professional identity within professions held in high regard by distorting historical views of 'ideal worker' behaviour (Howell, Beckett and Villablanca, 2017). This may include work ethic, attitude to the organisation and other characteristics considered to be the workplace norm.

Managers who behaved in a supportive manager increased the employees' level of control, which may heighten workers' ability to deal with conflict work and life priorities (Major and Cleveland, 2008). Yeandle *et al.*(2002) determined the relationship between the manager and employee plays a key role in the way flexible work-life policies are implemented and consumed due to the manager's requirement to also balance service delivery in addition to access (Beauregard and Henry, 2009) to selected flexible working options. This can lead to an employee perception of unfairness towards them due to the discretionary behavior of different managers, ranging from inflexible to accommodating (Yeandle *et al.* 2002). However, Kelly and Kalev (2006) argued that manager discretion can be used positively using 'formalized discretion' which explicitly sets out clear work-life flexibility policies and the possibility of case-by-case negotiation between the manager and worker. Friedman, Christensen and DeGroot (1998) suggested that new manager behavior is required to ensure a mutual level of clarity exists between both the manager and employee about work and relevant personal life impacts. For managers to support the 'whole person', they need to be aware that the employee has overlapping work and life roles and managers should continue to experiment with ways to ensure that work is done effectively whilst creating time for the employee's personal life pursuits.

Effective recruitment and retention of IT workers may have less to do with salary alone but instead a crafted HR strategy for IT personnel that considers compensation, work allocation and recognition (Agarwal and Ferratt, 2001).

Kaplan and Lerouge (2007) positioned the demanding knowledge and activity dynamics of the IT worker role and summarized the human resources (HR) profession should consider the use of *'middle range'* theories to develop a better understanding of how to manage this unique and complex employee subpopulation. Human resources teams also play a critical role in the broader workplace experience of IT workers through the development of organizational polices that help employees to balance personal and professional demands (Niederman and Ferratt, 2006). Professionally, IT employees are considered ‘knowledge workers’ therefore HR practitioners must develop strategies to motivate IT workers and help to reinvent their careers or risk losing them to other organizations (Patil, Patil and Waje, 2011). Proactive HR practices indicating that the organisation is investing in and supporting employees may contribute to the employee payback enabled by social exchange relationships formed as a result of individuals engaging in interactions based on expectations of corresponding rewards (Blau, 1986). Influenced by social exchange theory (Blau, 1986), Armstrong-Stassen and Ursel (2009) developed a model of older workers’ intentions to remain with their organisations and found that the respondents who felt their organisations provided employees with opportunities to upgrade and acquire news skills and valued them were considered supportive. Social exchange theory was used as the theoretical basis to inform psychological contract theory (Rousseau, 1995) and explain the reciprocity of the relationship between employee and employer (Chaudhry and Tekeab, 2013). Kraak, Russo and Jimenez (2018) found a link between older workers’ negative feelings of psychological contract breaches related to under-fulfillment of work-life inducements, with the results also indicating increased employee turnover intentions.

Extending the working life of a mature employee can be a positive outcome of work-life balance programmes. Bruton (2012) found achievement of a reasonable work life balance can have a positive impact on performance and professional identity therefore improving employee retention. Also, having mature employees assist with job and role redesign to develop age friendly workplaces and accommodate a redefined employee work engagement template can lead to further job satisfaction and an increased likelihood of them remaining in employment (Sharit and Czaja, 2012; Nagarajan et al., 2019). Taneva *et al*. (2016) explained that the role of flexible working options are not as prominent as may be expected but workplace flexibility can result in a continuation of employment within an organisation via the use of flexitime (Beard *et al*., 2012), COVID-19 inspired work from home practices (George, Lakhani and Puranam, 2020), or telecommuting remote working practices (Veth *et al*., 2017; Kylili *et al*., 2020).

Gender is recognised within this research, but the gender difference in relation to the engineer role is not the primary area of focus. Emslie and Hunt (2009) found that female employees discussed current concerns of jugging work, older children and ageing parents but male employees focused on work-life challenges and past instances when their work conflicted with the parenting activities. Existing research suggests work-life and family friendly work cultures based on the potential to deliver flexibility and increase opportunities are more important for job and work satisfaction to women than men (Parkes and Langford, 2008; Chung and Van der Lippe, 2020). The requirement to care for ageing family members in addition to parenting is also evident. Caring for children spans a typically predictable period of time but caring for elderly parents is less predictable and can vary widely in terms of duration (Moen *et al*., 2011).

### 5.6 Career pathway

This research combined multiple career and career development codes to form a theoretical category, *career pathway* that described the activities undertaken and outcomes achieved over a time span.  A general definition of the term ‘career’ is offered by Hall (1976) who described a career as individually perceived attitudes, behaviours and activities associated with job and work pursuits over the span of a person’s life. A richer career definition is positioned by Super (1976) who discussed careers as a course of person-centred events from adolescence to retirement that includes a sequence of life, occupations and other roles that enable a person to express their commitment to work and development. Echoing a similar perspective to Super, Brown and Lent (2013) positioned a career as a collection of jobs held over an individual's work life but also indicated that the term may be limited to a particular 'job family,' such as engineering.

Career development, similar to the term 'career' also has a number of loosely coupled definitions but can be considered a lifelong process of developmental experiences that encompass work life, with the information and education leveraged to create a career pattern that helps individuals fashion an identity or self (Hansen, 1997; Herr and Cramer, 1996). Khapova *et al.,* (2007) found an individual's professional identity is anchored in their profession, in this case information technology and is shaped by the career development activities they undertake both inside and outside of their existing employer. A programmatic approach to employee career development offers far more than the acquisition of new skills, with existing research undertaken in the IT sector also finding that it improves training activities undertaken in isolation and contributes to employee engagement (Semwal and Dhyani, 2017).

Chen (1998) indicates that a person's career pathway is constructed by life roles and events underpinned by meaning to the individuals that guide their subsequent actions. Pathways enable individuals to navigate their careers and can be defined as connected education, training and support activities to enable a person to advance to higher levels of employment over time within an industry (Jenkins and Spence, 2006). Traditional career pathways are commonly aligned to demarcated structures explicitly defined by organisational hierarchy and career ladders (Sonnenfeld, 1984). Davis (2020) posits career development approaches focus on preparing individuals for an organisationally aligned career pathway, but work must additionally be undertaken on their professional identity to improve their preparedness in the workplace. The British Computer Society (BCS) exists as one of the leading UK professional standards bodies responsible for structured development (Olifin and Emeagi, 2015), education, raising standards and professionalism in the UK IT practitioner domain (Weiss, 2003), however the IT profession lacks the maturity and perception of professional trust underpinned by values and behaviours granted to other established communities such as medical or legal professions (Cruess and Cruess, 2012). Potentially, the IT profession may lack equivalent public status granted to other established professions due to broad awareness of the lack mandatory membership to an industry authorised body prior to practicing as an IT worker (Weckert and Lucas, 2013).

Whilst the historical strengths of a traditional career path include the perception of lifelong or long-term employment (McDonald and Brown, 2005), the limitations include the potential for individuals to plateau or consider themselves a failure if they have not climbed upwards via promotion (Baruch, 2004). The flattening of organisations has reduced opportunities for upward promotion (Greenhaus and Kossek, 2014) as well as the globalisation of organisations driving the need for more dynamic career paths (Hedge and Rineer, 2017). The transformation of industries as a result of globalisation or technological change has led to the growth of alterative multidirectional career paths, which enable individuals to navigate their own careers, up and down the organisation, across or even outside of their current employer (Baruch, 2004). This shift may result in organisations becoming less important in the definition of career pathways with employee expectations guiding career decisions becoming more important (Tolbert, 1996; Cedefop, 2011), increasing the potential for employees to shape the creation of their own purposeful career pathways (Khan, 1990; Dik and Duffy, 2009; Witchger, 2011; Duffy and Autin, 2013).

Based on a study of IT workers Loogma, Umarik and Vilu (2004) found the dissolution of traditional career pathways and a growing shift towards fluid or boundaryless careers, correspondingly affected professional identity formation at work. This emerging trend of the employee taking greater responsibility for the direction and development of their career pathway brings both protean and boundaryless career concepts into focus (Larkin, 2016; Gubler, 2011) with both terms often used interchangeably (Briscoe and Hall, 2006; Segers *et al*., 2008). The demands for multidirectional career paths as a response to the highlighted organisational changes led to the development of the boundaryless career concept (Defillippi and Arthur, 1994), which challenges the linear, hierarchical career path and instead argues for dynamic for self-directed career paths not constrained by organisational boundaries and with a focus on skills to increase employability. However, existing literature indicates a key aspect of a boundaryless career pathway is the likelihood individuals detach or shift their professional identity (Weick, 1996) from being organisationally significant but instead develop a greater sense of belonging and identification aligned to their core profession (Defillippi and Arthur, 1994). The boundaryless career path focuses on a number of key elements, including career self-direction (Crocitto, Rousseau and Arthur, 1998), shifting the power away from a career path defined by the organisation to one defined by the individual, increased job autonomy, and mobility with an onus on the psychological fulfilment expectations of the employee (Arthur and Rousseau, 1996).

Douglas Hall augmented boundaryless career research by defining the protean career concept, with an emphasis on employee driven activities and outcomes and the importance of employee psychological success with continuous learning to form a new career contract (Hall and Mirvis, 1995; Hall, 1996). Older workers, a focus of this research, were also found to benefit from the 'new career contract' philosophy of a protean driven career path with research by Hall and Mirvis (1995), who extolled the importance and benefits of flexibility and the potential for older workers to self-direct and design their career development paths. Existing literature suggests both the boundaryless and protean concepts have been used interchangeably due to a degree of overlap between them (Briscoe and

Hall, 2006; Segers *et al*., 2008) and neither theory is without critics. Criticism of the protean career path focuses in the inconsistent use of terminology, limited coverage of key measures (Gubler, Arnold and Coombs, 2014), and the lack of empirical support and overemphasis on personal agency (Inkson *et al*., 2012). Whilst critics of the boundaryless career concept suggest that such paths may struggle to adequately capture the nature of traditional careers (Gerli, Bonesso and Pizzi, 2015), the ambiguity of the concept results in limited insight on how to operationalise the concept (Guest and Rodrigues, 2014), and that individuals still value and retain traditional careers (Clarke, 2013). The fluid nature of both career concepts, due to a job or role central to a person's understanding of who they are, may increase the importance of the career stories or 'scripts' that an individual accumulates over their careers to help to convey their professional identity to others (Ibarra and Barbulescu, 2010).

A dual or multitrack career pathway may best suit the needs of knowledge workers who may consider advanced technology specialism, management, or alternative future career domains (Hirsh, 2007). Dual career paths or tracks have been developed by organisations to offer workers the opportunity to navigate defined and adjacent technical and management career development paths (Ridings and Eder, 1998). Existing literature indicates that dual career paths have been applied in research and technical communities to reduce attrition, retain good technical employees (Ginzberg and Baroudi, 1988) and to inspire loyalty by offering an additional path for career advancement (Igbaria, Greenhaus and Parasuraman, 1991). Dual track careers can also help by offering opportunities for different disciplines and jobs. Igbaria, Greenhaus and Greenhaus (1991) also found that by implementing a dual track career, organisations offer a diversity of career orientations aligned to management and technical roles with appropriate rewards and opportunities. However, critics also exist for the dual or multi career path with Wakabayashi, Niskioka and Matsuyama (2008) highlighting the potential for senior technical experts on the technical career ladder to feel demotivated due to not often equally evaluated as managers with a similar ranking to persons on the managerial career ladder and (Allen and Katz, 1986; Ridings and Eder 1999). Additionally, Allen and Katz (1986) found that engineers favoring the technical ladder of a dual track career and, notably, those over 40 years old, failed to realise promotion and advancement as a reward for high performance. Lastly, dual track careers may also negativity affect a technical individual's professional identity with research by Rottmann *et al.,* (2019) finding the shift between jobs and roles can result in an 'identity crisis'.

Employee needs and values discussed regularly with line management will lead to the creation of meaningful career pathway goals (Collin, 1984, p. 141; Igbaria *et al*., 1991; Oliveira-Silva, 2015). From an older worker's viewpoint, career pathways can be less about navigation to promotion or hierarchical advancement but more aligned with personal growth and generativity, a concept aligned with a desire to guide future generations (Erikson, 1959; McAdams *et al*., 1992; Caines and Bordia, 2010; Arnold and Clark, 2015). It is generally accepted that the more control individuals have over career choices, the more likely they will choose a career path aligned to their core values, ensuring satisfaction and growth (Rhebergen and Wognum, 1997).

The role of self-concept in a person's career and an understanding of the inner self is fundamental before an effective career pathway can be defined (Chen, 1998). Self-concept or self-image is an individual's personal perception or assessment of what they think of themselves (Rosenberg, 1979; Nasir and Lin, 2013). Gegas (1982) expands of this definition by presenting self-concept as a reflexive concept that the individual has of themself as a physical, social, and spiritual or moral being. To this end, existing research has determined that self-concept or a person's perception of their psychological self, which monitors their own internal relationships and external interactions, has a pivotal role in life career development (Gottfredson, 1985; Chen, 1998). This is further emphasised by

Super *et al*., (1996) who theorised self-concept as a core element of a person that continually changes through their life as they age, leading to the creation of five developmental life and career stages that define vocational maturity. Super's (1957) five-stage life span model summarises the stages of an individual's career development across the lifespan as growth, exploratory, establishment, maintenance and decline with their self-concept changing across the span. Levinson *et al*. (1978) built on the life span model with an age associated premise and suggested that people grow through life stages via the completion of life and psychological changes regardless of background (Ornstein *et al*., 1989; Aktu and Ilhan, 2017). Schein (1996) added further depth to the self-concept literature by positioning career anchors as the result of a person's self-concept guiding their choices based on their self-perceived view of their talents and abilities, basic values, and the evolving set of motives and needs relevant to their career.

Arnold *et al*. (2019), utilising Schein's career anchor concept to examine the relationship between anchors and organisational career management (OCM), found that IT professionals have a range of career anchors and understanding the anchors helps to predict the OCM practice they find useful. In addition to this, Arnold *et al*. (2019) also found that the three highest career anchors scores were lifestyle, job security and dedication with the three lowest entrepreneurial creativity, technical functional competence and managerial competence. To this end, the results were surprising with two lower scoring anchors aligned to technical and managerial competence and corresponding to OCM practices of on-the-job skills development, leading the authors to reinforce the contextual nature of the career anchor and OCM relationships.

### 5.6.1 Career intervention timeframe

The career intervention timeframe concept developed within this research from participant interview codes indicating a lack of consistency or an acknowledged time span for the initial, mature engineer career development engagement activity. Multiple IT industry and academic definitions exist to describe the lower age boundary of mature employees. This section summarises the search results of available literature that describe age-aligned mature engineer career development timeframes, including a broader search for relevant non-IT concepts that may contain valid insights based on limited IT engineer-specific content.

The literature search indicated a lack of research on an equivalent industry or academic career intervention timeframe for mature IT engineers and also noted inconsistent definitions describing the range that defines older workers (Bourne, 1982; Kaliterna *et al*., 2002, Kooij *et al*., 2011). The search activity was extended to also consider non-IT research and sub-elements of the concept. No universally accepted definition of an older worker was found, however age 45 and beyond was used within this research and also within a substantial number of studies to indicate the lower boundary age of a mature or other worker with an upper boundary commonly the statutory pension age (Frerichs and Naegele, 1997; Berger, 2009; Cheung *et al*., 2011; Grima, 2011; Harris *et al*., 2018). Age-based perspectives in the IT industry compresses careers and define 'experience' in terms of possessing relevant and usable skills rather than seniority, and so are resetting the older worker boundary age (Brooke, 2009).

The potential for a compressed careers aligned to skills relevance was explored by Lee (2002) who identified career planning as an important activity for IT workers to ensure they realise a high level of professional career success as a result of the strategic planning undertaken. Employees in their 40s and 50s still offer an organisation more than two decades of professional life (Auer, 2007), a clearer sense a purpose, and determination to get the job done, offering the organisation a pool of talent (Buonocore, 1992). Barham (2010) explained that career advisors work with older people, usually from the age of 45 and older, to minimise the negative impacts of stereotyping or age discrimination and to help older employees to make satisfying choices about work and learning. Investment in older workers requires careful consideration to maximise the benefits for both employers and employees. The ageing workforce presents both a challenge and an opportunity to governments and organisations seeking to maximise the value of older workers with existing literature indicating the unemployment rate of older IT workers to be significantly higher than their younger counterparts (BCS, 2021). Patrickson and Ranzijn (2005) positioned worker retraining, job reassignment, and work place adaptation as a proactive government policy that will encourage workplace changes that will maximise the potential and experience of the older working population.

Undertaking training and gaining professional certification is considered vital to maintain the skill levels and expertise core to an IT employee's professional identity (Barbarà Molinero, 2015; Rahmatika, 2022). Ongoing development using a mid-life intervention timeframe as a catalyst, positions training to develop careers as a mutually agreed norm between the employee and employer. Additionally, it may reduce the reluctance to undertake training during the later career stage, as identified by other researchers (Kanfer and Ackerman, 2004; Van Vianen *et al*., 2011). Breaking the career time span into a number of defined courses/cycles/stages with employees acquiring and radiating particular characteristics at each stage acknowledges the alignment between development and 'self' over binary age alone (Super, 1980; Levinson, 1986; Nagy *et al*., 2018; Collins, 2014; Spasic, 2016). Career timeframes are also affected by and affect employee career transitions that facilitate inter-role and intra-role navigation through or out of an organisation (Louis, 1980) and the personal career anchors identified over time that showcase the employee's skills and values (Schein, 1974; Dalton and Thompson, 1977; Kniveton, 2004).

Skills obsolescence (Fossum *et al*., 1986; DeGrip and Smits, 2012) may be a problem for older workers especially in technologically intensive occupations, suggesting an approach based on continual training through the career lifecycle is critical (Pazy, 1990; Fu, 2010; Griffin and Beddie, 2011; Picchio, 2015). However, it may be possible for workers to stall or reverse *skills obsolescence* via ongoing investment in relevant training formal education to contribute to the ongoing evolution of their professional identity (Fitzgerald, 2020). Existing research indicates human resource and development teams will need to incorporate new employee development processes for the duration of an employee's tenure at the organisation due to older workers deciding to remain with the organisation for longer timeframes (Stein and Rocco, 2001; Shacklock and Brunetto, 2011). This has led to further academic research suggesting the need to extend the remain, retire and retrain framework to incorporate a 'renew stage', describing older workers capitalising on their expertise and a 'redesign stage' to facilitate work delivered on different terms as the career expectations change in later years (Avolio *et al*., 1990; Savickas, 1997; Rocco *et al*., 2000).

### 5.7 Self-worth and value

This literature search, which included separate searches of both terms and the inclusion of mature non-engineer concepts, found limited academic work focussing on the research core category, *self-worth and value* associated with mature IT field engineers or technology workers, however extant literature existed with the terms used individually. Additionally, self-esteem, a measure of self-worth, was found to be used interchangeably to explain self-worth in isolation, highlighting inconsistent use of, or understanding of, both terms. Within this research, the combined term *'self-worth and value'* which emerged as a core category, was considered to be a broader, more relevant definition that described the mature IT field engineer's perception of self-worth and the value delivered by that 'worth' to themselves and the organisation. *Self-world and value* has a close relationship with professional identity, broadly discussed in Chapter 2 and informed by the previous themes presented within Chapter 5 as shown by existing literature.

Self-worth describes an individual's internal perception of how of valuable or worthy they feel (Covington, 1992). Covington and Beery's (1976) self-worth theory of achievement motivation explored academic students managing their behaviour to minimise the personal impact of failure. The theory considers the sense of worthiness to be perceived by the individual and their desire to maintain this state even if this means making excuses or withdrawing effort to justify poor performance (Covington, 1992; Thompson and Dinnel, 2007; Al-Harthy, 2016). The measurement of output is at the heart of the theory with factors and conditions varying the perceived self-worth state, meaning that individuals may adjust effort to protect their own self-worth by applying limited effort to achieve an outcome to avoid self-worth vulnerability if maximum effort results in a poor result (Covington and Omelich, 1979).

This research combines *self-worth and value* to describe a single concept. Whilst self-worth was defined in the previous paragraph, '*value*,' as defined by this research, is aligned to human capital theory (Shultz, 1961), which describes how the skills and knowledge of human resources within an organisation are used to deliver productive work and achieve strategic goals (Baron and Armstrong, 2007). By associating self-worth and value together as a concept within this research, both the individual's perception of worthiness along with acknowledgement of the benefits, or value of their contribution to the organisation, are considered.

Other factors can affect an individual's personal appraisal of worthiness, with contingent self-worth theories extending existing research and considering influencing or 'contingent' factors, including age contingent (Ravary, Stewart and Baldwin, 2020) or feedback that positively or negatively affects feelings of value or self-esteem (Crocker and Wolfe, 2001). However, with this research guided by an older worker agenda, an alternative perspective exists advocating for increasing the focus on age neutral factors (Moen *et al*., 2017) rather than age contingent factors to reduce age stereotyping (Levy and Leifheit-Limson, 2009)

Woodruffe (2006) links self-worth to employee engagement, positioning the conscious effort needed by employers to utilise the financial and non-financial elements at their disposal to ensure the role meets the satisfaction, purpose and sense of self-worth expected by the employee. Employee engagement has been popularised by the work of William Kahn, who built on the work of Maslow (1954), Hackman and Oldman (1974) and others, to describe the 'self in role' concepts of personal engagement and disengagement to refer to the behaviours people bring into or leave out of their personal selves during work role performances (Khan, 1990). Pathardikar *et al*. (2019), built on Hackman and Oldman's model, found employees with higher levels of self-esteem and worth felt valued and satisfied with greater work engagement. Undertaking meaningful work that helps mature employees to realise a life purpose has a strong relationship with positive employee engagement (Kuchinke, 2000; Fairlie, 2011; Paullin, 2014; Malbašić *et al*., 2017; Luke and Neault, 2020). Meaningful work gives people influence over how their work is done, allows them to see their contribution, and provides a sense of purpose and self-esteem (Black, 2008). Incorporating value-based activities, that can include coaching and mentoring of other employees (Price and Colley, 2007), is an effective way of engaging with older employees and reinforcing their value when they pass on knowledge to remaining staff.

Measurement of self-worth is important in understanding the perception a person holds about themselves as capable or worthy (Pelham and Swann, 1989). Self-esteem is described as an individual's subjective evaluation of how they feel about themselves or their perception of 'worthiness' (Orth and Robins, 2014; Farooq *et al*., 2015). Self-esteem is commonly measured via an instrument designed to record an individual rating on a numerical scale (Elmer, 2001). However, existing literature indicates measurement of self-esteem may be challenging due to the availability of numerous approaches with weak or inconsistent corelation across models and indicators (Demo, 1985). Whilst no single or universal measurement approach exists, a number of well citied self-esteem measurement instruments are available with existing research indicating that the Rosenberg Self-Esteem Scale has been used in more than a quarter of published self-esteem studies (Tafarodi and Swann, 1995). The Rosenberg Self-Esteem Scale (Rosenberg, 1965), which focuses on feelings, is a commonly used measurement of self-esteem (Mannarini, 2010; Mullen, Gothe and McAuley, 2013). It was originally based on adolescent development, however it has been challenged based on invariance in adults (Marsh *et al*., 2010). Coopersmith's comparable self-esteem inventory instrument that focuses on worthiness (Coopersmith, 1967) was originally designed for children but has been modified to be effective for use with adults (Ryden, 1978). Whilst importance differences exist across the instruments with regards to the structure of self-esteem, all instruments directly ask the respondents to report how they feel (Brown and Zeigler-Hill, 2017).

Leary and Baumeister (2020) described the measurement of self-esteem and suggested that a person continually monitors the social environment via a psychological sociometer to distinguish momentary transient feelings of 'state self-esteem' and general overall 'trait self-esteem'. The differing characteristics of self-esteem variance are discussed in the literature. High self-esteem individuals emphasise positive and self-serving social traits to define self-worth than their lower self-esteem peers (Beauregard and Dunning, 2001). This may suggest that a focus on achieve high levels of self-esteem may lead to positive outcomes for individuals and, therefore, reduce underachievement (Mann *et al*., 2004). Cast and Burke (2002) extended existing self-esteem concepts by integrating them with identity theory to position the protective function of self-verification of identity on an individual's personal view of self. However, the varying stability of self-esteem

(Elmer, 2001) means the benefits are dependent on many factors leading some authors to challenge the views of the benefits of self-esteem enhancement. Critique of the focus on self-esteem includes individuals exhibiting greater persistence, which can lead to wasted time or counterproductive outcomes (Baumeister, 1998), or a response to social problems that may worsen them (Goode, 2002; Crocker and Park, 2004). The ongoing self-esteem debate has led to other authors extending this discussion by indicating that both self-esteem and self-concept refer to a person's thoughts and feelings about 'self' and therefore it is useful to position them together in a 'self-views' category (Swann, Chang-Schneider and McClarty, 2007), with both self-verified by the individual (Chen, English and Peng, 2006).

Self-worth is discussed in professional identity literature as an element of social identity theory (SIT) which considers how a person's perception of self-worth through membership of designated group and how it helps them to maintain a positive view of self (Marks and Scholarios, 2007). Social identity theory (SIT) explores the positive or negative benefits to a person self-concept which continually changes (Kroger and Marcia, 2011), as determined by membership of social groups or categories, for example professional (Tajfel and Turner, 1979) with a positive social identity beneficial to self-worth and esteem. Alvesson (2000) applied social identity theory to knowledge workers, an employee group fuelled by commitment and hard work and suggested definition of an individual's 'self' in relation to the work they do is important to their identity. Social identity is important to technical knowledge workers who develop a kinship with similar technology workers because of the professional identity they maintain based on the knowledge and skills they use to solve problems which helps them feel valued (Łubieńska, and Wozniak, 2012). Information technology engineers are a particular group of knowledge workers who use technology to solve problems (Varghese,

2011) with older workers accumulating valuable tacit knowledge that can be transferred to younger employees (Slagter, 2007).

Tacit knowledge (Nonaka and Takeuchi, 1995) is an important element of often hidden value within an individual and is important to the jobs they undertake. However, exposing it to ensure the person feels valued can be challenging (Smith, 2001). Corwin (2015) found that older workers believed the tacit knowledge they accumulated over time was valuable which correspondingly helped them to feel valued based on the worth of their knowledge and contributions. This suggests that the possession of tacit knowledge can be beneficial to older workers. Van Bonsdorff (2009) found workers who possessed useful tacit knowledge can result in extended employment or have a later retirement due to the value of that tacit knowledge to organisations. According to Petroni (2000: p.22), "Knowledge workers are a special kind of asset because they increase in value with time, especially when improvements and developments are made". Potgieter (2005) proposed that the benefits of training technical employees to gain knowledge and capability is important to motivation and their feelings of being valued employees. An individual's job and skills, beliefs, values and experiences in the workplace are important elements of their 'self' that forms their professional identity (Ibarra, 1999; Schein, 1978).

The inconsistency of definitions in the science and information technology field has made it challenging to quantify the identity of IT engineering workers due existing literature defining and measuring engineering professional identity in different ways (Patrick and Borrego, 2016). IT workers consider professional identity to be important to their perception of value based on the potential to be viewed as experts in their field (Katz, 2005). Importance of self was explored by Brooks *et al.,* (2011) who found IT workers perception of their ability to achieve a particular outcome or self-efficacy (Bandura, 1997) to be important to the self-evaluation of their professional identity.

Brooks *et al.,* (2011) emphasised the importance IT workers technical self-efficacy as a result of perceived competence and relevance via training and certification. Focussing on relevant IT certification is commonly used as validation of competency when recruiting engineers with the perception of reduced value when absent (Medlin, Schneberger and Husinger, 2007). Certification of knowledge is important to recognise an individual's professional and experiential knowledge (Borkman, 1976; Mackenzie and Marks, 2019). Smith (2016) researching the professional identity of information technology professionals found employee certification as evidence of competency to be at the core of their valued identity. In addition to this, Tsakissiris (2015) found industry recognised credentials and certification strengthens IT workers professional identity by enhancing their sense of belonging as valued members of their field. Certification of trained IT professionals is also valuable to organisations and can play a vital role in hiring and the demonstration of employee competence (Wiershem, Zhang and Johnston, 2010). with both considered valuable and beneficial to the individual. Both academic and technical certification and accreditation are considered important to the professional identity of IT workers as external validation of industry relevant technical competence (Anderson, Barrett, and Schwager, 2005; Kabia, Oni and Booher, 2014; Wiershem, Zhang and Johnson, 2010). Technical certifications are important elements of an IT professional's human capital and employees with a greater number of certifications are seen as more valuable, which may then increase their job opportunities (Quan and Cha, 2009).

Ongoing training and skills development is used to develop technical capability. Information technology manufacturer-defined training programmes equip the technical employees with skills that can be certified or accredited on completion or subsequent testing, potentially increasing the value of the employee (Ray and McCoy, 2000). Marks and Scholarios (2007) posits IT workers with formal qualifications who pride themselves on quality and client satisfaction therefore exhibit a high level of professionalism, may blur self-esteem with the personal pursuit of self-interest. Information technology workers associate much of their self-worth to the accomplishment of the work they do (Gussek, Schned and Wiesche, 2021) and also their certified skills (Smith, 2016). Therefore, as technical employees they may benefit from self-esteem enhancement gained by the 'peer regard' of others deeming them knowledgeable experts (Quan, Dattero and Galup, 2007) and the sense of belonging offered by their professional identity within the IT community (Rynearson and Rynearson, 2017) in addition to the status granted by their specialist knowledge (Eisold, 2007; Watson, 2002). Wasilewski (2015), concurs finding science and technology engineers who identify themselves as members of the technical 'in group' should experience an increase of self-esteem vs non engineers considered in the 'out group'.

Alic (2008) offers an expanded view on the value of experiential knowledge, highlighting the importance of the value of the knowledge of embodied competence in people and the potential for it to be a fundamental building block of competitive advantage. When an IT engineer has successfully concluded their certification training, they are more beneficial to the organisation due to increased employee productivity and system reliability as a result of higher levels of employee competence (Anderson, Marden and Perry, 2015). Older workers may be considered valuable assets, as sources of wisdom capital (Vasconcelos, 2018) developed as a product of their knowledge and experience with the potential to enhance organisations even through later career stages (Greenstein, 2007; Cortada, 2021). An interesting finding was made by Marks and Scholarios (2007) indicating experience to be a significant value add to older IT workers, weighing their experience higher than qualifications when compared with younger workers in the 31 -40 age range.

The ongoing emphasis of many data driven modern organisations to focus on productivity metrics as a primary performance measure has been described as 'metric fixation' (Muller, 2021). The focus on such measures can result in employee burnout and demotivation. Existing literature indicates it remains challenging to create and maintain productivity measurement frameworks for knowledge workers due to the complex multidimension requirement to include quality, productivity, cost, output, and many other factors (Ramirez and Nembhard, 2004). This is apparent in the IT field engineering environment due to the importance of consistent measurement of task completion, i.e., an output measure to ensure contractual expectations are met, in addition to a recognition of quality work. Molekoa and van der Poll (2019) expanded on this point with an assessment of literature focused on knowledge worker performance management and indicated a predominance of output measures, rather than process factors, including leadership, innovativeness and self-management. To this point, Garner and Fidel (1990) researching computer professionals found the older worker community in their mid-career stage to be critical of management engagement at a time when career and professional identity become most important. Older workers are more likely to remain in the workforce if they believe they are supported by their organisations and their contributions make a difference to their colleagues and the employer (Marvell and Cox, 2017). Employees want to feel valued at work, however it is not easy to identify the meaning of 'feeling valued' given that it is both a driver of employee engagement and an outcome of employee engagement (Claxton, 2014). Conlon (2012) suggested an interesting concept of optimal work happiness, which is underpinned by employees receiving appreciation and feeling valued by their employers but also, equally, the employees placing genuine value on their own employment identities within the organisation.

Recognition plays an important role in the extent to which employees feel valued, with the main indicators being acknowledgement of expertise skills and professional qualifications, which deliver a heightened sense of self-esteem and personal competency (Brun and Dugas, 2008). Employee recognition should be considered fundamental by employers who want to motivate employees by helping them to understand how their contributions are valued by the business and can include gifts for longevity or heightened acknowledgement of hard work in team meetings (Timmons *et al*., 2011; Amoatemaa and Kyeremeh, 2016). However, Taneva *et al*., (2016) suggested recognition, respect and fair performance evaluation were reported as not readily available for older workers or that it exists, but not communicated clearly. Older employees value job content, social environment or career value rewards over advancement or specific monetary benefits. However, work may be required to formulate total rewards strategies matched to the values and beliefs of IT professionals (Rumpel and Medcof, 2006; Potgieter, 2015; Leithman, 2016; SHRM, 2016; Kollmann *et al*., 2020).

Research considering the motivation needs of mature employees covers a broad span and includes the two-factor theory (Herzberg *et al*., 1957) that discusses employee hygiene factors, such as salary, which, if absent, can lead to job dissatisfaction, and motivators, such as recognition, that enhance the job. Whilst literature exists explaining how the two-factor theory delivers expected results, for example when using a written questionnaire similar to Herzberg (French *et al*., 1973), other literature displayed mixed or inconsistent results (Ondrack, 1974; Kendall and Robinson, 1975). This has resulted in Herzberg's theory being widely criticised on multiple dimensions including having an inadequate methodological definition that can lead to contradictory results (Malinovsky and Barry, 1965), an inconsistent approach to categorisation (House and Wignor, 1967), a lack of overall satisfaction measurement (Ewen *et al*., 1966), and inconsistency with previous evidence (Brayfield and Crockett, 1965). However, this may not be the end for Herzberg's two-factor theory with supporters advocating for the theory, saying that it is still relevant today as it was in 1957 due to the use of it as a framework over time and the contribution it continues to make (Smerek and Peterson, 2007; Stello, 2011).

Eyob (1994) summarised the characteristics of roles that serve as positive motivational factors to IT staff including achievement, recognition, advancement, personal growth, and responsibility. Lord (2002), researching engineers over the age of 50, reached conclusions similar to Herzberg *et al*. (1957) and Maslow (1943), found that engineers were motivated by acceptance, esteem and self-worth. Inadequate employee hygiene factors, according to Herzberg, often caused job dissatisfaction. However, to have a long term more profound effect on job satisfaction, hygiene factors but would need to be significant. Existing research indicates that mature workers are motivated less by salary and more by working conditions (Lord, 2002; Ryan and Deci, 2000; Bakotić et al., 2018) which includes flexibility, autonomy, good interpersonal relationships, and equal treatment regardless of age.

## 5.8 Chapter summary

This chapter summarised a selection of research from the preliminary literature review in chapter 2, in addition to the extensive main literature search contained within this chapter guided by the primary research question positioned in Chapter 1.

The literature search undertaken in this chapter reinforced the lack of literature available focusing specifically on mature or older IT field engineers and non-age aligned IT engineers, which resulted in a broader search conducted to include older employee career development and broader technology professionals beneficial to the research. The literature search was framed based on four categories created in chapter 4, which includes *management influence, job & role design work*, *work & life flexibility*, *career pathways* with the fifth category ***self-worth and value*** acting as the core research category. This chapter also includes relevant literature, discussing the characteristics that effect or formulate the professional identity of information technology and engineering workers building on studies and concepts highlighted in chapter 2 indicating it as a relevant area of inquiry that influences the self-worth and value perception of IT workers.

The topic of self-worth and value as the core category for this research was the key scholarly lens used to influence the literature search with limited research located specifically aligned to older information technology and engineering workers. Literature presenting common management styles were considered with a focus on the effects on knowledge workers who existing findings indicate may benefit from different motivation and rewards because of the importance of personal value to the employees. Job and role design literature summarised information technology or engineering workers and emphasized the importance of the value to IT engineers, with job redesign used to develop future focussed requirements but with additional flexibility to reduce the impact of ageing and improve life balance. The career development and the pathway literature summarised the value of developing and modernising engineer technical and soft skills to reduce the consequence of skills obsolescence because of workforce ageing and technology changes in the IT market.

Professional identity was an additional scholarly lens identified in Chapter 2 also used within the literature search in this chapter to present the impact of the five theoretical research categories created in Chapter 4 on the mature information technology workers and engineers' skills, jobs and management styles.

Professional identity in this research context considers the mature IT field engineers' determination of identity within their professional domain and how it influences the core self-worth and value core category of this research.

# Chapter 6: Findings

## 6.1 Introduction

This chapter presents the findings of a constructivist grounded theory research project carried out to understand the skills, type of support, and capabilities required for mature IT engineers to remain effective in the IT industry. Twenty-two engineers between the ages of 45 and 65, from a population of 471, were interviewed using semi-structured interviews to understand the first-hand accounts of the careers and experiences of mature field engineers.

The research findings summarised were created by initial, focused, and theoretical coding processes described in Chapter 4, leading to the development of five theoretical categories and emergence of a core category, *self-worth and value*. Chapter 5 discussed the extant literature relating to the five theoretical categories created in Chapter 4. To ensure that clarity and sufficient detail are conveyed when discussing the findings created by this research, the development and dimensions of the theoretical categories (**in bold**), subcategories (***bold and italics***), focused codes (*italics only*) are presented and described throughout Chapter 6 with relevant statements from selected participant transcripts *(right justified, indented in italics).*

## 6.2 Interpreting the theoretical categories

Grounded theory coding stages and constant comparison were used to construct twelve categories based on 185 final initial codes. Theoretical coding was undertaken to conceptualise and identify code and category relationships, elevating the research from a descriptive to an analytical account. Theorising how codes relate to each other is a vital, but often missed, stage when using the grounded theory method (Urquhart, 2013).

Charmaz (2014) suggested examining categories for power purpose and patterns, collapsing and integrating categories if required. Member checking described in Chapter 4 was used to apply additional analysis leading to the integration of seven categories as subcategories into the remaining five based on relationships to create the final major theoretical categories (Figure 35) described in the following sections.

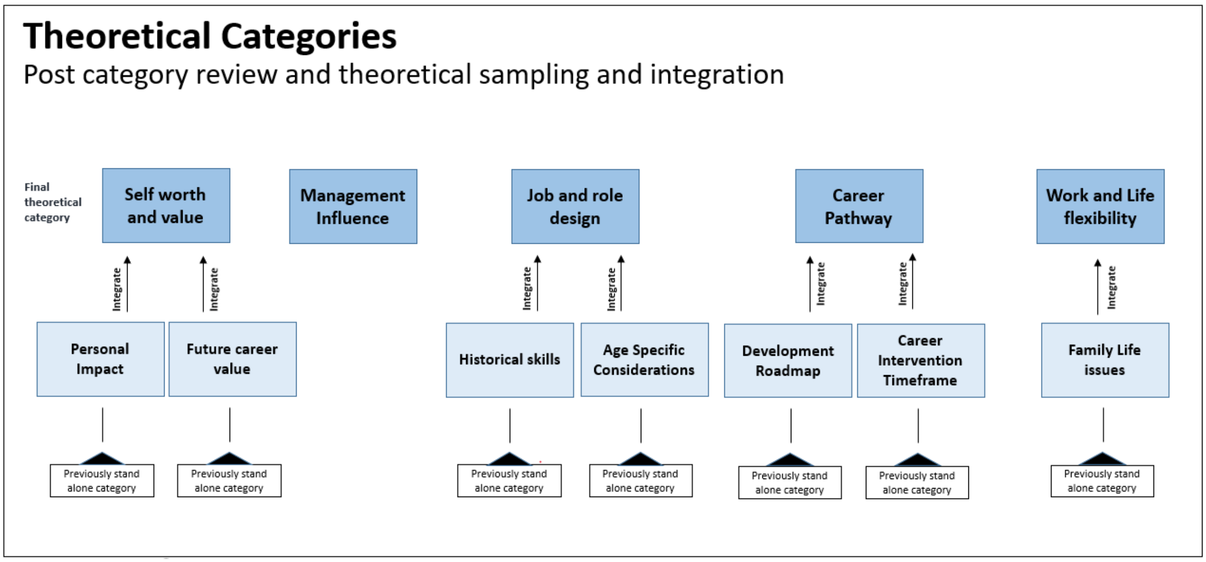


*Figure 38 - Theoretical Categories (Final)*

### 6.2.1 Self-worth and value

**'Self-worth and value'** was categorised as a core research finding to describe the perception conveyed by the mature IT field engineers who explained that they wrestled with their personal sense of worth as effective and productive IT engineers in addition to their internal and external view of the value they deliver to CompanyX and other relevant stakeholders. **Self-worth and value** was created as both a standalone theoretical category, based on points raised by the research participants and emerged as a core category which affects or is informed by the other created categories.

The interview participants positioned **Self-worth and value** as both their external perception of an IT field engineer and, equally important, the engineers' internal view coded as *'sense of self'*. Participant 3PH1818 emphasised the importance of feeling as they are adding value to the organisation and customers.

> *"In the old days there was so much going on technically and not enough people to do what I did but I'm a bit confused now because it's all changing. My personal value and self-worth are pretty much the same thing. It's all important to me because I must feel like I am adding value to the customer and the company."*
>
> *Participant 3PH1818*

The mature IT field engineers, when describing CompanyX, cited *'positive company engagement'* which indicated that their engagement with CompanyX as an employer was considered positive, with participants speaking passionately about the organisation as an entity but also questioning their own feelings of worth in relation to the value they believed they brought to their engineering practice and beyond job-specific measurable technical tasks. The findings indicate that the *personal knowledge assets* the IT field engineers possess, accumulated via on job activities or trainings, are held in high regard but, however, are based on ageing technology systems.

> *"I don't feel inspired and positively valued because I don't believe I have the right skills to install and repair the modern systems out there. at present I'm doing my job but I'm not sure how valuable that is when so much has changed in the industry."*
>
> *Participant 3PH1819*

They conveyed concerns about their *technical value* as worthy technical employees, affected by *skills obsolescence* due to the evolution of IT systems, which has stimulated the need for new skills they do not possess and possible future employment challenges based on a reduced need to maintain older systems. Participant 3PH1819 offered a viewpoint similar in tone to other engineers, indicating a lack of inspiration potentially influenced by the external perception that they may be lacking skills aligned to the deployment and maintenance of newer systems.

The findings indicate that resource manager acknowledgement of mature IT field engineer value and contribution beyond productivity and derived task completion measurements was inconsistent. Optimum utilisation of CompanyX IT mature field engineers are managed and maintained by resource managers who allocate the right engineer to the right skill, to the right location, to complete field engineering tasks at the right price point. This *productivity driven management behaviour* has potentially cultivated IT field engineer *self-worth and value* concerns that successful task completion statistics are the dominant measure of employee effectiveness over harder to measure elements that may include future potential or going above and beyond the norm.

> *"With the managers, utilisation is key. If your utilisation is good, they keep out of your way and leave you to get on with things. But my value is far more than completing the straightforward stuff - often utilisation rather than my experience and ability is the only thing focused on".*
>
> *Participant 7PH1823*

The resource manager undertakes an immensely powerful role as the primary source of authority, therefore *'manager perception of value'* conveys the engineer view of the importance of the opinion of the resource manager gained by actual or perceptual inputs as an important endorser of engineer value. The resource managers summation of engineer value as the gatekeeper to training and rewards is important to positive or negative career harmony and development of the engineers in question.

*"Staying on the right side of your manager is key. I doubt I would've done many of the things I've done over the past years or got the right training without the support of my manager (or maybe but it would've been much harder)."*
*Participant 2PH1817*

*'No longer feeling challenged'* and *'working on autopilot'* were coded based on an engineer's view that some personal value concerns may originate from not feeling challenged within their current role and needed to work on autopilot due to simplification or reaching a level of skill at the highest end of their IT domain. More than one engineer described themselves as '*surviving in the current role'* due to the renumeration remaining acceptable but disappointed they were not maximising the value they believe they possess. Participant 2PH1816 positioned the emotional challenge of a lack of role fulfilment but maintaining tolerance of the role based on acceptable remuneration and employee conditions.

*"The engineering job and the systems are totally dumbed down. It's not my fault that some things are easier now and I know so much. It's not so technical anymore often only with basic troubleshooting required. It's a lot more of - have you tried switching it on - than really fixing things. But the money is ok."*
*Participant 2PH1816*

*'Different value than sales'* was an emotive discussion point with the mature engineers describing their value compared to other sales colleagues within

CompanyX. The findings suggested that the participants held the perception that sales individuals or other teams within CompanyX were considered more valuable than the mature IT field engineers. The mature IT field engineers felt somewhat invisible at times based on the substantial volume of final customer outcomes described aligned to monetary successes over technical engineering achievements. Participant 2PH1813 echoed the field engineer concerns about value in comparison to their sales and technical peers.

*"I don't think people in field engineering myself included would be seen as a valued member self in the same way as perhaps somebody in the sales team or consultancy practise would feel valued."*

*Participant 2PH1813*

The consultancy practice is an adjacent team of technical personnel who undertake IT architecture design, implementation and troubleshooting services to an advanced level beyond the skill of the field engineering community. The consultancy team undertakes highly complex and challenging technical tasks and is held in high regard by all due to having an advanced level of technical competency. Jobs and roles within the consultancy team are coveted and viewed as a viable and aspirational career destination for technically capable and high performing IT field engineers.

*'Technology evolution'*, *'task simplification'* and *'increased technology reliability'* describe the external industry forces underpinned by accelerated levels of technical innovation and superior manufacturing processes that have led to the mature IT field engineers citing *value erosion due to diminished skills*. The continual IT industry evolution has changed the IT field engineering role and the perceived value of the once complex engineering tasks, now simplified and commodified, and the technical skills required to remain effective. Participant

2PH1812 explained the reality amongst IT field engineers who have observed the impact of an industry and technology shift in roles historically deemed essential and of high value to both the engineers and CompanyX.

*"I think the guys are aware that the high end technical installation and engineering work isn't there anymore, because they've seen their own work that they do day to day over a number of years kind of dumb down and in some areas disappear."*

*Participant 2PH1812*

The importance of the management and leadership team continuing to reinforce value beyond workforce productivity numbers was deemed a beneficial activity for engineers often immersed in a technology centric, non-human world. *'Perception of executive leadership'* and *'tenure-based company rewards'* describes engineers' feelings of enhanced personal value when the senior leadership team highlights the engineer's personal contribution or during 10, 15, 20 year employment anniversary gatherings, enhancing feelings of worth and togetherness. This may indicate that additional engagement from the senior management or executive leadership tier may enhance feelings of personal value with minimal effort required.

The **self-worth and value** findings presented in the previous sections may be the most significant within this research based its resonance with the interviewee and the relationships it underpins across the other categorised findings, as indicated in Figure 39.

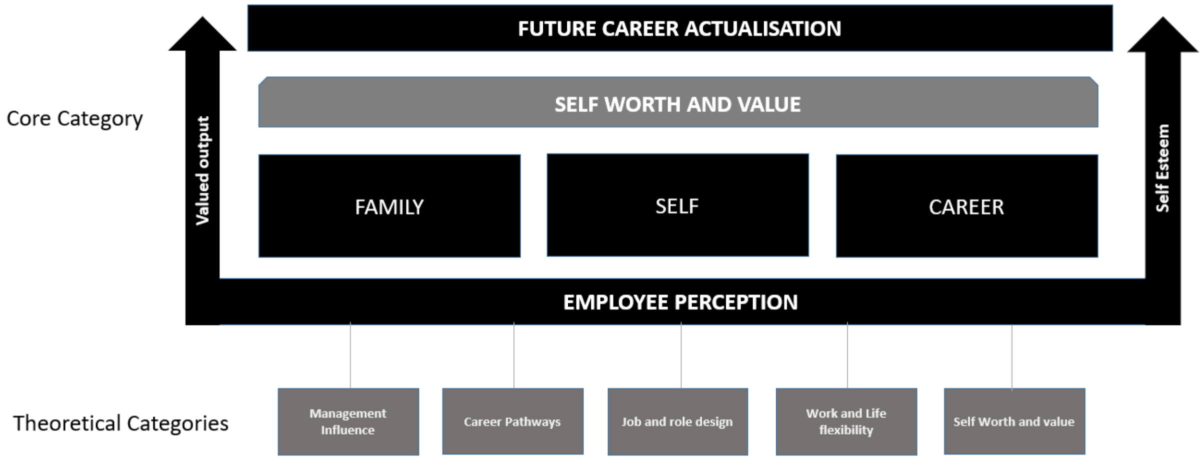


*Figure 39 - Self Worth and value (Core category)*

The findings indicate that mature IT field engineers with an average tenure of 14 years have remained relevant, in skills and capabilities, for a substantial period of time but they may be questioning their current and future *self-worth and value* guided by skills and job obsolescence concerns. The sections that follow build on the *self-worth and value* finding with four other findings categorised by the participant interview and data categorisation activities outlined in Chapter 4. The following section presents the *management influence* finding, followed by *job and role design, career pathways and work and life flexibility.* This will complete the presentation of the research findings relevant to the research aim of understanding the skills, support and capabilities required by mature IT engineers to remain effective in the present day and for the future.

### 6.2.2 Management Influence

**Management influence** was an important finding categorised by position to convey the prominent role performed by the resource manager in the career effectiveness and organisational engagement of the mature IT field engineers. The resource management activity of engineers is important and includes recruitment, HR aspects, career and skills development, reward management, and task allocation to list a few of the activities.

The codes *'variable manager behaviour'* and *'line manager perception'* captured the mature IT field engineers' view that each resource manager approached their day-to-day engineer development and management roles in an individualised manner guided by their own views, competence, and behaviour. They highlighted that the variability of management style, not described negatively, indicated differences between the management of mature IT field engineers often undertaking similar roles leading to differing rewards, motivation and career development experienced by the engineers.

*"If I require skills development or I'm considering I change the role, I would need to go and speak to my resource manager … and I imagine it could be quite a painful and long process."*
*Participant 3PH1819*

The mature IT field engineers expressed concerns about both personal and team member *'recognition of value'* by managers and highlighted the importance of manager behaviour and recognition of non-productivity or metric-derived engineer achievements. Resource managers who recognised and acknowledged the individual engineer capabilities or beneficial contributions to CompanyX were the considered the ideal. However, the mature IT field engineers highlighted the common experience of a 't*ick box management'* style not personalised to the engineer in question but, instead, being managed as a collective, therefore failing to tap into their unique and individual qualities.

*"Focusing on utilisation to justify good performance and rewards may seem easier for managers but doesn't really motivate me that much. And the other online systems for rewards are too hard to use if you are on site, which means you only hear about utilisation results."*
*Participant 1PH1807*

A notable concern cited by the mature IT field engineers was the reduced acknowledgement of the substantial volume of *tacit knowledge* and technical skill they possessed and accumulated over their long career that they believe will be wasted or diminished if not explored due to the *'restricted skills development'* behaviour of some managers. However, the mature IT field engineers also shared the opinion that such resource manager behaviour may be the result of a managers tasked with maintaining a highly efficient and productive operating model focused primarily on mandatory, not desirable, skills and capabilities that can be monetised. Participant 3PH1820 shared a quote aligned to their own experience.

*"You're doing exactly what we want you to do. You don't need to do anything special am I quite happy for you to do exactly what you're doing. There's no further progression required for you in your role."*

*Participant 3PH1820*

The resource managers possess the power and remit to guide and authorise the investments made in the maintenance and development of the mature IT field engineers' existing skills and development of new capabilities to undertake existing and future job roles. *'Positive manager interaction'* and *'development focused leadership'* was coded to describe the behaviour of selected resource managers as beneficial to career progression. The mature IT field engineers highlighted the benefit of managers who focused on the development of the engineer as a person and helped to secure or authorise the right training and, in some cases, endorsed the value of a role outside of the immediate engineering team to other stakeholder groups. Participant 1PH1806 discusses how important good managers are to the development  of effective mature IT field engineers.

*"I guess your development depends on the skill and experience of the manager because if they are good, they will try to encourage you and get the most out of you. But those who are not and don't train up their engineers and stop them growing and eventually they may want to leave."*

*Participant 1PH1806*

*'Restricted engineer development'* was an interesting finding coded to describe *productivity driven management behaviour* with a style that is considered intentionally restrictive to engineer development. This may, at times, keep highly effective mature IT field engineers aligned to existing tasks and roles to benefit services and productivity metrics, but with the mature IT field engineer's personal development beyond the required skills a secondary consideration. Participant 3PH1818 reinforced the power and impact of line managers, citing a less than positive development experience as a result on their own resource manager to engineer relationship.

*"I found a lot of my training to be self-driven, because sometimes it's not in the managers interest for you to move on if you're delivering a good utilisation. Of course, they don't stop you learning things, but you know that rather keep you doing what are you doing so at times it's easier to stay as you are unless you really drive your learning."*

*Participant 3PH1818*

It a great deal of financial and management expertise to balance the engineering practice, ensuring that the mature IT field engineers meet customer contractual or job expectations in an efficient manner and also to retain high levels of team engagement. *'Effectiveness can stall progression'* explained the feelings conveyed that the more effective mature IT field engineers were in a role, the harder it became to move to a different role or department due to the benefits delivered to the manager by the existing task effectiveness, financial metrics, team productivity and customer satisfaction levels. Participant 1PH1806 explains that there are inadvertent downsides for mature IT field engineers with good utilisation productivity metrics that may make it *difficult to progress out of the department* and to other teams.

*Sometimes I'm not sure if it's good to be great at your job because can be hard to move out of engineering into consultancy if your utilisation is brilliant. We should be developed and encouraged to eventually move to consultancy, and this would encourage people to always keep developing.*

*Participant 1PH1806*

**Management influence** is a key element of engineer effectiveness and the success of the field engineer practice within CompanyX and the positive actions of resource managers are at the heart of mature IT field engineers enjoying their roles and maximising their potential. The finding coded as *'Inspirational line manager'* described resource managers who acted in less of a command-based style and in a more collaborative manner, with *managers as coaches*, viewed as inspirational resource managers and highly contributory to a positive mature IT field engineer's employee experience and ongoing development within the organisation.

*"It's all about getting a good one with no guarantees to get a good or bad manager and sometimes two people just don't get on. But having a positive manager can be key to realise the career you want based on how important the manager is when it comes to signing things off and authorising training"*

*Participant 6PH1823*

The role and importance of resource managers, the primary reporting line for the mature IT field engineers, was cited as fundamental to skills development and beneficial to career effectiveness. With the day-to-day engagement between the resource manager and the mature IT field engineers covering so many dimensions, their influence is highly impactful to the job and role undertaken by the engineers they manage.

### 6.2.3 Job and role design

A key objective of this research was to determine the skills and support required by mature IT field engineers to remain effective in the future within CompanyX. The findings indicated the mature IT field engineers definition of skills and capabilities includes tacit knowledge and technical qualifications and is guided by the requirement to complete tasks relevant to a job or role. The finding *job and role design* was categorised to describe relevant job related current and future considerations that affect the likelihood or ability for the mature IT field engineers to be effective in CompanyX or potentially elsewhere, both now and in the future.

The IT industry is driven by ongoing technical innovation that drives the ongoing introduction of new systems to the market requiring different engineering skills for installation and repair. However, commoditisation of common technical functions and IT systems coupled with the increased use of software and automated processes has reduced the complexity of many IT systems. It was conveyed by the mature IT field engineers that the once 'valuable' skills they possessed delivered by the technical jobs they undertake are *'dumbing down'* and affected by *role demise* based on changing market needs. This implications of the technology shifts in the IT industry are outlined by participant 2PH1816.

> *"It's a challenge now for engineers who want to progress technically. it's a big issue for them because there isn't really any work in the technical engineering practise for them at that high level due to a reduction of*

*complexity within older IT systems. we need to learn about the new systems that people need us to work on but that isn't in the current job".*

*Participant 2PH1816*

It is clear the indicated speed of change may render historical skills obsolete and existing IT field engineering jobs less relevant.

The mature IT field engineers explained the ever-changing nature of the IT industry giving rise to new technology advancements that, in turn, require new installation or configuration services, assured that it will remain an exciting and interesting employment domain throughout their tenure. However, the acceleration by technology manufacturers in recent years to use software to transform IT functions has energised the need for *'software defined engineering'* as an important technical activity or outcome, which has led to a focus on IT engineering skills and jobs '*evolving from hardware to software'.* This is well captured by the statement from participant 2PH1810.

*"So, there was definitely a shift in the early 90s, to go from physical, mechanical type repairs and programming things with network switches to a software programmability type approach. This has grown massively now. The hardware role is basic installation now with all of the interesting stuff happening with software".*

*Participant 2PH1810*

However, the mature IT field engineer skills and job discussions do not focus on a world without requirements for historical tasks or jobs and only emerging skills. However, instead, the focus is on one that builds on existing capabilities and incorporates new skills to equip the mature IT field engineers to undertake relevant and *meaningful work*. *'Hybrid technical skills'* and *crossed skilled engineering jobs* were coded to capture the idea of a blend of capabilities that could lead to a future mature IT field engineer job that utilises existing IT fundamental skills reused in new ways, but also incorporating emerging infrastructure or software engineering expertise. The need for stimulating technical jobs is captured by this statement from participant 2PH1812 that also acknowledges a lack of advanced or complex work can result in staff attrition.

> *"I think the guys are aware that the high-end work isn't there anymore because they've seen their own work and what they do day to day over a number of years kind of dumb down to a greater or lesser degree. the maturity of the older guys realise that the high end work has pretty much all dried up and they have seen many good people leave the company to do something else"*
>
> *Participant 2PH1812*

Change was discussed extensively by the mature IT field engineers guided by the realisation that IT field engineers undertaking the current job may no longer be capable of meeting the expectations to deliver future focused tasks structured to meet different customer needs.

In addition to the potential for job redesign or changes to accommodate new skills and tasks to respond to new customer technical services requirements, the physical effects of the ageing process on older workers were identified. The physical concerns can include early starts, late finishes, a reduced desire for extensive long drives and carrying hardware systems. No mature IT field engineer cited the *physical demands* as insurmountable, however all requested the need for greater *job flexibility* offered by IT field engineering jobs that incorporate a notable degree of software engineering to reduce the need for site visits or labour intensive lifting of physical platforms, as remote access technology can facilitate working from home.

*"In the old days I love being out on the road visiting customer after customer, but it's different now as the work is drying up meaning it can be long travel to do things that are not that difficult or interesting. If it can be done less long hours in the car will be a great help especially there's so much remote configuration, but I'm not sure this can be changed*."

*Participant 2PH1813*

The mature IT field engineers have recognised the historical jobs and tasks they have undertaken effectively for an extended timeframe may now be inflexible when age-related physical demise and future task requirements are considered.

***'Age specific considerations'*** was also incorporated as a subcategory and included the elevated focused code *'age specific considerations'*, plus the codes '*different work ethic'*, *'attitude to work'* with a selection of additional codes described in the following sections. *'Physical demands of the role with age'* considered the impact of physical activities, for example the need to lift and carry heavy items, and '*bodily physical wear and tear*' encapsuled age-related strength or susceptibility to injury. Both codes are examples of a broad spectrum of *'ageing worker health concerns*', which the participants articulated as examples of their lived experiences that may impact their current and future effectiveness in an existing role. Participant 2PH1814 described the impact of the ageing process on the physical requirements of the IT engineering role in the following statement.

*"Physically at the moment it's not a problem but I can see that it could be an issue in time as I get older. Due the amount of carrying IT systems about, installing them, crawling under desks, fixing cabling and with lots of walking around. You have to be relatively fit."*

*Participant* 2PH1814

The findings indicated engineer concerns about age aligned physical declines may be offset by the emergence of new IT products and solutions underpinned by software functions replacing hardware-based technical features, which reduce the need for physical system deployment, repair, and removal.

The final point in this section, *'age normalisation',* describes an interesting mature IT field engineer observation of the CompanyX field engineering resource management approach that normalises engineering tasks, skills development, accreditation and competence to determine engineer suitability for roles and tasks. This indicates that mature workers are treated in a similar manner to junior workers, from a work allocation and skills development viewpoints, which minimises job related age discrimination if the mature IT field engineer can effectively undertake the technical role. However, this approach may also pay limited attention to the different work and life impacts across the demographic groups which may include physical, life impacts, attitudinal, learning styles, and motivational factors to name a few.

*Self-worth and value*, the core category for this research, was also considered by the mature IT field engineers when describing the possibility for job changes to maximise the extensive experience and value they possess. Coaching and the use of *mature engineers as mentors* for existing junior engineers was highlighted in several participant interviews as a potentially valuable element of future IT engineering jobs that offer mature IT field engineers opportunities to give back to their colleagues, CompanyX, and the broader IT industry.

> *"There should be something done far more proactive in terms of looking at what engineers have done previously and then putting them in front of other employees in some form of formal capacity to pass on knowledge training and experience.*

*Participant 3PH1819"*

This topic was described in relation to the possibility for revised IT field engineering jobs based on the perception the current job may lack the flexibility and task structure to explicitly incorporate mentoring activities to a measurable degree. Such an activity not only delivers value to the development of junior engineers but it may also offer self-worth benefits to the mature engineer.

### 6.2.4 Career pathway

The **career pathway** finding was categorised and coded from common and consistent discussions across all the participant interviews. The mature IT field engineers described the skills aligned to an engineering job or role type that have served them well through their IT careers, chronicling their initial employment through to the present day and ultimately into the future. The task set of the field engineering role includes configuration, installation and troubleshooting of a range of IT systems at both CompanyX and customer locations that must be undertaken by IT field engineering personnel with a knowledge level on par with technical personnel from the original manufacturer of the product.

*The 'career intervention timeframe'* finding was coded to highlight the lack of a consistent manager-to-engineer interaction aligned to mature IT field engineer skills and career development, resulting in the differing experiences described. The findings indicated that the discussions were initiated by a request from the manager or mature IT field engineers in the 45 and 55 age range. Participant 2PH1812 described a moment of realisation for the different feelings and factors experienced around midlife along with a long historical IT engineering tenure, highlighting that it was time to discuss changes and the future.

> *"I knew something had changed in me from a life and work point of view and wanted to change but didn't know what to do or how to do it. But I did*

*know the spark had gone from inside of me for the technical side off the role."*

*Participant 2PH1812*

Participant 2PH1812 concisely explains why a career intervention specifically aligned to mature IT field engineers that considers skills needs and relevant life factors may be valuable to ensure an engagement channel exists to supply beneficial input and guidance.

The mature IT field engineers described the existence of a training and development pathway with IT system manufacturer technical skills' expectations aligned to CompanyX field engineer roles that include competency graded boundaries. '*Training for accreditation'* was coded to capture the default IT field engineer state when trained to obtain designated technical skills to the level of competence to successfully deliver services to CompanyX customers. The IT manufacturer guided and accredited training development is at the heart of IT field engineer training programmes based on the opportunity for CompanyX to obtain a tangible return on training investment over longer periods of time by field engineers installing and servicing technical popular IT systems. *Skills obsolescence* was cited as a material concern with training programmes aligned to historical skills and IT industry systems. Participant 2PH1808 communicated the initial benefit of manufacturer guided training but then discussed the reduced value over time when experience supersedes the accreditation benefits.

*"Earlier in your career there is a lot of training to gain the main skills for basic tasks. Sometimes it's about getting the technical badge to get the badge because I already know how to work on the system. Then as you stay longer and get senior the training slows down because there is less work to justify it."*

*Participant 2PH1808*

Participant 2PH1808 somewhat challenged the merits of training, guided by existing field engineer career pathways, to obtain an accredited technical certification when they may already possess the actual skills for the task. The participant also challenged why such activities seem to slow down over a longer tenure.

The findings indicated contractual customer requirements, driven by CompanyX agreeing term-specific and SLA-based agreements to deliver technical engineering services to customers, have previously acted as impetus for mature IT field engineers to obtain additional skills beyond the default technical skill level for the role, but only according to the scope of the requirement. The finding '*training for practice income'* describes the influence of contracted customer field engineering requirements on the training and development pathway, frequently acting as a catalyst for IT field engineers to acquire skills with the highest potential to recover the training financial investment.

> *"I'm no longer developing myself proactively because training only seems to happen when a contract needs it. I've stopped asking now. it's always been like that in the engineering industry".*
>
> *Participant 2PH1813*

The mature IT field engineers indicated there may be a *'training vs development mismatch'* with no shortage of IT field engineer training influenced by short or medium-term customer driven or contractual demands for services. They also indicated that IT field engineer development with future career goals being considered seemed was less evident.

The findings indicated that the mature IT field engineer role expectations may be defined and offer guidance based on the key skills and behaviours required to advance to higher grades, with technical seniority potentially resulting in a *career ceiling* at the highest grade and the structured *pathway out of IT field engineering* to the next level of CompanyX technical consultancy roles may be inadequate. Participant 2PH1810 reinforced the opinion of an unclear career pathway into an adjacent and potentially attractive technical role within the consultancy practice.

> *"My job is now pretty boring, but I don't know what to do next. I know there was a pathway to consultancy jobs in the past and some other engineers were sponsored by their managers and lucky to take advantage of it. I don't think its running anymore so many of us are stuck."*
>
> *Participant 2PH1810*

Engineers at the top of the salary band for their role continue to gain valuable training but begin to question their worth if no further financial reward or value-derived benefit based on achievement is available due to them hitting the salary ceiling for that role and, in some cases, in senior roles beyond theirs. The findings indicate that training without a career purpose can lead to a *"trained but unfulfilled'* state as some engineers are also wrestling with numerous midlife considerations or retirement, therefore becoming disillusioned due to a lack clarity of their career objectives and outcomes.

> *"I know some engineers have looked at a job in projects because of more wages but why can't things just get better for technical engineers. I still do enjoy the technical aspects very much. I am certainly more technically orientated, than management or process orientated. I have realized that. I don't really want to go into projects but it's not easy to get into consultancy either."*
>
> *Participant 2PH1817*

*'Core skills development'* and '*dated technical skills'* were findings coded to indicate the current IT engineering skills that may be needed to evolve to ensure that mature IT engineers are equipped to affect the future tasks and role requirements emerging from both customers and IT manufacturers and that they no longer rely on legacy technical requirements, thereby remaining dominant. The

findings explicitly identified the value of software, and security and automation technical skills coded within the job and role design section as examples of future focused skills for evolved jobs. However, the current evolution of IT service delivery highlights the importance of a *development roadmap* with a longer term horizon. Participant 2PH1810 positions the impact of the industry shift.

*"So there is definitely a shift from physical repairs and programming hardware things to moving to the software programmability type approach. If means lots of the things I have been previously doing are disappearing and there is less demand".*

*Participant 2PH1810*

'*Insufficient soft skills'* indicated the existence of a need for the development of the mature IT field engineers and highlighted the importance of customer service, verbal communications and other meta-skills enhancements necessary to develop a new mature IT field engineer persona well positioned to serve changing office-based requirements (i.e., engaging with people and not only technical systems).

*"Not everyone wants to work on a customer site on a help desk, that wasn't how it used to be. Its less about field engineering now and there's a lot more customer service. Some of us just want to work on systems and that's it but I know everything's changing. I don't know how much you can train people for it because some people just haven't got that sort of customer facing skill. Maybe they can retrain engineers to make them more comfortable engaging in a more customer facing way."*

*Participant 3PH1821*

Participant 3PH1821 echoed a common view and expressed a lack of familiarity with the engagement style suited to customer facing or helpdesk roles. The participant also expressed an awareness that the expectations of the historical IT field engineer jobs are changing or have already changed.

Commonality existed across the participants with a concurring view that the dominant driver of career planning and employee development journeys have primarily resided with the resource manager, with limited input solicited from the IT field engineer in question. '*Self-development'* and *'increased career accountability'* highlight a desire for the mature IT field engineers to increase the level of engagement and accountability for their own skills acquisition and career development. Participant 2PH1813 indicated that the mature IT field engineers would like to increase the level of input into their own career development path to help them to progress in their job roles, but that some managers were less accommodating.

*"If they asked the engineers where they saw the industry going and what they wanted for from their career – rather than the short term job – and training was made available to meet that path I think that would work. You're sort of governing your own path rather than being limited. I've tried but my manager said no unless I do my own external training."*

*Participant 2PH1813*

This aspirational mutually defined career pathway approach, factoring in the needs of the mature IT field engineer personalised by the life and career expectations of the individual, was discussed with managers who softened their command and authority-centric approach; this was viewed positively by the participants. Participant 2PH1808 spoke favourably of managers who adopted a co-created approach to engineer development.

*"I know people who have been fortunate with a manager helping them with their development. they were offered a pathway out of the engineering team to another technical group in the company. I know a programme existed but not sure if it's still happening or what I need to do to be a part of it."*

*Participant 2PH1808*

The findings across the participants were consistent when positioning the importance of the resource managers through the mature IT field engineers' careers to date. Skills development was based on recommendations predominantly from the resource managers with the mature IT field engineers indicating the focus on productivity, resulting in continued development of traditional skills. As cited by Participant 2PH1808, the pathway out of IT field engineering to the consultancy practice can be challenging to navigate, in part, due to a lack of relevant skills.

The mature age segmentation guiding this research, meant that later stage employment, including retirement and career exit, were discussed by the participants. The findings indicated *'no fear of retirement'* with the mature IT field engineers passionately conveying a desire to continue working informed by the belief that with the right *pre-retirement career development,* they will continue to offer value to CompanyX and its customers.

> *"I know there is no retirement age but it would be helpful of the company would lead you through the stuff you need to need long before it becomes a problem. .... have a look at your pension, how much money do you need later on, do you want to do less hours, stuff like that. We need the options to make early decisions."*

*Participant 2PH1816*

Retirement was not positioned as a focus for the mature IT field engineers within this research. This was guided by the perception that with the right skills and *later career life guidance*, they will remain relevant in the future in a similar manner to their historical career.

### 6.2.5 Work and life flexibility

The **'work and life flexibility'** finding captures the mature IT field engineers existing experiences and perspectives that describe how they strive to be effective and valuable to themselves, for CompanyX and for others outside of the workplace. This category was intentionally coded as work and life flexibility due to the mature IT field engineers not seeking balance but, instead, the flexibility to dynamically adapt and allocate time and effort where required.

*'Job and life flexibility'* was positioned as essential for the mature IT field engineers to remain effective, guided by the value of modification their existing roles to accommodate additional "*life impacts*" such as care for parents or dependant family members. The findings indicated that the rigidity of the current mature IT field engineer role and task structure left little room to accommodate work-life balance initiatives. The interviews highlighted a greater emphasis on job flexibility, with an increased onus on making the role fit with the changing life expectations of the mature IT field engineer rather than the other way around.

*'Winding down for retirement'* also featured within the career aligned categories as a common discussion with the view that retirement has fundamentally changed the modern employment age and retirement may not mean a complete exit from the workforce. Instead, retirement may mean *more 'life' time*. The participants explained that job flexibility and improved availability of CompanyX work-life balance options may extend the careers of mature IT field engineers due to the flexibility and increasingly available employment opportunities. Participant 2PH1815 summarised a viewpoint common across the interviewees, indicating no desire to exit the workforce.

*"Job wise I still get quite a bit of satisfaction from working. I'm quite happy doing what I'm doing and I'm quite willing just to keep it going. So, I'll probably just stay on until my employment finishes with no real desire to stop working."*

*Participant 2PH1815*

Although Participant 2PH1815 radiates a positive view about continuation in the workforce, the findings also indicate a lack of *'later career life guidance'* with explicit 'later in your career' information to assist with decision-making about the availability of work and life balance options to support such "limitless" working desires.

*'Proactive work-life intervention'* describes the mature IT field engineers' view that not all managers are as intentional in the way they reinforce the availability of work-life balance options partially due to current roles lacking the flexibility to accommodate them. A portfolio of work-life benefits are currently available at CompanyX to all IT field engineers which may include remote working, career sabbaticals, modified work times and reduced travel, to name a selection. However, the findings also indicate that many IT field engineers are unaware of the full span of work-life balance options, with a *lack of visibility of work-life options* or a lack of manager encouragement to utilise them. Participant 3PH1819 offers an example of a viable work-life balance option and its benefit when available for use in a flexible manner.

> *"I may not want to use it every year but some years I may want to say I want to take extended periods off in a year and work in a truly flexible manner. For example, the ability to apply for greater flexibility of the use of annual leave but without the formality of a sabbatical. It could be about giving the company notice to allow me to take random blocks of time off or working flexi time."*
>
> *Participant 3PH1819*

The findings do not indicate intentionally obstructive resource manager behaviour to reduce the visibility of available work-life balance options. But the findings did note an inherent inflexibility in the historical IT field engineering role due to the need for contracted technical or services resources at customer locations. Creating flexibility by design within the IT field engineering job role was highlighted by all participants as necessary to accommodate *changing life priorities,* which may offer the potential for individualised work templates with sufficient flexibility to accommodate non-work related demands. Participant 2PH1808 conveys the limitations of the current field engineering role in situations where greater flexibility is required to accommodate changing family circumstances.

*"I need to look after a young child but also have a broad countrywide engineering role. To balance this well without work-life flexibility you really have to be someone that doesn't have a family.*
*Participant 2PH1808*

The findings created a specific *code, 'family life issues',* to describe non-work *'life impacts'* that must be accommodated and that are affected by the work-related demands and expectations of a mature IT field engineer. All participants discussed *reprioritising family involvement* as they reached the mid-life career stage, not necessarily resulting in the allocation of more time for family, but the requirement to consider different life-related impacts. Whether via reduced hours (days) or the chance to refactor expected utilisation for the day in line with nursery or school drop off/collection, *'seeking more life time'* indicates the desire to move the work/life pendulum towards life or family, as 2PH1813 explains.

*"Due to children related reasons, I don't want to travel and work long hours anymore. I would like to spend more time being part of my kids growing up or interacting with their children when they have them."*
*Participant 2PH1813*

The findings show that mature IT field engineers were affected by non-work life-related impacts at both ends of the age scale, from the need to accommodate time for *young family responsibilities* (for example grandchildren) to the importance of time available for *'ageing family assistance'* (parents and grandparents as an example). This interesting dynamic is a reality for many mid-life employees but one that the mature IT field engineers cited as challenging due to the rigid time and location demands of the engineering role.

And finally, a finding discussed at length prioritised the importance of *'future focused financial management',* coded to describe the current social and economic climate with no retirement age, which is encouraging for mature IT field engineers to accelerate the accumulation of additional income in their mid-life time frame when they perceive their work-related capacity as remaining high. This spans both careers and work-life topics, but was most prominent when discussing working less in the future but remaining financially viable to enjoy non-work *'life time'*.

## 6.3 Chapter summary

Chapter 6 provided a summary of the findings from the coding and analytical processes, with categories created to describe the mature IT field engineer career experiences and skills through their tenure with CompanyX.

The findings described five theoretical topics indicated by the main category headings: **management influence**, **career pathway**, **job and role design**, **work & life flexibility** and **self-worth and value**. **Self-worth and value,** the core category informed by the categories listed above, described the perception conveyed by the mature IT field engineers who explained that they were wrestling with their personal sense of worth as effective and productive mature IT field engineers, which is key to the value the believe they offer they CompanyX and other relevant non-work stakeholders. The resource manager style and **management influence** was found to be inconsistent across the research cohort. However, the findings indicated that effective resource manager engagement contributes to a positive IT field engineer perception of self-worth and value due to the importance of manager acknowledgement and authorisation of engineer activities. **Job and role design** also informed feelings of **self-worth and value**, fuelled by the mature IT field engineers' awareness of their diminishing value as the need for their historical jobs and skills declined, thereby potentially reducing their relevance. The findings indicated that the mature IT field engineer **career pathway** or navigation is tightly coupled with the development journey of the existing engineering job and informed negative feelings of self-worth and value due to lacking development activities to offset skills and job obsolescence. And, finally, **work and life flexibility** were also found to be important to the mature IT field engineers' feelings of self-worth and value and is influenced by job inflexibility, competing work and midlife priorities, and the engineers' personal desire to be considered valuable inside and outside of the workplace.

The following chapter, Chapter 7, will discuss the findings in further detail. Within the context of the grounded theory process, the ensuing discussion will be informed by the aforementioned five theoretical concepts, meeting the aims of this research and answering the main question.

# Chapter 7: Discussion

## 7.1 Introduction

This chapter will discuss and synthesize the findings presented in Chapter 6 to determine their significance in relation to the research question, i.e., to understand the skills, support and knowledge that mature IT field engineers perceive are necessary to remain effective in the IT workforce within CompanyX. The findings will be discussed and integrated with existing research, with the developed theory presented to explain the relationships between categories and the outcomes they enable.

## 7.2 Theoretical interpretation and integration

This research aimed to understand the challenges faced by mature IT engineers who wish to remain effective in the continually changing IT industry. This research addressed the career and skills needs of an ageing community of IT field engineering workers who concerned about their future career prospects, based on real world considerations about the applicability of the tasks they perform within their historical and current roles.

The research was guided by the following primary question:

What skills, knowledge and organisational support do mature IT field engineers perceive are required for them to remain effective within the information technology workforce?

Semi-structured participant interviews were undertaken, with a constructivist grounded theory-based qualitative research methodology used to analyse data and create five theoretical categories. The findings from the five theoretical categories, management influence, job and role design, work and life flexibility, career pathway and the core category ***self-worth and value*** were presented in

Chapter 6 and were supported by extracts from the research participant transcripts.

This chapter is structured according to the three themes that were derived from the research and analysis conducted for this study as discussed in the previous chapters. The resulting theoretical categories fulfil the research aims and answer the main question. The themes are **the impact of management style** (informed by the *management influence, job and role design* and *the work and life flexibility* categories*)*, **career development for maturing engineers** (informed by the *career pathway* category) and the core category **self-worth and value** as the enabling factor (informed by the *self-worth and value* category*).* **Self-worth and value** emerged as an important enabling factor for the mature IT field engineers at CompanyX as they considered their skills and career development, with this chapter also exploring the relationship with professional identity concepts highlighted by the preliminary literature search in chapter 2.

## 7.3 The substantive theory

The grounded theory research method is used to develop two types of theories, formal and substantive. Formal theories are general in nature and cut across different conceptual or theoretical areas, increasing the possibility for generalisation and applicability outside of the original research domain (Glaser and Strauss, 1967). In common with many grounded theories, this research has developed a substantive theory (Strauss and Corbin, 1998; Glor, 2008) with no intention of developing a formal theory due to the focus on understanding the specific nature of the development of mature IT field engineers within CompanyX.

A key aim of this research was to understand the skills, knowledge and organisational support that mature IT field engineers require to remain effective as employees of CompanyX and, as such, a limited understanding of the development practices of generic older workers was deemed beneficial. However, the multitude of definitions of both older ageing or mature workforces, in addition to the potential for numerous academic descriptions of, for example, career development or inclusion within HRD studies, (Cameron, 2009) made it difficult to scope the topic.

This research developed a constructivist substantive grounded theory (Charmaz, 2006) to understand the skills, knowledge and organisational support that mature IT field engineers require to remain effective in the technology industry; see Figure 40 for a depiction of this.

The substantive theory developed (figure 40 and appendix 15) is influenced by the emergence of the importance of ***self-worth and value*** as the core finding that the mature IT field engineers in CompanyX consider as they understand the beneficial skills and capabilities the required to remain effective. The mature IT field engineers discussed their perception of a reduced sense of self-worth informed by the relevance and value of their historical skills diminishing as a consequence of accelerated industry changes and technology advancement. Skills and abilities are important to an individual's identity (Barbarà Molinero, 2015) therefore the resulting skills obsolescence amplified the mature IT engineers' concerns that their traditional mature IT field engineer jobs will lack relevance as both CompanyX and customer expectations continue to evolve which may change their existing and future professional identity.

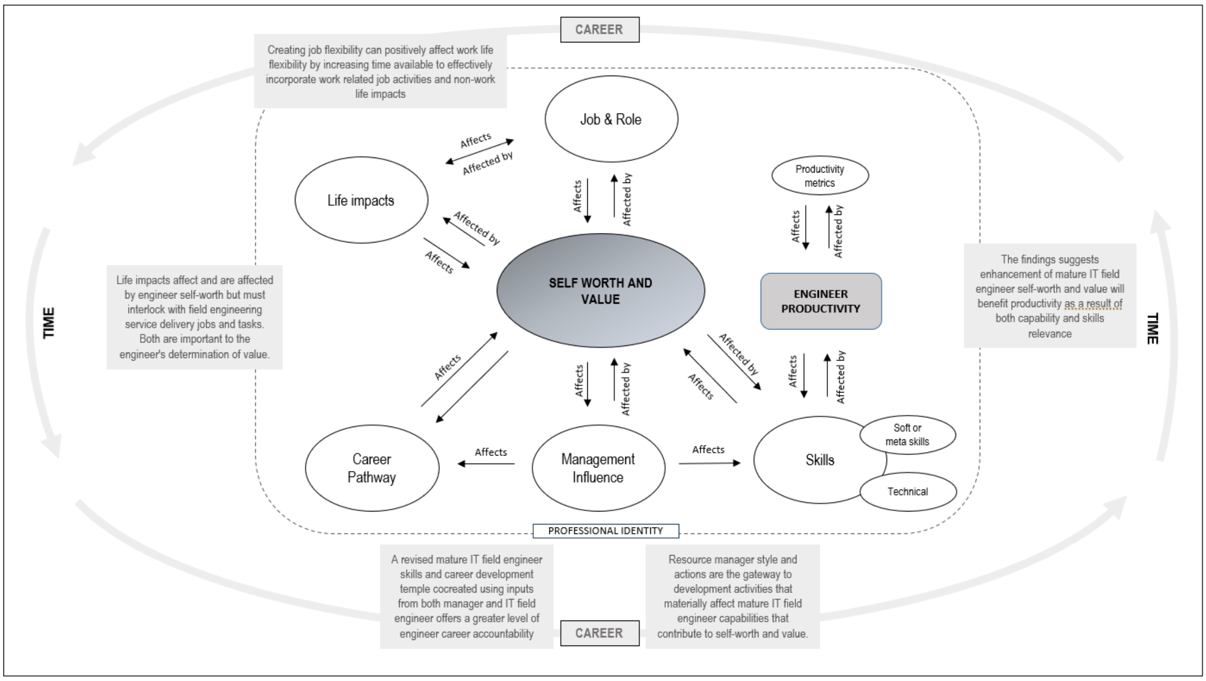


*Figure 40 - The substantive theory*

A selection of relevant literature focused on the skills and career development of older workers was explored to compare with the findings of this research. The findings of this research supported work by Armstrong-Stassen (2008) by recognising that older workers, i.e., older IT field engineers, viewed organisations highly if they were supportive of investments in skills or job modifications. However, this research differs from the Armstrong-Stassen findings by placing a higher level of importance on work-life flexibility, suggesting that older workers view additional job flexibility as beneficial possibly due to dependent expectations from younger family members (grandchildren) and care for older parents. Additionally, there is a desire for more personal fulfilment, a view also supported by Brooke (2009).

Whilst this study shares some commonality with the findings of Armstrong-Stassen (2008) and Brooke (2009), neither have identified the importance of self-worth and value as important to the development of older workers. The emergence of self-worth and value within this research may be a result of the IT field engineering dynamic, with long serving employees who benefited initially from skills scarcity and a long period of skills relevance which enhanced their self-worth and their resulting value, but who are now affected by a skills decline. This study also acknowledges existing literature focussed on the professional identity of information technology professionals with commonality of findings on the positive value of technical certification and industry recognised credentials as evidence of competency (Smith, 2016) and to enhance their sense of belonging and professional identity (Tsakissiris, 2015). However, this research builds on both Smith (2016) and Tsakissiris (2015) due to the mature IT field engineers' perception of self-worth and value emerging as the core element of their future skills and career development for consideration by both employee and resource manager, which is informed by their existing and aspirational professional identity.

This research advocates for an intentional career intervention for mature IT field engineers, with the findings suggesting the mid-life/mid-career life stage (Super, 1980), positioned within this research as 45 years old and beyond, as a well-positioned employee / employer mid-career engagement timeframe. However, the findings also indicated an important first activity in this process should be the determination of the mature IT field engineers' personal perception of their self-worth and value. By understanding the IT engineers' evaluation of self-worth, based on existing skills and future capability requirements, current and future development can be individualised and guided by the engineer's own life and future career aspirations.

The emergence of the importance of the IT field engineers perception of self-worth and value as the core category underpinning both skills and career development was significant to this theory. The developed theory emphasises the importance of co-creation of the mature IT engineer's career development roadmap by both the resource manager and engineer, to mutually determine the relevant technical and soft skills required to equip the engineer with future focused capabilities to enable them to remain valued contributors. The shift from a manager and organisation dominated career pathway to one with an increased level of self-direction by the mature IT field engineer, will be contributory to self-worth and value enhancement where job redesign and new skills equip the engineer to be future relevant in a manner that serves both the employee and the organisation. Due to the midlife or older worker classification guiding this theory, the impact of the ageing cannot be ignored with the grounded theory highlighting the importance of personalised engineer evaluation and consideration of age-related impacts, which can be offset by job redesign to minimise the detrimental effects of ageing, such as physical decline, whilst incorporating added flexibility to embrace valuable non-work family outcomes. Finally, the theory suggests enhancement to the mature IT field engineer's perception of self-worth and value will in turn evolve their historical professional identity developed across previous, discrete career and life stages, because of new skills and career expectations underpinning the professional identity changes deemed key to their future relevance and career effectiveness.

### 7.4 Self-worth and value as the enabling factor

***Self-worth and value*****,** as a core category was identified as a significant finding of this research and pervasive within the other categories created, leading to the repositioning of *self-worth and value* as a core category central to the integration of others in this research (Hallberg, 2010). Self-worth can be described as the evaluation of the personal perspective of the self being valued or feelings of worthiness (Covington, 1992), with both terms linked within this research by the participants and data analysis. This finding was unexpected due to broader employment and technical discipline topics initially discussed during the participant interviews, but it then emerged as a result of theoretical sensitivity, data analysis and the grounded theory constant comparison process.

The emergence of *self-worth and value* as the core category was considered a significant development due to the relationships identified between other findings which include, the importance of resource management style and influence, the benefits of job redesign for ageing or mature IT field engineers, the value of revising existing career development approaches and the need to incorporate greater job flexibility to assist with the balance of work and family needs. The research suggests, the relationships that emerged with self-worth and value at the centre may help the mature IT field engineers to enhance their perception as valued and worthy contributors in and out of the workplace. Figure 40, above presented the relationships between self-worth and value and the indicated research findings.

The relationships between self-worth and value can be summarised as follows.

**Self-worth and value – Work-life flexibility:** The impact on self-worth is guided by the potential for mature IT field engineers to utilise available time more effectively, therefore increasing valuable and mutually beneficial contributions both in and out of the workplace. With the IT field engineers highlighting the growing demand of non-work-related requirements, self-worth and value may be enhanced due to increased possibilities of performing effectively in the workplace but also remaining available and invested in non-work, life or family impacts.

**Self-worth and value – Career Pathway:** This is underpinned by the opportunity for the mature IT field engineers to be heavily involved in their own growth with increased accountability for both skills and career development, co-created with resource managers. This will ensure congruence in both areas with resource manager support to ensure relevant skills and career development, helping to maximise IT field engineer self-worth and the value.

**Self-worth and value – Management influence:** This is significant to the mature IT field engineers based on the role and input from resource managers deemed fundamental to engineer success as they are the principal authority for skills investment and job assignment. Resource managers adopting a collaborative engagement style with greater awareness and recognition of value have the potential to contribute positively to the IT field engineers' determination of self-worth and value.

**Self-worth and value – Job Design**: The research highlighted the changing technological and service expectations in the IT industry, reducing the value of historical jobs and skills and indicating new roles with new skills are required to remain relevant and effective. Changes to the mature IT field engineer job will help engineers to remain relevant to CompanyX at work but also with the flexibility to equally feel valued undertaking out of work activities.

Whilst existing literature considers the topics positioned by the five categories defined by this research individually, this research determined that a relationship exists between them when considering the skills and career development outcomes of mature IT field engineers. Furthermore, the findings also suggest the emergence of self-worth and value as important to mature IT engineers' perception as valued and effective employees which can have a shifting effect (Briggs, 2007) on their professional identity where fluctuations in an individual's self-concept occur (Kroger and Marcia, 2011) because of subsequent identity changes due to new skills, jobs or careers.

### 7.4.1 Considering age insecurity

The mature or age-related dimension of this research resulted in a discussion of whether or not the mature IT field engineers perceived their *value diminished by age* as older workers when compared to younger employees. This led to an initial review of age contingent self-worth literature (Ravary, Stewart and Baldwin, 2001) to determine if insecurity about age in older IT engineers, in relation to their younger counterparts or contingent factors, influenced the mature IT field engineers' perceptions of worthiness. The findings offered no support to age insecurity concerns with no fears of the ageing process or "getting older" being cited by the research participants as diminishing their value compared to other employees. This research argues that the mature IT field engineers considered their maturing age an advantage and were assertive when conveying that both age and tenure had given them a depth of accumulated professional and experiential knowledge supporting Alic (2008) that reinforced their stored value. Contrary to existing research, for example Kanfer and Ackerman (2004) who found older workers negatively affected by cognitive decline that may a reduce mental processing speed, the mature IT field engineers within this study perceived their tacit experience and continued effectiveness were evidence of no detrimental cognitive effects as a result of aging (Freund, 2008). This may be a result of the high value that the mature IT field engineers placed on their own knowledge and capabilities with reinforcement that their age indicated longevity of tenure and accumulated experience or wisdom capital (Vasconcelos, 2018), a source of tangible value over their younger counterparts. This research suggests that the possession of industry relevant technical credentials remain an important self-evaluation element of value by the mature IT field engineers (Marks and Scholarios, 2007; Smith, 2016; Mackenzie and Marks, 2019) in part due to the historical importance of them by the IT industry and recruiting employers (Medlin, Schneberger and Husinger, 2007). They also act as an evidence-based indicator of the ability to achieve tasks commensurate with the role and, therefore remain effective and valued employees nullifying age derived inevitabilities.

### 7.4.2 Understanding the mature IT engineers' feelings of worth

This research offers support to Covington and Beery's self-worth and achievement model (1976), which theorises that humans prioritise the need for self-acceptance and equate 'worthiness' to effective accomplishment in competitive situations. The mature IT field engineers placed high levels of value on the achievement of relevant *technical value* via accreditations as an element of measurement of trained competence and value to CompanyX which has remained an important element of their 'social identity' within the organisation (Tajfel and Turner, 1979) and also the feelings of self-worth gained through their professional identity as competent engineers (Marks and Scholarios, 2007; Łubieńska, and Wozniak, 2012).

The findings indicate technical value is considered important to the mature IT field engineers, because it acts as an enabler of their personal value and employment purpose, which is the delivery of beneficial technical services to CompanyX customers to the highest level of satisfaction. The mature IT field engineers valued their social membership within both the CompanyX engineering community and also the wider information technology profession, proud of the peer endorsement they cultivated as knowledgeable members of the technology industry (Quan, Dattero and Galup, 2007) with that knowledge, validated by both experience and recognised industry credentials. The findings highlighted the IT field engineers' perceptions and measurement of self-worth and value includes the high regard they place on the technical knowledge (Alvesson, 2000) with much of it is tacit within the engineer and therefore challenging to surface without bidirectional company and employee effort (Smith, 2001). However, the findings also suggest the historically effective accumulation of technical credentials as the primary measure of IT field engineer value is no longer appropriate with the research deeming it to be the evaluation of a broader set of factors that combine skills, experience, job design, their perception of personal value and future career potential. It is important to measure a person's perception of self-worth to understand their positive and negative feelings about themselves, their specific beliefs about themselves and the way they frame those beliefs (Pelham and Swann, 1989). In the case of the mature IT field engineers in this study, the findings indicated the engineers were considering their perception of value informed by both current and future capability. Self-esteem, as a core measure of self-worth is considered within the findings to describe an individual's internal and personal evaluation of 'worthiness' (Orth and Robins, 2014; Farooq *et al*., 2015). This research had no defined mechanism to measure the self-esteem of the mature IT field engineers in a consistent manner as a contributor to their understanding on self-worth during the research timeframe and whilst self-esteem is discussed within later sections, specific measurement guided by the research findings were beyond the scope of the research but are positioned as a post research recommendation in the conclusion Chapter 8.

In keeping with Cast and Burke (2002), the mature IT field engineers described self-worth and value as their feelings of the 'perceived value' of the traditional engineering activities they undertook, the importance of them and therefore how valuable it made them to CompanyX. Throughout their careers, the mature IT field engineers had exhibited evidence of self-determination of value and worth, however this was primarily governed by their perceived value as effective contributors for CompanyX in favour of their own perception of their valued self. This research argues that mature IT field engineers highly valued their behaviour and *personal knowledge assets* or general human capital (Quan et al., 2007) and as technical professionals they were considered an important element of their perception of self-worth. This reinforces the existence of two perception scales, 'worth and value', both held by the resource managers aligned to measurable capability and output and by the mature IT field engineers defined by their perception of existing experience, training, capability and future job relevance. The findings also support Potgieter (2005) and existing literature reinforcing the motivational benefits of ongoing training and development to the self-worth of technical employees to gain knowledge and capabilities to enhance their feelings of value. Whilst sufficient engineering jobs remain utilising historical hardware-based IT field technical skills (Goles, Hawk and Kaiser, 2008), the mature IT field engineers were increasingly aware of the declining market need for their once valued IT engineering and service skills, resulting in corresponding personal concerns of their worthiness to CompanyX. The research participants, with multiple decades of consistent employment with their personal skills, job role and knowledge contributing to a stable professional identity (Popescu, Bulei and Mihalcioiu, 2014) indicated they were unsure of their value amid continual industry changes. However, findings indicate the likelihood of a change in their professional identity because of revised investment in skills to equip them for current job requirements changing at an accelerated rate due to digitisation (Kudryavtseva *et al*., 2019) and future customer and CompanyX expectations of IT service delivery.

The research findings reinforced the importance of market relevant technical skills and behaviours to ensure the mature IT field engineers remained competent and capable to perform expected tasks which were in line with existing literature indicating information technology workers associate much of their self-worth to their certified skills (Smith, 2016) and accomplishment of the work they do (Gussek, Schned and Wiesche, 2021). However, the research participants also reinforced their desire for future skills and career development to be mutually defined between themselves and the resource manager to enhance their perception of self-worth and value, guided by expectation of joint personal and company benefits as a realisation of their revised professional identity. This research suggests, effective measurement of the mature IT field engineer's perception of self-worth or self-esteem as a contributor where appropriate may help to guide future career and skills development activities to positively enhance the IT field engineer's personal self-worth viewpoint. Self-esteem is considered and important element of self-worth. The commonly used Rosenberg self-esteem scale (Rosenberg, 1965) has been challenged based on invariance in adults (Marsh *et al*., 2010) however, the broader research community continues to deem it the most commonly used and effective instrument for measuring self-esteem (Tafarodi and Swann, 1995; Mannarini, 2010; Mullen, Gothe and McAuley, 2013). This research therefore suggests where self-esteem measurement is considered to be a beneficial contributor to the determination of IT field engineer self-worth, a recognised self-esteem measurement tool should be used to reduce negative consequences supporting Baumeister (1998), to provide both resource managers and the mature IT field engineers with an evidence-based empirical measure of engineer self-esteem which may aid the effective development of beneficial skills and career development programmes that positively affect employee perception of self-worth. By resource managers recognising the importance of determining a measured state of self-worth and value within the IT field engineering community, future career development investments that cultivate healthy self-esteem and enhance the employee self-view (Swann, Chang-Schneider and McClarty, 2007) can be prioritised, thus helping to reduce the dissonance between the individual's personal and professional identity (Mount et al., 2022).

### 7.4.3 Valued contributions

This research also positions self-worth alongside value, which led to the original creation of the self-worth and value core category. Whilst self-worth was defined earlier, 'value' as defined by this research has a partial alignment to human capital theory (Shultz, 1961), which describes how the skills and knowledge of human resources within an organisation are used to deliver productive work and achieve strategic goals (Baron and Armstrong, 2007). The mature IT field engineers are technically skilled employees with their ability to competently undertake engineering jobs, important components of their evaluation of worthiness and value to offer to CompanyX. Information technology workers view the perception of them as experts in their field based on the value they possess as an important element of their professional identity within the profession (Katz, 2005). With over a decade of effective engineering task and service delivery to CompanyX customers and internal colleagues, the mature IT field engineers perceived their personally valued historical career activities warranted greater acknowledgement from the resource manager community as a valuable company human capital asset. This research offers support to Corwin (2015) who found that older workers believed the tacit knowledge they accumulated over time was valuable which correspondingly helped them to feel valued based on the worth of their contributions and experiential knowledge (Borkman, 1976). The findings describe and link IT field engineer value with task and career relevance due to the importance of being equipped to effectively perform the jobs and tasks required by CompanyX and its customers. The value centric identity of the mature IT field engineers in this study highlighted the activities they undertook had to 'matter', suggesting their value and contribution to a beneficial customer outcome was fundamental to them, not simply the conclusion of the technical task. Resource *manager perception of value* and acknowledgement of valuable work activities was considered important by the mature IT field engineers as a source of positive endorsement of them being valuable employees, concurring with Crestani (2018) and Betlisky (1978). This finding was emphasised throughout the participant interviews due to the mature IT field engineers believing it was key that their contributions were considered valuable by one of their primary evaluators, i.e. 'the manager' and secondly future skills investment decisions by the manager would be influenced by the manager's perception of their worthiness as effective engineers. An individual's job and skills, beliefs, values and experiences in the workplace are important elements of the 'self' that forms their professional identity (Ibarra, 1999; Schein, 1978). This research determined that the resource manager style and feedback on the work undertaken and its contribution to both CompanyX and the customer requiring the engineering service, is a vital contributor to the engineer's opinion of self and value. The perception of value from both parties may also affect turnover intentions, with this research also supporting the research of Marvell and Cox (2017) who found that older workers believing their contribution is valued by the organisation may prolong their tenure in the workforce, however this research also found no evidence of the mature IT field engineers seeking to end their tenure within CompanyX.

Resource managers were described as focusing primarily on task completion and productivity data as the principal measure of value with their prioritisation on utilisation or 'metric fixation' (Muller, 2020), at times failing to emphasise the accumulated knowledge and future potential the mature IT field engineers which was deemed essential to their feelings of self-worth and value. This may be a result of misinterpretation of the importance of the knowledge mature IT field engineers possess rather than focusing on output-based measures best suited to manual workers (Ramirez and Nembhard, 2004). The research findings reinforce this, suggesting the knowledge worker element of the mature IT field engineer professional identity was somewhat diluted by the CompanyX resource manager primary focus on utilisation derived, productivity centric task and activity measures. Furthermore, the historical hardware-based IT field engineering role was substantially manual by design based on the need to undertake the physical installation and engineering of IT systems which influenced the resource manager task management style. Hardware-based infrastructure systems remain essential to the delivery of IT services, but the need to physically engineer or install them is declining as many traditional IT functions have shifted to software, leading this research to argue that the mature IT field engineers also were questioning the value of their accumulated knowledge. Knowledge is required whether hardware-based engineering or software configuration and engineers as knowledge workers consider the recognition of the value and their skills, qualifications and achievements contributory to positive self-esteem (Brun and Dugas, 2008). The knowledge required to configure, deploy, and troubleshoot IT systems was fundamental to the role and the jobs they undertook therefore adaptation is required to shift the measurement of engineer value from output to one that includes a predominant value-based dimension. This indicates a different type of reward framework that builds on existing productivity-based task completion metrics with an additional value-based dimension may be required to positively recognise IT field engineer contributions and enhance the mature IT field engineer's positive perception of self-worth and value.

### 7.4.4 Recognition of valued knowledge

The mature IT field engineers hold their historical knowledge and the corresponding value as a key component of their worthiness and believe they should be rewarded accordingly (Brun and Dugas, 2008). Historically, the focus on relevant IT certification whether academic or industry specific may be manifestation of employers focussing on such credentials as validation of competency when recruiting engineers (Medlin, Schneberger and Husinger, 2007) potentially leading to perception of reduced value when they are absent. This research offered similar findings indicating validation of technical competence and corresponding 'value' of the mature IT field engineers was biased towards the successful achievement and accumulation of technical accreditation and certification which increased their availability to undertake required technical services. This is approach is common within the IT industry with existing literature indicating, the mutual benefits to both the employee and organisation with recognised certification a consistent demonstration of competence (Wiershem, Zhang and Johnston, 2010). The findings do not suggest credentials are not required because they remain evidence of successful completion of required training and therefore competence to undertake engineering tasks effectively, however the findings indicate they must be augmented with additional elements, including soft skills to radiate a broader picture of engineer value and effectiveness. The findings also indicated that *a lack of value centric rewards* were available to consistently recognise non-metric or productivity centric IT field engineer outcomes and the full span of the value the engineers believed they delivered. The mature IT field engineers, as knowledge workers, placed a high level of importance on rewards for their contributions (O'Neil and Adya, 2007) and whilst acknowledging the existence value-based reward systems within CompanyX indicated they were not consistently used due to lack of awareness, time and resource manager orientation. The findings also indicated that Herzberg- style (1957) hygiene factors of salary and working conditions for the mature IT field engineers were in place with no IT field engineers indicating concerns about renumeration. However, more work may be required on non-monetary (Thite, 2004) or intrinsic rewards to reinforce a sense of value and purpose (Ryan and Deci, 2000). The mature IT field engineers emphasized that they wanted to be considered as valued technical employees by remaining relevant and recognised for their skills and knowledge. Existing literature suggests that managers of technical professionals have been slow to realise 'the work itself' is an important intrinsic motivator and therefore, continual education and recognition is valued (Potgieter, 2005). This is also evident in this research with utilisation and productivity dominating engineer perceived value conversations. The IT field engineers remained positive when discussing the broader IT profession and the work they had undertaken in CompanyX based on a career history of effective service delivery and reinforced the importance of 'intrinsic factors' (Inceoglu *et al.,* 2012) on their perspective of the job and organisation. They also explained that the qualitative nature of their competence and the future potential they knew they possessed as mature IT field engineers was not always recognised but remains valuable due to being guided more by their personal behaviour over monetary benefits (Brun and Dugas, 2008). This research therefore lends support to Lord (2002) who not only reinforced the importance of older engineers as a valuable asset at this time of skills shortages and increasingly so in the coming decades as valuable resources, but also the value of intrinsic rewards as motivators to older engineering knowledge workers.

The mature IT field engineers discussed the existence of CompanyX employee recognition platforms but suggested that some were complicated to use and even though opportunities existed for nominated engineers to participate in advanced development programmes, the selection criteria were unclear. This suggests that CompanyX may be suffering from a communications challenge of available recognition and rewards (Taneva *et al*., 2019), which can result in the value of such activities being nullified. Additionally, the findings highlighted other teams, sales as an example, were perceived to have greater access to employee recognition and access to rewards. Existing literature indicates that employee self-worth expectations can be met by employers utilising the full span of rewards at their disposal (Woodruffe, 2006). This suggests the CompanyX resource managers have a key role to play by ensuring they develop and maintain a workplace culture that continually advertises and reinforces the importance of available engineer relevant recognition and awards, to act as a valuable motivator to the mature IT field engineers and other technical personnel to reduce the inconsistency across the management team mentioned by the research participants. The findings support Parry (2007) who proposed the use of a 'total rewards' approach for the management of older workers, guided by the possibility of realising the enhanced employee engagement benefits delivered to equivalent technology organisations such as IBM and Microsoft (Slade *et al*., 2002) whilst also offering the IT field engineering resource managers a visible and mutually accepted rewards platform (Silverman and Reilly, 2003; Rumpel and Medcof, 2006). The adoption of such an approach may help to balance the current productivity centric mature IT field engineer engagement approach that measures activity with a transparent rewards structure designed to also highlight and recognise employee value. However, this research also acknowledges such a differentiated engineering team rewards program may be challenging to enable within CompanyX due to the organisational approach to apply a consistent centralised reward framework across all employee groups.

### 7.4.5 The benefit of meaningful activities.

The field engineers reflected on their enjoyable and successful tenure in their IT career, with skills currency driven by ongoing training and development in line with resource manager requests and changing customer requirements. However, the reduction of IT system complexity driven by technology commoditisation and extensive on job experience with deskilling (Frey and Osbourne, 2013), leading to day-to-day tasks lacking the cognitive and intellectual challenges of the past. This has stimulated an engineer desire to undertake *activities that matter,* such as different and meaningful tasks with an organisational or societal impact as another route to enhance self-esteem (Black, 2008). The findings argue in favour of the definition and task assignments for future roles to be developed in a collaborative manner between manager and engineer with feedback and input from the mature IT field engineers presenting the opportunity to incorporate meaningful activities that stimulate feelings of value and life purpose (Fairlie, 2011; Paullin, 2014). Across the broad spectrum of mature IT field engineering day-to-day roles and tasks, the acceleration of both IT industry and technology evolution has resulted in skill and job changes that are irreversible. Additionally, the previous technology complexity and specialist elements within common tasks and roles no longer exist. Augmentation of engineering roles and work tasks with "giving back" activities will assist the engineers in realising their true selves (Erikson, 1959) as a result of the personal involvement in outcomes that benefit others. The mature IT field engineers expressed a desire to use their knowledge to help with the development of others such as younger employees and lesser skilled colleagues. This research concurs with those of Ng and Feldman (2008) via an extensive study job performance who determined it was beneficial for organisations to train older workers in mentoring skills to use their experience to develop younger workers, however this research did not support the Ng and Feldman view that less technical training should be offered to older workers in favour of better suited younger workers. The mature IT field engineers were not seeking to mentor other employees whilst abdicating existing technical roles, but to impart their knowledge and experience on younger workers in addition to their existing IT field engineering tasks. Therefore by incorporating value-based activities like coaching and mentoring of other employees (Price and Colley, 2007), or customer beneficial activities beyond the traditional engineering task set, the findings indicate the mature IT field engineers can expose untapped capabilities for use in a manner that they believe delivers tangible value to others.

## 7.5 The impact of management style

The research finding, **management style** described in this section was created by the categories *management influence*, *job and role design* and *work and life flexibility* and considers the relationship between the resource managers and the mature IT field engineers they are responsible for. The term management style in this research context was defined as the activities, knowledge and behaviors exhibited by the CompanyX engineering resource managers as they conduct their day-to-day management roles of leadership, task allocation, and career guidance (Rezvani, 2017). The CompanyX engineering resource managers are the primary source of management and authority for the IT field engineers. With responsibility for recruitment, line management, authorisation of skills and development and rewards, the resource managers are fundamental to career effectiveness and successful development of the mature IT field engineers they are responsible for.

### 7.5.1 Evolving engineer engagement

The CompanyX engineering resource managers style incorporates the core Fayol (1916) management activities of planning, organization, coordination and control. However, the *management influence* finding concurs with Mintzberg (1973) who argued that the fluidity of activities and outcomes required to be an effective manager results in numerous personas exhibited in a highly dynamic manner. The resource manager is the dominant role within the CompanyX engineering teams which means management behaviors and activities have a significant impact on the employee's feelings of belonging (Tsakissiris, 2015). The power and dominance of the resource manager potentially nullifies the equivalent social power a mature IT field engineer may accumulate due to age or longevity in the organisation. However, the findings indicated a positive relationship between resource managers and the mature IT field engineers with the findings supporting Wiles (2013) with the IT field engineers potentially radiating the professional identity expected by the manager. The CompanyX engineering resource managers shape the culture within the teams they manage with operations and 'ways of working' defined by the managers' style. The influence of managers on the individuals they manage is significant with the manager role also acting as a role model in addition to offering job and career guidance that helps to form the professional identity of their team members (Gibson, 2004). However, the research findings indicated the management interaction and activities initiated differed across the CompanyX engineering resource managers and were guided by the *line manager perception* and style of the manager. The findings indicate a shift management style applied to the mature IT field engineers may be required to acknowledge the significant accumulated professional status (Watson, 2002) the engineers perceived they have achieved with the resource manager reinforcing to them they are highly valuable current and future assets rather than 'last resort' aging workers (Billet et al., 2001) who have previously delivered value.

This research argues that the CompanyX engineering resource managers may benefit from adaptation of their authoritarian leadership style and be mindful of the mature IT field engineers' long and effective tenures with evidence-based experience of effective service delivery, which will help to reinforce the mature IT field engineers' perception of value as highly capable employees requiring minimal intervention. Existing literature suggests adaptable manager behavior may be aligned to management effectiveness (Calarco, 2020), which is also supported by this research and conducive with the *variable manager behavior* and inconsistent experience indicated by the research participants and potentially shaping an IT field engineer professional identity dominated by the organizational control of the managers behavior (Alvesson and Willmott, 2002). The mature IT field engineers understood the importance of utilisation and productivity measures to the engineering practice health and success and job longevity. There is no escaping the need to undertake defined IT engineering tasks guided by the expectations of the engineering job has encouraged a dominant, *tick box management style* guided by task completion and productivity measures (Potgieter, 2005). However, the changes discussed may encourage the resource managers to rethink the use of relevant and essential productivity metrics, communicated in a manner that enhances the engineer perception of value without feeling draconian or punitive.

### 7.5.2 Managing productivity and output

Assignment of the mature IT field engineers to requests for an IT engineering service activity is the responsibly of the resource manager who will allocate the correct mature IT field engineer based on skills, current availability and customer location, to a particular job. In CompanyX resource managers help to maintain the organisational and professional standards at the heart of the professional identities of the jobs and roles in the team (Briggs, 2007). The historical IT field engineer identity was heavily informed by the importance of utilisation as a productivity metric to reduce the engineer time spent on the work bench due to a lack of allocated chargeable work, not generating company income. The findings infer the existence of a thin veneer of Taylorism management influences (Taylor, 1911) within the CompanyX resource management approach, with an emphasis on task, time and utilisation affecting the mature engineer's perception of *self-worth and value* due to task completion as the primary measure. *Utilisation driven management* is a style adopted by the resource managers to manage the mature IT field engineers' availability to undertake tasks and successfully complete them, guided by CompanyX expectations of expected output for a task or job. Dorsey and Mueller-Hanson (2017) counsels against the use of goal attainment or utilisation as a primary performance measure, a finding this research also supports. However, this research mirrors existing literature with the findings reinforcing the importance of utilisation metrics as an important contributor to resource manager decision-making within CompanyX. The findings indicate hard utilisation measures must be balanced with additional softer non-metric measures or shared outcomes, for example volume of internal colleague or peer beneficial activities, such as mentoring to enhance engineer feelings of positive self-worth and assist with the articulation of multi-dimensional value. Kamara and Mould (2020) suggested the use of shared goals and objectives by managers to cultivate a 'one team' culture to enhance professional identity, however with the IT field engineers in this research often working in singular mode completing their own tasks, shared measures may fail to motivate. This topic was the source of much discussion with the participants citing an overemphasis on productivity and output metrics prioritized over acknowledgement and *recognition of value that* the IT field engineers accumulated and demonstrated through their tenure. The literature search surfaced an innovative management approach, leader member exchange (LMX) based on a dyadic social relationship between manager and subordinate (Graen and Uhl-Bien, 1995) which was explored within this research to determine suitability but was rejected as a recommendation due to the potential for the "in out" separation to further stabilise the employee management relationship (Jha and Jha, 2013).

Instead, a coaching or co-created manager to engineer relationship was deemed a more appropriate management style due the cultural fabric of CompanyX and the benefits of such an approach to older workers (Leisink and Knies, 2011). As positioned by Locke and Latham (2006), a coaching-based management style with employee feedback may be the right engagement approach to assist with employee performance management using a collaborative manager to engineer a communications style with reduced emphasis on metric-based task completion productivity targets. The experience and behaviour of the mature IT field engineers throughout their long tenure within CompanyX offers evidence that successful completion of IT service tasks are the norm, expected and therefore other measures should be prioritised. The findings suggest the mature IT field engineers are advocating for a shift of management style to one that primarily rewards contributions over task-based metrics supports Petroni (2000) with equivalent recommendations for the effective management of engineers.

The importance placed on *recognition of value* describing the resource managers' use of recognition and *rewards* by the mature IT field engineers was not unexpected, with existing literature indicating older employees value job content, social environment or career value rewards over advancement or specific monetary benefits (Leithman, 2016; Kollman *et al*., 2020). The findings suggest, the CompanyX resource managers may benefit from a shift of thinking that repositions their view of the historical resource centric identity when considering the knowledge rich mature IT field engineer field-based technical personnel, to one that emphasizes their value delivered beyond a measure of the volume of tasks completed. This can be further reinforced by considering the IT field engineering job as less of a manual task based endeavour but instead one in the knowledge worker category (Harrigan and Dalmia, 1991), a job family of workers who prioritise recognition of the value of their skills (O'Neil and Adya, 2007), qualifications, and achievements which in turn contribute to their positive self-esteem (Brun and Dugas, 2008). The research findings stated rewards were offered to the mature IT field engineers in recognition of good performance, however they were considered inconsistently issued, associated with the managers engagement style and lacked the depth to explore value centric activities beyond the time and task-based conclusion of the agreed technical services job or activity.

The productivity and measurement centric resource manager style described earlier may be effective for jobs predominantly aligned to manual workers, with performance recognised by the measurement of completed tasks. The highlighted mentioned a concern concurring with Drucker (1999) that the mature IT field engineers blend of manual work and technical knowledge to deliver their contribution made it challenging to understand their productivity (Drucker, 1999). The research suggests the *lack of value centric rewards* results in a 'recognition void' among the mature IT field engineers who work in a manner that blurs the rigid manual vs knowledge worker categorisation and undertake technical tasks that historically included manual elements, but also require the extensive knowledge they possess and value highly. Existing literature indicates the fluidity of the IT field engineers knowledge and task worker personas can lead to the individuals struggling to maintain their constantly changing professional identity

(Alvesson, 2001).  The impact of the accelerated IT industry shift from the implementation of hardware systems to software engineering and emerging technologies has greatly reduced physical IT system configuration and deployment, an activity historically core to productivity measurement. The mature IT field engineers as knowledge workers utilise technology to solve problems (Varghese, 2011) leading this research to concur with existing literature indicating measurement of the field engineers in the traditional, productivity driven way may create disappointment and tension (Petroni, 2000) due to their use of personal 'knowledge capital' making it challenging to quantified work performance (Zhan *et al*. 2013). Therefore, this research argues for a revised approach to the resource managers' use of rewards, lending support to Lawler's (2002) new pay theory that rewards a person for increasing their skills and developing themselves relevant to the needs of the organisation, which correspondingly increases their value as a worthy company asset. Potentially, this adds a new dimension to existing literature on the recognition of the work done by the mature IT field engineers and argues for a revised reward framework to ensure the measurement of the historically manual component of the job and tasks engineers undertake is augmented by an equivalent element that acknowledges the value they possess.

### 7.5.3 The value of coaching

The benefits of *managers as coaches* which is a collaborative style well suited to the needs of older workers (Leisink and Knies, 2011) were discussed by the interview participants guided by a desire to soften the resource manager style and increase input into their own development. The findings indicated the resource manager style was dominated by mature IT field engineer utilisation and productivity influenced the engineer job and skills development. The research indicated a downside of the resource manager 'metric fixation' (Muller, 2021) with a primary focus on task measured utilisation which resulted in a negative consequence with evidence of *restricted skills development* in some cases due a lack of drive by selected managers to retrain highly productive IT field engineers to undertake other tasks, which could then lead to *effectiveness stalling progression.* The mature IT field engineers within this research, cited examples of restricted career progression as a result of resource managers retaining highly productive engineers within their practice and the challenge faced by those same engineers seeking to leave the engineering practice to pursue other internal jobs. The findings indicated the mature IT field engineers were also seeking increased input into their skills and career development to supporting Loogma, Umarik and Vilu (2004) who found there is a growing trend towards IT workers dissolving traditional development approaches and requesting dynamic fluid careers. This research concurs with Tjosvold *et al*. (1991) highlighting that a coaching or collaborative management style will be rewarding to older engineers by virtue of their substantial professional experience because it will recognise their personal goals and career motivation, leading to cooperative development of future activities instead of manager dictated outcomes. This lands well within this research with the mature IT field engineers believing that their maturity and experience should be considered as important and shift the interaction with resource managers to be less command and control and more collaborative. This is reinforced by Dello Russo, Miraglia and Borgogni (2016), arguing that a coaching leadership style is a beneficial development approach for older workers based on the value of the interpersonal nature of the exchange. A level of realism exists with no expectation that coaching alone can be the only management style, with time and service levels aligned to scheduled task completion remaining an important resource manager expectation. However, the incorporation of coaching capabilities was viewed as favourable by the participants to enable *positive manager interaction,* increasing the likelihood of collaborative *development focused leadership* approach over a restrictive one.

However, the introduction of a coaching-based style is not without its challenges, with existing research indicating managers may be reluctant to attempt it without

training to acquire coaching skills first (Ladyshewsky, 2010). The historical CompanyX resource manager dominant persona which proved valuable in previous decades when field engineering technical tasks and output were primary measures of success may be challenging to shift to more collaborative employee engagement mode. Therefore, providing CompanyX resource managers with coaching skills will be an important initial activity to incorporate coaching behaviour into the existing management style and increase effectiveness (Leisink and Knies, 2011). If coaching training is offered to all resource managers, it will ensure that a consistent management skills base exists for incorporation into their existing productivity influenced management style. Equally, coaching effectiveness within CompanyX may be dependent on broader company acknowledgment and acceptance of the benefits of coaching to ensure any manager adopting a coaching style has the necessary support (Lindbom, 2007) as the mature IT field engineers are aware it is a viable company engagement style. This suggests a further level of approval and endorsement may be required at the senior leadership level above the resource managers to ensure that company support exists for an engagement shift that an increased use of coaching may facilitate. However, even with potential challenges aligned to the introduction of a coaching management style, the findings highlighted that mature IT field engineers will benefit from the collaborative nature of a coaching influenced management style (Locke and Latham, 2006), with the evolved engagement contributing to positive employee self-worth (Woodruffe, 2006). The findings clearly highlighted that the mature IT field engineers are eager to embrace a revised collaborative management style that enables greater involvement in their own development decisions.
Additionally, the study participants are willing to provide manager effectiveness feedback (Watola and Woycheshin, 2016), which can increase trust based on their own experiences as subordinates. This was discussed in the findings with selected participants expressing a positive communicative relationship with their resource managers but others, and indeed a greater population found it challenging to have

difficult conversations with their resource manager, concerned of the ramifications of such dialogue.

### 7.5.4 Job design

The mature IT field engineers, with an average tenure in CompanyX of fourteen years, were allocated roles by resource managers guided by capability and workplace competence (Billet *et al*., 2011), which are based on the technical training and the service requirements of historical IT field engineering expectations. However, contrary to Billet *et al*. (2011), this research found no evidence of mature IT field engineers being discriminated against by their resource managers for age-related reasons, with job design and structure consistent regardless of age. Whilst a mature or older worker age segmentation was applied to this research the findings indicated a need for job redesign less influenced by age related reasons but more as a result of the accelerated industry changes, legacy IT system obsolescence and revised customer expectations reducing the inbound volume of requests for historical technical engineering tasks therefore bringing both skills and job relevance into question. The IT industry changes and skills obsolescence indicated by the research findings, in additional to the mature IT field engineers desire for increased job relevance and flexibility to incorporate family impacts, meant there was no resistance to job redesign, contrary to the findings of Chen and Reay (2021), however this research does support the expectation the engineers are likely to see a shift to a potentially revised professional identity as an outcome of redesigned roles for the future (Baczor and Zheltoukhova, 2017; Zamolo, 2020). Training and certification authorised and frequently initiated by the resource managers are aligned to job outcomes and serve as evidence of the mature IT field engineer's competence to undertake tasks at the manufacturer-expected level. Existing research indicates that this can contribute to feelings of value as a certified employee (Ray and McCoy, 2000). Therefore, the findings suggest both job redesign and skills enhancement must occur in tandem and are fundamental to the engineer's future success with skills relevance for future tasks and job changes ensuring the mature IT field engineer job are equipped for future effectiveness. Certified technical training guided by industry or IT manufacturer requirements are a core element of IT field engineer development with CompanyX, benefiting from staff efficiencies and the productivity gains of certified employees with validated competence (Quan and Cha, 2009; Anderson, Marden and Perry, 2015). The findings indicate that investment in technical competency remained consistent regardless of engineer age and continues to be a valuable measure of the ability to undertake engineering roles which differs from Findsen (2015) who indicated managers may feel money spent on older workers may be a wasted investment. However, the findings also argue for job design changes to minimize detrimental *age-related impacts* as a result of the 'ageing process', such as physical declines that may inadvertently and negatively impact the mature IT field engineering workforce have the potential to remove a significant obstacle to workforce longevity for the mature IT field engineers.

The CompanyX field engineering resource managers are key to job design considerations with the objective to ensure that IT field engineers deliver satisfactory customer outcomes and to guarantee that skilled and competent IT field engineers are available at required locations to undertake any identified IT service tasks. Existing literature indicates, as older workers age the associated decline in physical ability may affect employee availability or capability (Parker *et al*., 2017; Sousa, Ramos and Carvalho, 2019), however whilst the mature IT field engineers within this research suggested age related physical declines should be considered by resource managers to influence job redesign, they did not perceive age related declines reduced their effectiveness as mature IT field engineers. Therefore, this research supports existing literature highlighting the organizational benefits where managers reposition older workers, for example the mature IT field engineers as a potentially valuable population by equipping them with optimum skills and redesigned tasks and roles that maximise the capabilities of older employees (Sharit and Czaja, 2012). The findings offered no support for the potential for 'professional identity threat' where workers raise concerns about the absence of historical elements or tasks of a job role (Chen, Currie and McGivern, 2022), instead indicating the mature IT field engineers were asserting job redesign and skills evolution to be essential to remain relevant in the future.

In addition to this, training for managers to better equip them with the knowledge and skills required to ensure an optimum work experience for older workers (Armstrong-Stassen, 2008) will benefit both parties. *Bodily wear and tear* was a research finding used to describe the mature IT field engineer view of the consequence of an accumulation of several years of infrastructure-centric IT field engineering that included a substantial volume of lifting and installation of heavy IT systems. Musculoskeletal physical concerns attributed to age and a reduction of strength or increased tiredness (Harper and Marcus, 2006) were also discussed by the research participants. Incidentally, the mature IT field engineer future job redesign requirements may be a beneficiary of the ongoing technology industry changes that are shifting the historically hardware centric role that required a substantial amount of physical intervention to lift and install systems, to one underpinned by software system installation and configuration therefore reducing the physical labour engineer job requirements (Sharit and Czaja, 2012). The mature IT field engineers added that these concerns should be considered by resource managers for appropriate job adaptation and guide the way the IT field engineers are operationally managed prior to resource scheduling or task allocation. Appropriate job redesign activities, removing work-related elements that may negatively affect career longevity, can be highly rewarding as experienced and loyal mature IT field engineers expressed the desire to remain in employment for a longer tenure. Therefore, this research assertively supports (Hiesinger and Tophoven, 2019) who advocated for the reduction of physical demands for older workers to prolong employment. However, in the case of CompanyX only minimal changes may be required due to the future mature IT field engineer role likely to be knowledge-based with lighter physical elements (Christensen, 1955) as a result of increasing software centric engineering demands.

The adaptation suggested by the mature IT field engineers to remain effective by compensating for *ageing worker health concerns* and instead maximising the benefits of age, lends support to the selection optimisation and compensation (SOC) life span theories of Baltes *et al*. (1990) who positioned that individuals compensate by increasing their life resources aligned to life maintenance and reduction of age-related losses as they age. This research suggests that the mature IT field engineers are already compensating for any *physical demands of the role with age* by amplifying the use of their knowledge skills, an area that remains highly valuable as the IT industry shifts from hardware to software resulting in the reduction of the need for physical engineering. This research argues that resource managers can intentionally limit the disadvantages of age-related physical impacts to mature IT field engineers by restructuring jobs to build on their existing historical technical experience, augmented with future-focused technical and in-demand software engineering skills that may include networking, security, and automation (Litecky *et al*., 2009; Hawk *et al*., 2012). These new skills and job requirements do not eliminate the physical engineering need to deploy engineer and troubleshoot IT systems. However, they increase the potential for engineering service delivery jobs in a growing market, that can be delivered remotely (Kylili *et al*., 2020), reducing the volume of physical engineering and travel, whilst remaining viable and fulfilling engineering roles if they are redesigned to accommodate these new market trends. By proactively focusing on skills and career development that can be used to configure emerging software-based IT systems (Alt *et al*., 2020), the reduced requirement for physical activities unlocks immediate skills and job relevance benefits to both the mature IT field engineering community and CompanyX.

Additionally, the findings support existing research which explains that resource managers can also maximize the value of retrained mature IT field engineers in technical customer service roles due to older workers being well-placed to perform in demand helpdesk or client facing roles by virtue of their historical technical expertise coupled with well-formed communications skills (Abraham *et al*., 2006; Kearney and Davidson, 2012). Whilst the findings indicated the mature IT field engineers were eager to remain knowledge-rich technical personnel, there was acknowledgment for the growing requirements for onsite customer support kiosks or tech bars presented a viable career destination for employees with both technical and customer service skills.

### 7.5.5 Meaningful work

Resource managers are people managers within the CompanyX technical engineering practice, with line management responsibility for role design, engineer skills development and task allocation and ensuring that the mature IT field engineers remain motivated with the right skills for the customer outcomes expected. Using the core tenets of Hackman and Oldham's (1976) job characteristics theory as a basis for discussion of the mature engineer role, the findings highlighted the repetitive nature of the existing role and a lack of skill variety as areas requiring a review. The existing mature IT field engineer role with implementation, troubleshooting or repair of technical systems, guided by clearly defined skill requirements and service outcomes, has resulted in a long tenure of similar task delivery. The challenge of *skills obsolescence* and engineer concerns due to the reducing relevance of existing tasks and job roles supports existing views that job design will be valuable to stimulate the employee and ensure they can perform future activities that matter to them personally and to CompanyX (Morgeson and Humphrey, 2008), thereby reducing professional obsolescence (Fu, 2010). The mature IT field engineers described the feelings they once had in the earlier phases of their careers when the technical field engineering activities they undertook were unique and valuable to both CompanyX and customers due to complexity and scarcity of skilled personnel. However, those once lucrative skills and engineering task are now simplified and commoditised, which has reduced the personal value the engineers historically gained by the use of their knowledge assets to undertake once intellectually complex technical jobs.

This research therefore argues that resource managers where possible should incorporate *meaningful work* with increased role autonomy into the development of roles for mature IT field engineers with the confidence that both experience and certified skills will ensure the employees will remain effective (Stein and Rocco, 2001; Chalofsky and Krishna, 2009; Ng and Feldman, 2012). The engineers in this research are older or mature in age with an extended tenure within CompanyX, possess an evidence-based history they have consistently evolved their existing jobs by absorbing new skills to remain effective for many years and therefore justifying a level of trust should be bestowed to them. The findings indicate, if CompanyX resource managers engage the mature IT field engineers with meaningful work activities that enhances employee satisfaction, the motivational impact may benefit their professional identity (Popescu, Bulei and Mihalcioiu, 2014). The research participants consistently expressed they wanted their future professional identity to contain an element of 'giving back' to CompanyX based on their emotional investment in the organization that had granted them successful careers and the realization they had additional value to offer to younger incoming employees into the profession. Giving back to both CompanyX and the IT industry by offering personal and technical knowledge, via mentoring activities, to younger or future employees is a mutually beneficial example of meaningful or valuable work supporting Brooke and Taylor (2005); Smith *et al*., (2010). This sentiment was voiced positively by the mature IT field engineers but they also noted that it will require explicit role changes to incorporate mentoring into the expected engineer task set. Job redesign initiated by the resource managers, aligned to organizational objectives and guided by the personal aspirations of the mature field engineers will be rewarding (Marvell and Cox, 2017). The findings therefore indicated that resource managers are in a key position, based on their role in mature IT field engineer task and skills development and the current hardware to the software capabilities inflection point to reimagine the role of tomorrow's IT field engineer.

### 7.5.6 Work-life flexibility

***Work-life flexibility*** was borne from the mature IT field engineers in the mid to late career stage, reprioritising the importance of life, health and their out-of-work activities but were tempered by the rigidity of existing job roles and the resource manager control of tasks and engineer time.

The theoretical category, *work and life flexibility,* positions a different mature IT field engineer career need, one that requires increased flexibility to remain effective in the workplace but equally utilises existing work-life balance concepts to enable life satisfaction and work equilibrium (Greenhaus *et al*., 2003; Pandu *et al*., 2013; D'Souza, Adams and Fuss, 2015). The findings of this research, were used to develop a work life flexibility category not at the expense of work life balance concepts which it absorbs, but guided by the research participants indication that greater flexibility is required in the jobs they undertake to enable them to continue to perform them in a productive manner but with increased potential to utilize work balance options to deliver value to both CompanyX, themselves and in non-work related environments. The research findings concurred with (Smith, 2016) and emphasized the importance of family or home life considerations which were deemed to have a significant impact on the mature IT field engineer workplace professional identity. This indicates the potential for a new relationship between the mature IT field engineers and CompanyX that will evolve the positive career experiences they believe they have realised to date to accommodate and increased volume of family and life demands (Yeandle *et al.* 2002). The employee psychological contract in this research defining the employment and career expectations between multiple parties (Rousseau, 1989), the resource manager CompanyX and the IT field engineers has a bearing on the employees' work-life flexibility due to increased prioritisation of *life impacts,* family or external non-work impacts as the mature IT field engineers consider longer term future employment. The findings failed to support conditions of psychological contract violation (Robinson, 1996; Kraak, Russo and Jiménez, 2018) based on the mature IT engineer role meeting historical expectations. However, the mature IT field engineers highlighted a lack of job flexibility because of the existing job design reinforcing the assertion for job design to accommodate aging employee needs also positioned by Armstrong-Stassen (2008) to reduce the challenges employees face maximising available work-life balance options that may aid with work life flexibility.

In common with existing research (Yeandle *et al*., 2002; Beauregard and Henry, 2009), awareness of available work-life options was highlighted as inconsistent across the interviewed mature IT field engineer cohort, in part due to a shared view of the difficulty in maximising available resources. In the case of the mature IT field engineers, the rigid nature of the field engineering job with contractual SLAs with time and quality dependencies that guide task outcomes, can lead to difficulties with flexibility. Additionally, the *lack of visibility of work-life options* mirrored work by Cegarra Leiva *et al.* (2012) as the mature IT field engineers explained that certain resource managers may not actively support work-life practices as they wrestled with the difficult task of balancing the need to drive IT field engineer productivity whilst also maintaining employee well-being. As discussed by Vandenberghe and Bentein (2009), managers play a key role in employee task management and well-being from recruitment to retirement, with resource managers in CompanyX at the heart of a mature IT field engineer's decision-making process that determines when they retire or choose to continue. The findings indicated selected resource managers due to their primary focus on productivity made it challenging to incorporate work balance and flexibility options. If CompanyX can introduce a work life flexibility template that benefits both the organisation and the knowledge rich mature IT field engineer, it will help to empower the engineer and offer increased agency within their professional identity Loogma, Umarik and Vilu (2004) to deliver value in ways previously not envisaged. The research findings offered no support or suggestion of the mature IT field engineers seeking completely flexible jobs (Yeandle, 2005), with them well aware of the needs of the engineering practice. However, the findings also indicate CompanyX may benefit from an elevation of the importance of job flexibility by designing the mature IT field engineer role to maximise the value of the highly effective mature engineer pool who have expressed no desire to retire and are keen to continue delivering maximum value.

*Winding down for retirement* was discussed however, the mature IT field engineer's indicated cessation of work through early retirement was not a priority in part due to the importance of retaining and maximising income (Barnes *et al*., 2009). As previously mentioned, no engineers expressed a desire to retire due to a perception they still had immense technical and employment value to add to CompanyX in addition to their own unrealised potential, which is important to their feelings of self-worth and additionally the reality that they need to continue achieve a financial income (Kodz, Harper and Dench, 2002). The mature IT field engineers within this research were seeking greater work flexibility to balance both home and professional identities to be equally effective and build family life in tandem with an effective career supports (Kossek, Perringo and Gounden Rock, 2021). This was also due to considerations for the future guided by the belief that with increased work/life flexibility, they could remain valuable as mature IT field engineers or CompanyX employees in other roles. This supports existing research reinforcing the value of *later career life guidance* for IT workers, who historically favour non-linear career transitions over retirement (Brooke, 2009), to assist with the decisions faced by mature IT field engineers as they consider career development, extension, or cessation. Garner and Fidel (1990) researching computer workers found them to be critical of management engagement during their mid-career state at time when career and professional identity was most important. The career intervention timeframe concept developed by this research to undertake an intentional midlife career review aligned to older worker needs from age 45 onwards, may be an example of an activity beneficial to both the mature IT field engineers and CompanyX to ensure both skills and jobs that underpin the formation of a career are managed proactively, aware that mature IT field engineering employees of the future may seek increased longevity in the workforce. The use of such an older worker, age derived career intervention creates the possibility to incorporate a 'renew' life stage to increase opportunities for older workers to capitalise on the expertise they develop (Avolio *et al.,* 1990).

The mature IT field engineers were affected by *changing life priorities* with the findings consistent with Nagarajan *et al*., (2019) who positioned the benefits of using work-life balance programmes to extend the working life of mature employees through the development of age friendly workplaces. The research findings failed to support the mature IT field engineers exhibiting a workaholic (Russo and Morandin, 2019), 'nostalgic professional identity' with their balance biased towards work (Cruess *et al.,* 2015) with this research population actively seeking job flexibility to effectively incorporate family or non-work activities. Redesign of the mature IT field engineer job to reduce the age-related physical concerns detrimental to older workers were discussed in a previous section. The findings also support existing research that highlighted additional benefits available where managers encourage the use of and incorporate work-life options, such as flexi time or flexi-location (Beard *et al*., 2012) or reduce of long-distance working, within roles to improve mature worker longevity (Beauregard and Henry, 2009; Veth *et al*., 2011; Taneva *et al.,* 2016). The research findings were clear, with the mature IT field engineers exhibiting no desire to cease working or leave the employ of CompanyX. This offers support for Bruton (2012) who found achievement of a reasonable work life balance to be both positive for performance and professional identity therefore helping to improve employee retention. The findings indicate the historical field engineer job may be challenging to redesign in an age friendly way, however hybrid or remote working options (Veth *et al*., 2017; Kylili *et al*., 2020) now gaining in popularity due to the shift to software centric engineering offers immense potential for the development of a modernised field engineer professional identity. The findings therefore support recent research (George, Lakhani and Puranam, 2020) advocating for the increased use of virtual working and remote access technologies, which help to reduce the need for mature IT field engineers to travel to customer sites and therefore, may be valuable additions to employee role and resource management change programmes which may enhance the mature IT field engineer career longevity and help to defer retirement from CompanyX.

This research asserts that the mature IT field engineers are *reprioritising family involvement* as a factor of their mid-life position. The findings failed to support Hearn (1999) who suggested work to be the dominant life interest that shaped male workers professional identity, with this research population clearly seeking a greater degree of balance to include family / parental responsibilities potentially by virtue of their older workers life stage. Therefore, resource managers must play a key role in the team's awareness of work-life balance options, positively reinforcing the benefits of incorporating them and, in addition to modifying IT field engineer roles, increasing flexibility to ensure work life options can be maximised (Kodz, Harper and Dench, 2002; Fapohunda, 2014). The findings indicated the mature IT field engineer role is currently designed to meet contractual time and task expectations, that limit flexibility therefore, this research is not advocating for the creation of a comprehensive flexible working arrangement (FWA) programme. Instead, this study reinforces resource managers should apply formalised discretion (Kelly and Kalev, 2006) to incorporate work life flexibility within the IT field engineering jobs via redesign in a manner that benefits both the mature IT field engineers and CompanyX.

## 7.6 Career development for maturing engineers

**Career development** is a collective concept positioned by combining the findings and properties from the *career pathway* and *career intervention time frame* categories to understand the skills, support and capabilities mature IT field engineers require to remain effective in the IT industry**.** This approach aligns with Herr (2001) who positioned career development as two theories, one that explains development and the other that explains how career behaviour is changed by particular interventions. Career development considers the tasks and behaviours that embrace work-life balance that can be used to formulate activities that help a person to create an identity or sense of self (Hansen, 1997; Herr and Cramer, 1996). Multiple definitions exist to define careers, including (Hall, 1976) who conveys careers as individually perceived attitudes, behaviours and activities associated with job and work pursuits over the span of a person's life. Another definition put forward by Super (1976) defines a career as a course of person-centred events from adolescence to retirement that includes a sequence of life, occupations and other roles that enable a person to express their commitment to work and development.

### 7.6.1 Career span

The findings indicate that an inconsistent approach exists to mature IT field engineer career development for mature or ageing workers and is guided by the resource manager style and the discussion that guides decision-making with reference to age-specific training, learning, career and life choices. The definition of the age that defines an older or mature worker is erratic in existing research (Bourne, 1982, Kaliterna *et al*., 2002; Kooij *et al*., 2011). Therefore, this research argues for a consistent intervention timeframe and a programme of activities to ensure that sufficient time exists to onboard the requisite knowledge and potentially consider new roles before retirement considerations are evident. Auer (2007) indicated that the average tenure in EU organisations is 10.74 years, which may lend weight to an intervention with an explicit focus on mature IT engineer career development occurring in the mid-40s timeframe, which accommodates at least two more expected employment timeframes prior to the current UK statutory pension age of 66 (Auer, 2007). Therefore, this research argues for a consistent, documented timespan or *career intervention timeframe* for mature IT field engineers in the region of the midlife or maintenance phase that considers both career and life interventions and developmental expectations corresponding with personal growth expectations (Super, 1980). By incorporating a mature IT field engineer career intervention approach, the maximum time frame is available to accommodate vocational behaviour that can affect self-concept and work-life flexibility expectations of the employee in question (Savickas, 1997). This concept may deliver additional value due to organisations wrestling with the challenge of an aging population (Patrickson and Ranzijn, 2005) therefore may need to take proactive steps earlier in the employees' career to ensure they remain equipped at all career stages to deliver personally and organisationally beneficial relevant value.

The findings indicate the historical professional identity that served the mature IT field engineers well for multiple decades may be challenged to remain relevant during accelerated industry changes and skills obsolescence as a result of existing capabilities becoming outdated (DeGrip and Smits, 2012. The recognition of the potential for both job and skill related changes for the mature IT field engineers to remain relevant and valued, indicated a new approach is required to career development to reshape the existing engineer professional identity (Khapova *et al.,* (2007). The historical technical engineering training programme was guided by multiple decades, of consistent technical skills requirements as an outcome of an IT engineering industry based on core hardware centric skills with limited change. Lee (2002) positioned planning as an important activity for technology workers to maximise their professional careers, but the findings suggested forward planning with the future in mind was potentially lacking in favour of the development of short-term technology skills guided by historic and common technical skills requirements. In addition to the activity of planning, the findings from this research also found that greater input was sought by the mature IT field engineers into the planning process to increase the level of self-directed learning which is considered beneficial to older workers (Šatienė, 2020) over a primarily resource manager determined the development path. This may challenge the existing CompanyX technical IT field engineer organisationally determined career pathway and how it affects the current engineer professional identity (Davis, 2020), with the findings of this research indicating the mature engineers are seeking increased input into future career development both to remain skills relevant but also to balance life and family demands. Modification of the existing engineer *development roadmap*, to incorporate development tracks that consider the different career requirements and life impacts that affect mature or older field engineers (Warr, 1993) will equip the IT field engineers with relevant technical capabilities for current and future job roles. The findings indicate the historically resource manager determined skills and development pathway may benefit from cocreated greater input from the mature IT field engineer who possess a vast amount of technology market insight based on regular 'in the field' interactions with customers that are well placed to guide career development.

Therefore, this research suggests that a revised approach to mature IT field engineer career development will not only enhance the skills of the of the mature IT field engineers but may also enhance employee engagement as a result additional focus and long-term thinking (Semwal and Dhyani, 2017). The findings also support existing literature indicating that relevant and optimal developmental engagement that increases the likelihood of beneficial occupational and life choices may positively enhance the mature engineer's self-concept, therefore increasing the possibility of a personally improved measurement of self-esteem and enhanced feelings of self-worth or purpose (Buonocore, 1992; Baumeister, 1998; Swann, Chang-Schneider and McClarty, 2007). The CompanyX mature IT field engineering role was highlighted as demanding and made up of complex dynamics mirroring Kaplan and Lerouge (2007). As 'knowledge workers', the mature IT field engineers may benefit from guidance from HR professionals to help them to reinvent their careers (Patil, Patil and Waje, 2011) to overcome both job and skills obsolescence. The CompanyX human resources (HR) team will have a significant role to play in the overall employee development strategy with the findings also reinforcing compensation, job and recognition as important in addition to salary concurring with Agarwal and Ferratt (2001). With flexibility between work and life featuring highly within the mature IT field engineer interviews, the subsequent findings suggested internal company policy changes may be required to help the IT employees to improve their life and work-related demands (Niederman and Ferratt, 2006).

### 7.6.2 Age-related declines

The information technology industry is affected by ongoing skills shortages (Freeman and Aspray, 1999) energised the continual adoption of digital technologies and solutions in daily business operations (Industrial Strategy Council, 2019). However, the scarcity of talent may be due to inadequate *core development* of the right skills (Cappelli, 2000), as opposed to a general lack of skilled employees. This research positions the mature IT field engineers as a valuable source of wisdom capital based on their mass of accumulated, meaningful knowledge (Vasconcelos, 2018). However, the findings also indicate if existing approaches to skills appraisal and career development are maintained, the trapped potential that will enable older workers to build on their historically valuable career contributions will remain hidden. The accumulated tacit knowledge and experience of the mature IT field engineers as older workers within CompanyX was both valuable and helped them to feel valued based on the contribution it offered to the organisation concurring with Corwin (2015). CompanyX can benefit from this vast knowledge pool by adopting a revised approach to nurturing engineer development to positively affect the shortage of IT workers in emerging technology areas. The mature IT field engineers as knowledge workers store valuable intellectual capital, which adds support to Patrickson and Ranzjin (2005) who determined that older knowledge workers with the right organisational support can utilise their accumulated knowledge due to the competency benefits of increasing longevity in the workforce well beyond the state pension age. The findings argue against existing work from Brooke (2009), who indicated that the fast-paced nature and demands of the IT industry with the need for ongoing training were incompatible with an extended career for older workers. Neither the pace of change, the challenge of absorbing new technology skills or cognitive issues were indicated by the research findings as concerns with the mature IT field engineers radiating "knowledge confidence and competence" in their current roles and eager to gain knowledge in emerging or future technology areas so they can remain relevant in the future. This may be explained by existing research which explains crystallised intelligence (accumulated knowledge skills, experience, wisdom), a key cognitive engine used by field engineers that may peak circa age 60 and then decline gradually beyond this (Ackerman, 1996; Salthouse, 2004). The mature IT field engineers in this research had a base age of 45, with an average age of 52, which may indicate why the aforementioned detrimental cognitive effects of ageing were not highlighted as cause for concern which conflicts with research by Kanfer and Ackerman (2004) who found that older employees perceived that they were negatively affected by reduced mental processing speed or intelligence. The opposite was conveyed by the participants within this research with the mature IT field engineers vast experience and tacit knowledge cited as reasons for continued effectiveness with no evidence of intellectual decline. However, the mature IT field engineers did acknowledge they were victims of legacy skills obsolescence (DeGrip and Smits, 2012) as result of technology obsolescence (Kudryavtseva *et al*., 2019) and failing to remain aligned to future focused technical needs.

### 7.6.3 The value of tacit knowledge

Older workers possess valuable tacit knowledge accumulated across an extended tenure (Van Bonsdorff, 2009) and “know how" (Nonaka and Takeuchi, 1995), which are important company assets that are considered to be a source of immense worth by the engineers yet may be overshadowed by resource managers who emphasise task completion and output measures as principal indicators of valued contributions. Ensuring engineers feel valued based on their wisdom capital (Vasconcelos, 2018) and knowledge is critical. The multi decade employment careers of the mature IT field engineers’ in this study led them to position the breadth and depth of knowledge they accumulated, both tacit and certified throughout their careers and the future potential they perceived they still had to offer CompanyX as a result of their skills and a ‘engineering mindset’. Information technology engineers are a particular group of knowledge workers who use technology to solve problems (Varghese, 2011) and this research of mature IT field engineers is based on a population of older workers who spoke favourably about the accumulation of valuable tacit knowledge they possessed that can be transferred to younger employees (Slagter, 2007). This is because there will be a loss of *tacit knowledge* from CompanyX if the mature IT engineers choose to move to another company or retire, which can lead to a knowledge void that limits the ability of the organisation to remain effective within particular technical or troubleshooting situations. The findings argue for the use of mature IT field engineer knowledge transfer programmes to recognise and reinforce to the engineers that the relevant tacit skills and knowledge they possess are of high worth to themselves and to CompanyX. By encouraging the mature IT field engineers to codify existing tacit knowledge, to create explicit knowledge that can be repurposed by the broader community of technical personnel (Smith, 2001), positive benefits will be realised by both the mature IT engineers and CompanyX due to the additional acknowledgment and recognition of personal value.

This research indicates that the mature IT field engineer feelings of self-worth will be enhanced if they are publicly recognised as valuable human capital assets (Vasconcelos, 2018) and not merely as "resources". This therefore changes the personal self-worth perception the mature IT field engineers hold of themselves and external opinions of them as older workers with outdated skills but instead older workers with valuable skills with the potential to extend their employment (Van Bonsdorff, 2009). Such changes are underpinned by the resource manager style and internal and external communication of the value that exists within the mature engineering community that should be developed further to ensure ongoing value is delivered to CompanyX. Such activities will shift both the engineer's internal and external view of self-worth and value, echoing the behaviour of IT industry exemplars, including IBM, who emphasise the benefits of leveraging the value of their knowledge, experience and tenure as valuable future contributors to company innovation and success (Greenstein, 2007; Cortada, 2021). The UK is affected, similar to many developed nations by ageing population concerns (Government office for science, 2016) which suggests by CompanyX celebrating the value of its older IT engineer community it will increase the potential to upskill (Barnes, Bimrose and Brown, 2006) and maximise them to deliver positive company value instead of reinforcement of the diminishing value of older workers (Bernard and Phillips, 2000; Ng and Feldman, 2012).

### 7.6.4 The technical reskill.

The research findings echoed the importance of certification to both IT professionals and their employers. The mature IT field engineers within this research described the need for relevant skills, qualifications and technical certification (Borkman, 1976; Potgieter, 2005; Medlin, Schneberger and Husinger, 2007; Anderson, Marden and Perry, 2015) which existing literature also positions as the primary element of their IT professional identity (Quan, 2009; Marks and Scholarios, 2007; Tsakissiris, 2015; Smith, 2016; Mackenzie and Marks, 2019; Rahmatika, 2022). The findings supported the relationship between the evidence of competence offered by certification or accreditation (Potgieter, 2005; Wiershem, Zhang and Johnston, 2010; Smith, 2016) with the mature IT field engineers perception of the enhanced value they offered to CompanyX on successful achievement of required certification or accreditation. Quan and Cha (2009) positioned certification and credentials as important to an IT workers identity with a greater number corresponding to increased value and employability, similar to the historical perception held by the mature IT field engineers within this study. Marks and Scholarios (2007) studying technical workers, determined certification and qualifications enhance identity and help employees to be considered within the privileged category by virtue of their differentiated qualifications with Tsakissiris (2015) and (Rahmatika, 2022) presenting similar findings. And lastly, Smith (2016) researching the professional identity of information technology professionals found employee certification as evidence of competency to be at the core of their valued professional identity. However, the findings of this research challenged Quan and Cha (2009), Marks and Scholarios (2007), Smith (2016), Rahmatika (2022) and existing literature that prioritises technical certification as the primary element of the mature IT field engineer's professional identity with self-worth and value emerging from this research as the core factor considered by the mature engineers in this study to guide skills, career and work life changes. The midlife age segmentation of 45 and over guiding this research may be a factor in the prioritisation of self-worth and value over the historical industry validation of value by certification (Medlin, Schneberger and Husinger, 2007) due to the IT engineers already possessing an extensive body of accumulated certification but now finding their skills and value diminished due to reduced demands for their historical jobs. Therefore, the emergence of self-worth and value as the highly pervasive core research category that linked the other categories (Glaser and Holton, 2004) created by this research indicates it has potentially replaced technical certification or credentials as the most important factor that affects the professional identities of the mature IT field engineers in this study.

The findings also indicated that both training and the corresponding certification associated with it will benefit from a shift towards emerging or future focused skills to address the mature IT field engineers' self-worth and value concerns because of skills obsolescence (DeGrip and Smits, 2012). It was interesting to discover the *'engineering mindset'* mentioned by the research participants during their interviews and considered a highly valuable work skill due to the equipping them with a seemingly innate ability to approach complex problems, was positioned less favourably by existing authors suggesting it led to 'narrow thinking' and an inability to consider external inputs (Udwadia, 1986; Laato and Sutinen, 2020). The findings also indicated the level of skill and competence the mature IT field engineers possessed was extensive and, in some areas, challenging for CompanyX resource managers to quantify due to the sheer depth of experiential capability accumulated over many years. This cultivated, a high-level of responsibility and self-accountability which has ensured the mature IT field engineers act as a unique technical resource capable of thinking innovatively and doing whatever is required to achieve a successful customer outcome. For example, an important element of the CompanyX mature IT field engineer persona is the ability to work without supervision and demonstrate competence, which

Katz (2005) positions as important to the establishment of a professional identity within a chosen profession.

The research finding of *skills obsolescence* suggests that the erosion of the importance and demand for once highly sought-after skills may contribute to a decline in self-esteem. The findings highlighted those mature IT field engineers, over the age of 45 with an average working tenure of 14 years at CompanyX, were potentially suffering from *value erosion due to diminished skills* over the last decade as a result of accelerated technology innovation and IT industry evolution. The effect of *skills obsolescence* or technical employee deskilling (Frey and Osbourne, 2013), as the once lucrative but now commoditised x86 based-IT service market has commoditised and new advanced technologies have emerged, may have had a corrosive effect on the professional identity of IT workers (Hall, 2004). Technical skills and validation of competency were found to be important to the mature IT field engineers, therefore undertaking training and gaining professional certification is considered vital to maintain skill levels and indicate expertise is important to an IT employee's professional identity (Rahmatika, 2022). However, with existing research suggesting qualifications and certifications to be the most significant element of information technology workers professional identity (Tsakissiris, 2015; Smith, 2016) the findings of this research differ due to the emergence of the mature IT engineers' perception of *self-worth and value* as the core factor in their career development with the potential to reshape their existing professional identity. Existing literature also indicates, older workers with long industry tenures can be disproportionately affected by *skills obsolescence* due to knowledge deterioration or failure to acquire new skills over time (Dalton and Thompson, 1977; Fossum *et al*., 1986) resulting in a *career ceiling* and a lack a *structured pathway out of IT field engineering* which left them feeling *trained but unfulfilled*. This research mirrors the view of Hall (2004), with the interviewees questioning the viability and value of once lucrative, but now deprecating, technical skills that have served them well for over a decade. Therefore, the findings indicated that both training and the corresponding certification associated with it will benefit from a shift towards emerging technology centric growth areas for the future (Jones *et al*., 2018) to address the mature IT field engineers' concerns of skills obsolescence. Intentional development of relevant technical skills will also address the challenge identified by the findings that suggests that IT field engineers, even those who reach a *career ceiling,* lack a *structured pathway out of IT field engineering* which leaves them *trained but unfulfilled*. Therefore, this research reinforces the importance of a proactive investment in future focused technical skills that may include in demand competencies such as networking (Hawk *et al*., 2012, cyber security (Jones *et al*., 2018; DeZan, 2019), soft skills (Sunarto, 2015) to equip the mature IT field engineers with relevant skills for emerging customer technical requirements that are evolving at a rate far greater historical technical competencies. The research findings discussed the growing importance of software service delivery activities for consideration within mature IT field engineer job redesigns to evolve existing skills in favour of emerging non-physical technologies with the possibility to also reduce age related physical job concerns. Software engineering (Hawk *et al*., 2012), programming (Jones *et al*., 2018) and automation (Litecky *et al*., 2009) may be positioned as *software engineering skills* for the future offering real potential for career longevity, but due to historical technology platforms remaining in the IT industry, roles will always exist for those who install and maintain traditional hardware-based systems (Goles, Hawk and Kaiser, 2008). However, the reduced volume of such roles means that future focused development must be considered a priority. A full summary of relevant skills, development and technical learning objectives is beyond the scope of this research, however, the earlier positioning of the importance of a specific mature IT engineer career path to define relevant learning and objectives will be the optimal forum to identify market relevant skills acquisition. This research argues that mature IT field engineers, as a potentially ageing worker pool, are not a problem or burden due to future employability concerns (Bernard and Phillips, 2000). Instead, they are a highly valuable and readily available resource pool and an increased focus on intentional upskilling programmes (Barnes, Bimrose and Brown, 2006) for mature technology workers will build on and reinforced by many existing attributes of exhibited over many years (loyalty, reliability, self-motivation, existing experience).

The indicated skills decline was not due to a lack of CompanyX investment in IT engineer training, but due to technical obsolescence (Kudryavtseva *et al*., 2019) leading to declining relevance of once common IT skills requirements during the last decade and a failure to prioritise future focussed development in favour of common, traditional skills which widened the gap between existing capabilities and emerging future focused IT industry and customer requirements. The findings mirror DeGrip and Smits (2012) who found that technical skills and knowledge may be lost over time due to systems and organisational changes resulting in technical obsolescence. The mature IT field engineer *dated technical skills* that depreciated over time (Fossum *et al*., 1986) were the result of accelerated technology innovation and change coupled with the increased adoption of automation, which reduced the widespread need for hardware engineering and installation related technical capabilities. This research argues that the mature IT field engineers are a well-trained in situ technical workforce with historical evidence of the capacity to learn new technologies and concepts. They are also well-equipped to stall or reverse *skills obsolescence* via ongoing investment in future focused career and skills development with relevant training formal education contributing to the ongoing evolution of their professional identity (Fitzgerald, 2020). The mature IT field engineers reinforced the fact they also benefited from both peer and industry acclaim through their long technical careers as accredited, professional employees with specialist expertise (Watson, 2002) which generated praise and stature in CompanyX. The findings support Eisold (2007) who positioned knowledge possessed by practitioners as specialist and therefore, accruing professional status and privilege. However, in the case of the IT worker community, IT professional status may lack the public resonance other mature professions such as medicine and law benefit from (Cruess and Cruess, 2012). In the UK, the British Computer Society (BCS, 2021) are responsible for standards and professional certification (Weiss, 2003) and offer a formal route for IT workers to gain professional accreditations because of membership and structured development (Olifin and Emeagi, 2015), however membership to a professional body is not mandatory to be considered a viable IT practitioner (Weckert and Lucas, 2013).

The merits of a dual track career to offer a path for advancement (Hirsh, 2007) and reduce attrition (Ginzberg and Baroudi, 1988) are well positioned with such a programme already existing in CompanyX, offering mature IT field engineers project management, line management or other career disciplines as possible careers subject to skills, job availability and capability. Surprisingly, the findings offered no support for Allen and Katz (1986), as there was no decline in the desire exhibited by the mature IT field engineers in this research to remain on a technical career development path and their passion to remain as valuable technology centric resources was strong. The professional 'identity crisis' indicated by Rottmann *et al.,* (2019) when dual track careers are offered was not highlighted within this research with a body of historical examples of successful job or career transitions within CompanyX of IT engineers shifting into other professional domains both inside and outside of the organization. However, this research supports Ridings and Eder (1999) with evidence that mature IT field engineers do not believe that there is financial equity and hierarchical career advancement for those eager to remain as mature technologists due to hitting a skills development and financial career ceiling which, as a result, may signal a reluctant shift away from a technical career. Therefore, the findings of this research position the value of dual track career development for technical engineers (Igbaria, Greenhaus and

Parasuraman, 1991) as a way to extend employment longevity in the technical domain without the need to shift to other management activities for increased renumeration or professional growth. However, the findings also suggest team structure and financial changes may be required for mature technology centric employees to remain fulfilled where their depth of accumulated skills and experience results in them hitting renumeration and seniority boundaries within existing technical roles, meaning they may choose to leave the technical profession influenced by extrinsic factors. The findings also suggest that structural changes may be required for technology centric employees to be fulfilled.

### 7.6.5 Skills for the future

The mature IT field engineer historical skills development focussed on the training, acquisition and certification of technical skills. However, the findings indicated the mature IT field engineers had *insufficient soft skills* with the need for an increased volume of "engineer-to-customer" (i.e., person-to-person) communication and on-site collaboration increasing the importance of communications and on job adaptability heightened the value of meta skills for the mature IT field engineering community. Adaptability and the ability to design new careers and professional identities is considered a valuable meta skill for mature workers (Mirvis and Hall, 1994; Lahn, 2003). The acquisition of soft or meta-skills will develop capabilities to help the mature IT field engineers as older workers, to thrive (Hennekam, 2015) and, in some cases, consider roles outside of the field engineering workforce. With future career effectiveness and employment in mind, the accumulation of technical skills alone may still result in mature IT field engineers lacking capabilities if the technological and industry changes continue at the current rate or accelerates. Technical knowledge and management (resource or project). or hard skills and capabilities that can be tested (Sopa *et al*., 2020), are not the only elements of human expertise positioned as highly relevant for the future. Soft and meta-skills, which depreciate slower than technical skills (Schultheiss and Backes-Gellner, 2022), are considered equally important.

This research suggests future mature IT field engineer development must also include soft skills which can be described as human engagement, social, life skills that include communications, honesty, decision making, rapport building amongst many others (Sunarto, 2015; Schultheiss and Backes-Gellner, 2022), that enhance the ability for effective person-to-person engagement. By incorporating soft or meta-skills, mature IT field engineers will be effective whether future jobs are predominantly technology systems focused or require on-site customer person-to-person interaction, such as an IT helpdesk or techbar, lending support to older worker career longevity positioned by Yang (2022). The also findings suggest that the future IT field engineering role, due to an increased level of engagement with human end users rather than installation of IT systems, has a requirement that engineers are adaptable, flexible with good communications and problem-solving skills, often working with minimal support. This reinforces the view of Mirvis and Hall (1994) who suggested that effective development and use of meta-skills as skills, that help the recipient to learn how be effective, will be at the heart of the new career contract of beneficial lifelong learning for an older worker.

### 7.6.6 Self-directed careers

The findings identified that the mature IT field engineers, aware of the declining relevance of their legacy skills and the historically resource manager-led career development roadmap, are seeking *increased career accountability.* By increasing the level of engineer ownership of their personalised learning pathway, the use of alternative developmental approaches such as self-directed (Hall and Mirvis, 1995) or autodidactic learning (Thijssen and Rocco, 2010) which existing research indicates as beneficial for mature workers, will enable the employee to onboard new skills in a manner they deem is consumable (Knowles, 1975; Candy, 1991;

Šatienė, 2021). Such an approach will tap into the enthusiasm and desire exhibited by the research participants to learn and acknowledge their concerns about the availability of time in relation to the current role, to absorb new subjects to the required depth, in addition to the importance of a broad range of training modes (classroom, virtual, peer to peer). The participant feedback in this research may be congruent with existing research suggesting fluid intelligence declines across the life course (Kanfer and Ackerman, 2004) can lead to slower processing of new technology learning constructs. However, the mature IT field engineers highlighted their depth of historical knowledge and the value of different training modes, potentially with additional learning time allocated to older workers (Charness and Czaja, 2006) will ensure ongoing learning and development is not considered problematic. However, this should not be considered an obstacle to development, but something to be acknowledged, leading to a revised approach to training delivery methods. In addition to allocating more time within the training session (Picchio, 2015), the findings support Zwick (2015) who positioned self-induced or on-the-job training as more effective for mature workers.

## 7.7 Chapter summary

This chapter built on the research findings presented within the previous chapter 6 with the objective of understanding the meaning within, and comparison and integration with existing literature.

The five theoretical categories created by the research were integrated into three key themes to enhance and elevate the discussion - self-worth as an enabling factor (informed by the *self-worth and value* core category*)*, the impact of management style (informed by the *management influence, job and role design* and *work life flexibility* categories*),* and career development for maturing engineers (informed by the *career pathway* category).

Chapter 7 also discussed the grounded theory developed which resulted in a significant theoretical contribution of the research, i.e., the emergence of self-worth and value acting as the core category, affected by the impact of management style and effective career development for mature IT field engineers to enhance career longevity and enhance work life flexibility. The research indicated by understanding and acting on the relationships between the findings identified, the skills and career development of the mature IT field engineers can be enhanced by structured and relevant future-focused capabilities. The impact of the theoretical research categories on the professional identities of the mature IT field engineers was also considered and yielded an additional significant theoretical contribution, with the emergence of self-worth and value emerging as the core consideration of the mature IT field engineers professional identity, in favour of the historical view of the accumulation of technical certification as the primary measure of engineer value.

This chapter also discussed the finding that resource managers should reduce their emphasis on productivity-centric, metric-driven mature IT field engineer management in favour of increased recognition of the valuable knowledge possessed by the engineers, with positive encouragement to onboard future focused skills to increase value. Job redesign of the mature IT field engineer role to incorporate flexibility to positively affect both work and non-work requirements was highlighted as important to the engineer's perception of self-worth by increasing possibilities to be considered valuable within both domains.

The chapter concluded by summarising the benefits of mature IT field engineer career development roadmaps co-created between resource managers and engineers, which include future relevant IT skills, with software engineering considered highly valuable, in addition to meta or soft skills to enhance non-technical areas (for example, communication and adaptability).

The following chapter positions the research contributions to theory and practice in line with the research aims and the question, research limitations, and recommendations for further research.

# Chapter 8: Research Conclusions and Contributions

## 8.1 Introduction

This chapter builds on the discussion of the research findings within Chapter 7 and presents the research conclusions. The sections that follow will position the findings in relation to the research aims and main question, followed by contributions to theory and practice. The chapter concludes with a section on limitations, suggestions for further research and the researcher's personal reflections based on the experience and lessons learned from the study.

## 8.2 The importance of this study

This research started as a venture into the unknown, guided by the need to understand and illuminate the challenges faced by a mature IT field engineering community to ensure they remain effective and productive participants in the future workforce in CompanyX. It was undertaken due to a lack of existing research focusing on the mature IT field engineering community after the completion the preliminary literature review, summarised in Chapter 2. This research addressed the career and skills needs of an ageing community of IT field engineering workers concerned about their future career prospects, based on real world considerations about the applicability of the tasks they perform within their historical and current roles.

The importance of understanding this area of concern within CompanyX was the motivation to use grounded theory, a research methodology well-positioned to research topics with little existing research. As a result, the findings that follow constitute the creation of new knowledge that will benefit both CompanyX and the IT industry. The research question that follows was answered by the summarised findings in this section.

**Research Question:** What skills, knowledge and organisational support do mature IT field engineers perceive are required for them to remain effective within the information technology workforce?

The research fulfils the original aims and objectives via the identification of five theoretical categories: *management influence*, *job and role design*, *career and career pathway*, *work and life flexibility* and, most notably, *self-worth and value. T*he five theoretical categories, with *self-worth and value* acting as the core category, position the support and development elements that are significant when considering activities required to equip mature IT field engineers with the skills and capabilities to remain effective in the future. Limited research existed focusing on the development of mature IT field engineers. However, existing research on IT professionals, whilst also considering *management style,* tended to emphasise engineer development elements that contribute to productivity enhancement (Petroni, 2000; Potgieter, 2002). This research argues for a shift of focus away from engineer productivity as the key driver for development, in favour of progressing development guided by the theoretical categories defined, which positively contribute to engineer *career and career development* by enhancing engineer *self-worth and value.*

The emergence of *self-worth and value* as the core theoretical concept is a significant contribution to theory and a key factor for consideration that influences the effectiveness of the mature IT field engineer skills and *career development* activities. This finding adds to broader *self-worth* literature by highlighting the importance IT field engineers place on their personal knowledge and experience as a key component of their value and 'status' (Fasbender and Gerpot, 2022). Further, the corresponding perception of reduced 'worth' as a valued asset if that knowledge is not considered valuable and relevant. The research also built on the preliminary literature search of chapter two and determined the core finding, *self-worth and value* was considered the prioritised element of the IT engineers' professional identity, challenging the previous career long alignment to qualification and certification as the prominent factor (Marks and Scholarios, 2007; Smith, 2016).

The need for CompanyX resource managers to prioritise development activities to impact mature IT field engineer *skills obsolescence* is due to the pace of change in the IT industry accelerating the demise of accumulated, historical technical skills. This research reinforces existing literature positioning the challenge of substantial skills depreciation as a result of a failure to acquire replacement skills fast enough (Fossum *et al*. 1986). This adds to the importance to favouring 'future relevant' skills in favour of a safety-first development of once productive historical capabilities.

Additional support will be required from CompanyX to initiate an engineering resource manager development programme to soften the current *authoritative resource manager* style, potentially augmenting it with coaching-based practises, a view reinforced by existing literature based on the effectiveness of coaching-based management approaches when developing mature employees (Dello Russo, Miraglia and Borgogni, 2016) and the benefits that such an approach delivers to older workers *self-worth* via the enhancement of self-esteem (Woodruffe, 2006).

Consistent resource manager-to-engineer career interventions should co-create the mature IT field engineer *career development pathways* that focuses on career, skills development, job design and external *life factors* that affect mature engineers affected by midlife or older worker impacts. The findings suggest such an approach will positively contribute to engineer *self-worth and value* by improving *career development* effectiveness and increasing the potential for the mature IT field engineers in question to offer their value both in and outside of the work environment. This research also adds an IT field engineer and older worker dimension to existing literature, suggesting computer workers who plan and increase ownership of their careers experience greater progression and satisfaction (Lee, 2002).

The findings argue that the historical field engineer *skills development* lens used by resource managers within CompanyX, based on engineers acquiring and accumulating certified technical capabilities driven by market requirements and internal productivity centric ‘metric fixation’ (Muller, 2021), must evolve. If CompanyX resource managers intentionally focus on technical *future relevant skills* augmented by *soft skills* that increase the mature IT field engineer’s ability to adapt to future industry capabilities and non-work life impacts, the engineer will remain relevant and possess worth.

This research aimed to understand the skills, knowledge and organisational support mature IT field engineers perceive are required for them to remain effective within the IT workforce. The findings above fulfilled the research aims and objectives by offering to CompanyX and the IT community, IT field engineer grounded theory-based developmental findings that will benefit an increasingly ageing IT workforce. Most importantly, the research outcomes offer guidance on the organisational support, skills and career development activities that positively contribute to the IT field engineers’ perceptions of *self-worth* by replacing diminished skills and lacking capabilities with future relevant valuable, behaviours skills and capabilities that influence their professional identity formation (Mount et al., 2022).

## 8.3 Contributions to theory

### 8.3.1 The emergence of the importance self-worth and value to mature IT engineer career development

A significant contribution to theory was delivered by this research due to the emergence of the importance of understanding and affecting the mature IT field engineer's perception of *self-worth and value* which was not previously indicated within existing studies. This research aimed to understand the challenges faced by mature IT engineers to remain effective in the continually changing IT industry, with the findings filling a gap in knowledge due to limited academic literature in this area. The sections that follow will bring together findings developed within this research that explain the need to determine and affect the mature IT field engineer's perception of *self-worth and value* as a significant contribution to theory. This is due to the impacts of such feelings on *career development*, value offered in out of work environments, and the skills they require to remain effective within the IT industry, all of which contribute to the engineer's professional identity.

The research focused on a population of mature IT field engineers with a substantial tenure in the IT industry. Therefore, existing CompanyX people management and career development practises have affected their careers for over a decade. Figure 41 presents the historical pre-research findings view of the mature IT field engineer career development approach, with the relationships between the categories within the boundaries of the curved arrows highlighting areas for consideration. The *management influence* exhibited by the resource manager is positioned as a key element of the historical mature IT field engineer career development approach due to managers being responsible for *job and role* allocation and career development. Historically, the resource management style was heavily influenced by mature IT field engineer task completion, *productivity* *metrics,* as the primary indication of engineer productivity and contributor to the perception of value. The diagram positions the style of the resource manager, a person in authority with responsibility for field engineer well-being and team leadership, affecting the IT field engineer *career development* track, with resource managers suggesting *skills* development guided by job and productivity expectations. The findings indicated that whilst the mature IT field engineer job and roles affected and impacted non-work *life impacts*, the emphasis on job related productivity outputs limited work-life flexibility.

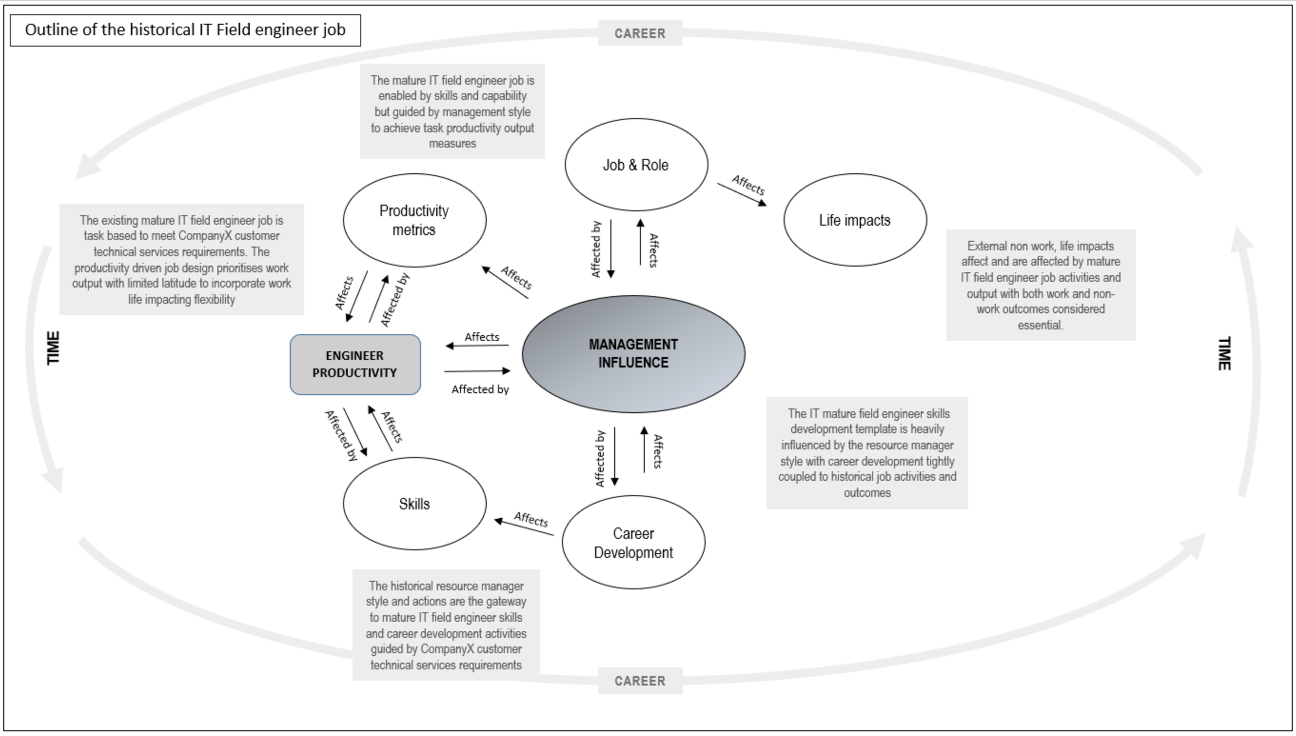


*Figure 41 - Original IT field engineer development approach*

The findings from the research participant interviews indicated that mature IT field engineers believed they offered more value than the task or job completion productivity metrics conveyed but that the pathway or activities required to drive change were deemed unclear. The research found no evidence the mature IT field engineers were seeking to exit CompanyX or curtail their careers as technical IT employees, thus challenging Brooke (2009). Instead, they reinforced the need for change in existing management and employee development practices to positively affect their current and future careers. The research findings created theoretical categories to represent the interplay between CompanyX engineering resource managers and IT field engineers, categorised by *self-worth and value, management influence, career pathway*, *job and role design* and *work and life flexibility,* to indicate related areas that affect the skills, support and knowledge that IT field engineers require to remain effective in the future. However, the unexpected identification of the importance of the need to understand and affect the mature IT field engineer's personal perception of *self-worth and value,* the core theoretical category defined by the research (figure 42) to ensure effective future skills and career development, was a surprising finding and significant contribution of this research to theory.

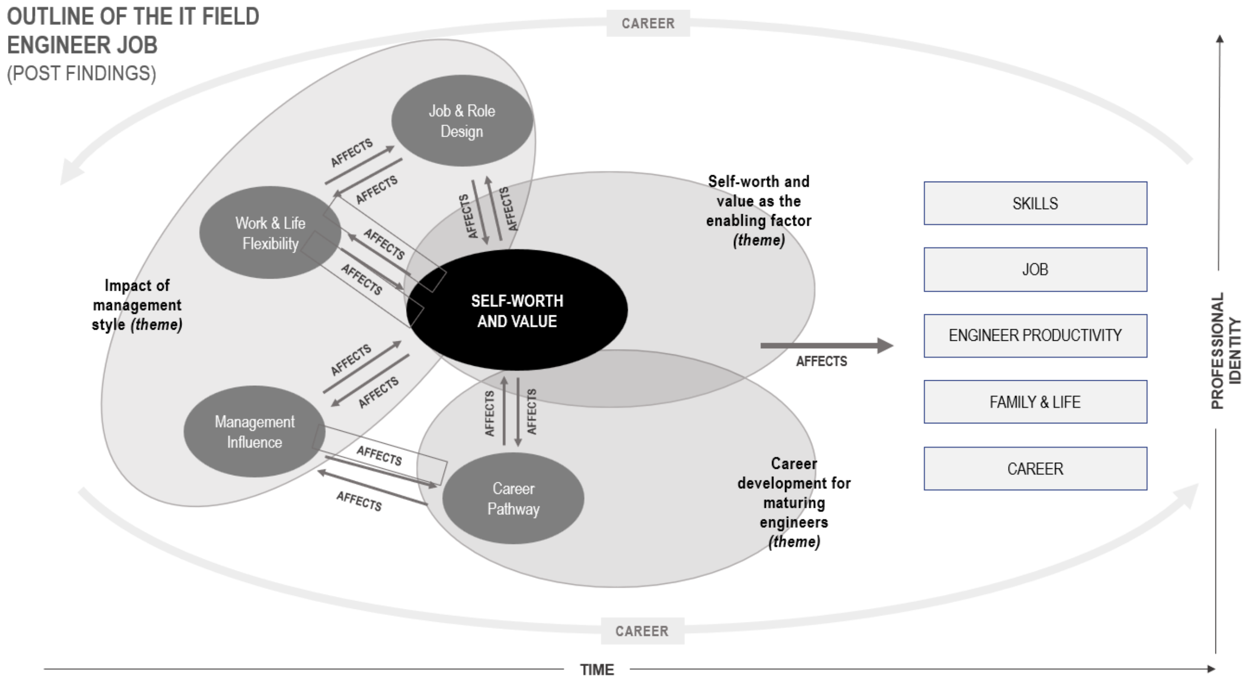


*Figure 42 - The substantive theory*

Figure 42 displays the relationship between *self-worth and value*, the core research category and the four previously mentioned theoretical categories, with the findings suggesting elevated importance of *self-worth and value* in relation to the historical productivity-driven management ideals. The findings suggest the historical resource management influence on mature IT field engineer productivity metrics with a focus on task completion in addition to the market decline for existing skills has contributed to mature IT field engineer self-worth and value concerns. As a knowledge workers, skills, capabilities and perceived value are important elements of the mature IT field engineers' sense of self. Therefore, the emergence of self-worth and value as a core category, positioned in the centre of figure 42, illuminates the impact of the other findings in relation to it. By understanding that the mature IT field engineer's perception of self-worth guided by an awareness of the relevance of existing skills and future capability requirements, career pathways can be individualised and developed based on the engineer's own life and future career aspirations which will in turn formulate a revised professional identity. The theory emphasises the benefits of co-creation of the mature IT field engineer development pathway between manager and engineer, to mutually determine the relevant technical and soft skills required to remain valuable and effective in future. Finally, figure 42 elevates the importance of life impacts and work and life flexibility to indicate the valuable contribution that redesigned IT engineering jobs make to the mature IT field engineer's self-worth by increasing time available to offer value to non-work requirements in addition to restructuring jobs to maximise the valuable of older workers' capabilities.

The findings also established that the acquisition and application of skills necessary for IT field engineering job-related activities within CompanyX were not the only contributors to the mature IT field engineer's perception of *self-worth.* Their ability to offer value to an increased volume of external non-work life outcomes was also emphasised. The findings suggest that it may be beneficial for IT field engineers' *self-worth and value* to consider skills and career development less as a collective, more as a co-created individual activity (Semwal and Dhyani, 2017) between the IT field engineer and resource manager. This will enable the formulation of personal and relevant capabilities that are suitable for current and future jobs beneficial to CompanyX but with sufficient flexibility to ensure non-work life impacts valuable to the IT field engineer, can be accommodated. The research supports existing literature that highlights the enhancement to employee *self-worth* when supported and valued by their leaders (Crestani, 2018). However, the findings extend this by emphasising the benefits of modification of the resource manager style to affect how they influence engineer job assignment, training and development in a manner that positively impacts the engineer's perception of *self-worth.*

This research adds weight to the notion of a career for mature IT field engineers as more than an accumulation of technical skills for defined jobs, but as an undertaking that embraces personal, professional and non-work life factors to inform their self-concept (Schein, 2007). This can influence the mature IT field engineers' personal feelings of self-worth based on individual internal and external outputs of value to others which may lead to changes in their professional identity (Marks and Scholarios, 2007). This is a diversion from the historical productivity and task-based output metric-driven (Muller, 2021) that IT field engineering careers were based on, with the findings suggesting the mature IT field engineers' expectations had changed. The sheer volume of IT field engineer work available in previous eras validated task completion as an engineer productivity metric. However, this research adds to existing knowledge by identifying the need to evolve the productivity and utilisation derived measurement of technical workers to emphasise the value of qualitative or service-based outcomes.

*Self-worth and value* emerged as the core theoretical category that offered an integrating relationship between the theoretical elements of *management influence, career pathway*, *job and role design* and *work and life flexibility* that were determined by the research to work together to enable the effective, future focused career desired by the mature IT field engineers. To this end, the emergence of the significance of *self-worth and value* to mature IT field engineers helps to situate the research amongst existing academic discourse aligned to *self-worth* (Covington, 1976) and, potentially, to the measurement of self-esteem (Rosenberg, 1965), which is considered an important component of *self-worth*.

This research offers an additional contribution to broader employee self-worth literature by identifying a relationship between the mature IT field engineers historically "valued" technical identity and their current perception of diminishing worth, primarily based on capability-based measurements of value. This research also positions the importance of determining and affecting *self-worth and value* when developing mature IT field engineers, building on existing literature that focuses on the benefits of job modification, retraining and the role of managers for the development of ageing knowledge workers (Patrickson and Ranzjin, 2005). To this end, the findings suggest that the evaluation of the mature IT field engineer's perception of *self-worth,* using appropriate academic or professional instruments to influence development decisions, offers the engineer and CompanyX opportunities to positively affect *self-worth and value*.

The importance of understanding and affecting the mature IT field engineer's perception of *self-worth and value,* identified by this research, is both significant and valuable to the mature IT field engineering community. This understanding of their perception of self-worth and value adds to an area with limited prior research and focus, such that that if it is addressed by further research, the career effectiveness of mature workers may be enhanced. If CompanyX resource managers apply focus to the impacts of feelings of *self-worth and value,* potentially overlooked topics within existing mature engineer development programmes, the research suggests that the career potential of the field engineers can be maximised by reinforcing them as valuable future 'human assets' (Vasconcelos, 2018), if relevantly upskilled (Barnes, Bimrose and Brown, 2006), within an IT industry that continues to suffer from emerging skills and human resource shortages.

### 8.3.2 Mature IT field engineer professional identity and the influence of self-worth and value

The findings of this research offer an additional contribution to theory by positioning the emergence of the mature IT field engineers' perception of ***self-worth and value*** as the key factor influencing their professional identity, challenging existing literature and historical perspectives positioning qualifications and certification as the predominant element for technical workers (Quan, 2009; Marks and Scholarios, 2007; Tsakissiris, 2015; Smith, 2016; Mackenzie and Marks, 2019; Rahmatika, 2022). This research posits the mature IT field engineers' professional identity, as accepted members of the engineering community included feelings of belonging, attachment and belief (Barbour and Lammers, 2015) but with an increased emphasis on the mature IT field engineer's personal perception of self-worth and value that was important to their belief they remained a valued member of the technical community.

The findings concurred with existing research indicating technical training and certification were valid and established approaches to ensure relevant learning or knowledge transfer commensurate with the job and tasks expected of a mature IT field engineer (Rahmatika, 2022). Existing literature suggests undertaking applicable training that resulted in a technical individual achieving large numbers of technical certifications and credentials (Quan and Cha, 2009) was historically used within the IT industry as evidence of technical worker competence and value (Medlin, Schneberger and Husinger, 2007) and therefore offered validation of the mature IT field engineer of the standard expected within their professional identity (Popescu, Bulei and Mihalcioiu, 2014).

However, the midlife age segmentation of age 45 and above guiding this research may be a factor in the prioritisation of self-worth and value over technical certification due to the mature IT field engineers determining they had historically accumulated an extensive body of technical certification to support their historically productivity driven (Muller, 2021) mature IT field engineer jobs and as evidence of technical community membership via external certification (Rynearson and Rynearson, 2017) but were questioning their self-worth due to finding their skills and value diminishing due to reduced demands for their historical jobs and tasks. This research also found the mature IT field engineers, in keeping with other older workers may have competing priorities between in work and out of work pursuits, in addition to changing family roles (Yeandle *et al.* 2002) which may soften the importance they once positioned on retaining expected technical certification (Quan and Cha, 2010) and exhibiting the behaviours that underpinned their historical mature IT field engineer professional identity prevalent through their formative career years.

Therefore, this research indicated the professional identity formation including knowledge & skills, integrated with personal values (Mount *et al*., 2022) of the mature IT field engineers required more than the accumulation of technical training and certification they held (Ford *et al.,* 2021), an approach historically used to positive effect but instead was influenced by the IT field engineer's multi-dimensional perception of self-worth and value, which challenges existing research and literature focussing on IT worker prioritising technical certification as the most significant professional identity component (Marks and Scholarios, 2007; Tsakissiris, 2015; Smith, 2016; Rahmatika, 2022).

The findings do not suggest training and the acquisition of certified skills were not considered important supporting (Bimrose and Brown, 2011), with the mature IT field engineers reinforcing their desire for relevant and future focussed skills. However, the research suggests the elevated importance of the mature IT field engineer's perception self-worth and the value, the core category of this research (Glaser and Holton, 2004) and how that value realised by CompanyX and to other stakeholders in out of work situations therefore shaping their professional identity is a significant contribution to theory.

## 8.4 Contributions to practice within CompanyX

This research aimed to understand the skills, knowledge and organisational support mature IT field engineers perceive are required to remain effective within the Information technology workforce which led to the following recommendations within section 8.4. The research recommendations within sections 8.4.1 to 8.4.4 apply to CompanyX, in addition to the managers and the mature field IT engineering community within the organisation. Section 8.4.5 considers the findings of this research with reference to external professional bodies who represent the broader computing and information technology industry.

#### 8.4.1 Contribution to organisational policy

##### 8.4.1.1 Increased work life flexibility for time dependent IT field engineering workers

The mature IT field engineer's indication of the value for job changes and added work life flexibility were important findings of this research guided by the engineer's primary belief that they still possessed immense value and subject to appropriate skills investments were eager for their jobs to have the flexibility to deliver outcomes that mattered to CompanyX and also in life or family environments (Kossek, Perringo and Gounden Rock, 2021). Job and financial security, the need to continue to support an existing quality of life and family circumstances conducive to older workers (Woodruffe, 2006) remained important factors that reinforced the mature IT field engineers' decision to remain employed for the long-term.

It is therefore recommended that organisational policy changes are made within CompanyX to increase the opportunities for work life flexibility or 'flexicurity' (Cedefop, 2010) for mature workers with time dependent jobs for example the IT field engineers, who need to accommodate external life and family-related factors but also want to deliver meaningful work (Black, 2006; Thijssen and Rocco, 2010 and remain in productive long-term employment in CompanyX. Such an approach will increase scheduling latitude and accommodate greater flexibility to both the resource managers and the mature IT field engineers. The policy changes may ease apparent task or job restrictions and challenges to make job or outcome flexibility realisable for mature workers keen to continue to remain valuable in work and non-work, family environments (Kodz, Harper and Dench (2002).

#### 8.4.1.2 CompanyX to externally present itself as a destination employer for mature IT field engineering personnel.

The research intentionally focused on mature IT field engineering workers with a timeframe commencing at the mid-life career life stage (Super, 1980). The rationale behind the segmentation was to apply focus to a population of IT workers affected by job and skills obsolescence (DeGrip and Smits, 2012) due to accelerated market changes in IT industry. Such a phenomena may not be unique to CompanyX with other technology organisations employees within a similar mid 40s age range affected in an equivalent way with older IT workers with out-of-date skills or unemployed older IT workers at a time when the industry is suffering from skills shortages in emerging technology areas (Hawk et al., 2012)..

This research recommends CompanyX should present itself externally as a destination employer for competent mature IT field or systems engineers, keen to invest in new skills to remain relevant in emerging and future IT roles but who may be struggling to remain employed (BCS, 2021). Such an approach may offer several benefits, including the potential to tap into workforce that possesses both tacit and experiential technical skills (Alic, 2008) who may be affected by future employment challenges, in addition to the potential to reskill a technically competent employee population with new skills in emerging areas affected by shortages.

### 8.4.2 Contribution to human resources management (HRM)

#### 8.4.2.1 Mature IT field engineer career intervention and career development

This research was initially guided by a researcher-defined age of 45 years and older, which was subsequently found to be in keeping with existing mature or middle-aged employee studies (Berger 2009; Cheung *et al*., 2011; Harris *et al*., 2018). The age boundary defined allowed for an intentional selection of the mature IT field engineering population, within the mid-life or 'maintenance' life stage (Super, 1980), guided by a desire to understand the competing factors of career, job, older worker impacts, and life factors on the employee's future career and life expectations. However, the research recognises whilst proving suitable, the research-defined age range is one with no prior acknowledgement in CompanyX.

Therefore, this research recommends that the CompanyX HR team produces a consistent mature age definition for use within mature IT field engineer career interventions due to the inconsistency highlighted by the findings and the confusion surrounding the definition of employee age in the workplace (Bourne, 1982, Kooij *et al*., 2011). This will ensure that age-related career development intervention is initiated and made available in a consistent time frame, but with the mature IT field engineer determining to what extent they participate. Whilst this research advocates for a chronologically defined age-related IT field engineer career intervention circa age 45 to add consistency to employee engagement, it does acknowledge the benefits of calibrating it with an employee-guided behavioural element (Kaliterna *et al*., 2002) due to person-to-person differences, even between people with similar ages.

#### 8.4.2.2 Beneficial realisation of the value of mature IT engineer knowledge reuse within CompanyX

The mature IT field engineers within this research are considered knowledge workers with recognition of the value and their skills qualifications and achievements contributing to positive self-esteem (Brun and Dugas, 2008), a component of *self-worth*. In keeping with existing literature (Smith, 2001), the findings of this research indicated the value of the mature IT field engineers tacit knowledge was underutilised and potentially under validated in CompanyX, which supports Smith (2001). Codification of valuable units of tacit historical engineer knowledge accumulated over time by the mature IT field engineers within CompanyX may help to positively contribute to their perception of self-worth by acknowledging the hidden value they possess, with the flow from tactic to explicit as equally beneficial to the organisation (Nonaka and Takeuchi, 1995).

Therefore, it is recommended by this research that CompanyX consider the development and adoption of mature IT field engineer recognition frameworks that actively rewards tacit sharing and evidence of positive engineer contributions that are not recorded by monetary or productivity metrics. The research established that mature IT field engineers valued the tacit knowledge they possessed highly, therefore the potential to be rewarded for it can be a valuable contributor to their personal measure of *self-worth and value*. The identification by this research of the importance of valued rewards for the IT field engineers is supported by O'Neil and Adya (2007) who positioned rewards as a positive influence on the psychological contracts that govern the knowledge sharing attitudes and behaviours of knowledge workers. The findings of this research also reinforce that such rewards do not need to be monetary in nature, also indicated by (Thite, 2004). This recommendation highlights that additional recognition of the accumulated and beneficial knowledge within the mature IT field engineers will help to reinforce their historical worth and showcase them as possessing valuable 'wisdom capital' (Vasconcelos, 2018) which will positively contribute to their perception of self-worth and value.

#### 8.4.2.3 Redefinition of the IT field engineer 'dual track' career

The findings suggest that existing mature IT field engineering career development activities whilst historically effective, may now be challenged to serve the long-term needs of IT field engineers who are eager to remain technologists through their mid or later career stages but perceive that a career diversion to management disciplines may be required to ensure employment longevity or fulfil future financial and career promotion needs.

Therefore, the research recommends that the CompanyX human resources team as part of the redefinition of mature IT field engineer career pathway should reinforce the value of a dual-track career path (Hirsh, 2007) to the mature IT field engineer resource managers in a manner that makes both technical and management skills development possible (Abraham et al., 2006). However, the career attributes within the dual-track career framework will need to be revised to ensure job promotion and financial equity exists on both the technical and management development tracks. Revision of the IT field engineer 'dual track' career characteristics will ensure that mature IT field engineers are not disadvantaged if they choose to remain technologists with their concerns alleviated that their career or financial stature will not be diminished.

### 8.4.3 Contribution to managers

#### 8.4.3.1 Future relevant mature IT field engineer job design

The mature IT field engineer job and the subdisciplines within the CompanyX field engineering practice have remained stable over multiple decades. The research findings were consistent with Freeman and Aspray (1999) with evidence CompanyX trained the mature IT field engineers to execute stable, well-defined technical tasks for completion within a time boundary to a contractually agreed quality level that satisfied customers. The findings indicated that the mature IT field engineering job will benefit from changes to align it with evolving customer demand and skills requirements that places different expectations on the mature IT field engineers personally and professionally. Job changes are required to revise the historically IT hardware influenced task centric engineering activities to increase flexibility and incorporate software configuration & engineering services in new or emerging technology areas, and where possible include meaningful work (Black, 2008).

Therefore, this research recommends that CompanyX resource managers consider redesigning the mature IT field engineer job to reduce older worker job obsolescence (Yeatts, Folts and Knapp, 2000) with an emphasis on skills & job capabilities for future relevance in the continually changing IT industry but with sufficient flexibility to also accommodate the increased volume of non-work demands that affect older workers (Yeandle and Wigfield, 2002). This research equally highlighted elements similar to those within the job characteristics model (JCM) of 'skill variety, task identity, task significance, autonomy and feedback' (Hackman and Oldham, 1976), indicating this may offer a viable framework to consider.

Job redesign of the mature IT field engineer's job role will also give rise to opportunities to benefit from the lessons learned from work-from-home policies established during the COVID-19 pandemic (Kaushik and Guleria, 2020) and consider the benefits of explicit technical job designs enabled by hybrid ways of working via increased use of remote access technologies and centralised virtual support desks (George, Lakhani and Puranam, 2020; Kylili *et al*., 2020). The increase flexibility and help to reduce physical expectations of the mature IT field engineering role may increase the employment potential for mature IT field engineers who may be affected by age-related physical demise (Parker and Andrei, 2020) but who remain intellectually and technically capable.

#### 8.4.3.2 Elevation of the importance of mature IT field engineer historical skills

This research indicated an important component of the mature IT field engineers' perception of *self-worth and value* was based on their personal perception of the value and relevance of their existing skills, capabilities and experiences. With historical growth and career stability in the IT industry (Freeman and Aspray, 1999), the accumulation of technical skills offered evidence of engineer competence, guided by the perception that the greater the number of skills an engineer possessed could be equated to increased engineer value and higher levels of productivity (Anderson, Marden and Perry, 2015), however the landscape is now different with continual industry and technological changes resulting in skills obsolescence (DeGrip and Smits,2012). The findings of this study challenged existing technology skills and career development norms in the IT industry, focussing on an engineer's or technical persons *'value',* primarily measured by an accumulation of a body of certified technical skills (Quan and Cha, 2009; Wiershem, Zhang and Johnston, 2010) but instead argued for a management style shift to consider an IT engineers value beyond technical certification.

Therefore, this research recommends resource managers elevate the importance of historical mature IT field engineer skills and experiences that may be reducing in market relevance but continue to offer valuable contributions to the mature IT field engineer and broader community. Whilst the existence of traditional or historical IT technical systems and customer requirements may continue to decline due to technology innovation and changing customer expectations, leading IT vendors including IBM, have shown the historical mature IT field engineers' technical skills and capabilities will remain valuable within redesigned roles or used to mentor and train others helping to shift the legacy perception of older technical workers (Greenstein, 2007; Cortada, 2021).

#### 8.4.3.3 Adaptation of the resource management style

The mature IT field engineers highlighted that adjustment may be required to the day-to-day resource management approaches, with the findings suggesting the need to modify the authoritative management style historically used to manage them in a highly productivity driven manner (Potgieter, 2005) with task completion and utilisation primary measures of mature IT engineer value.

This research recommends a softening of this direct management style to one that is more collaborative in nature, which will positively contribute to the mature IT field engineer perception of *self-worth* by the inclusion of a coaching-based style to drive the development of the mature IT field engineering cohort based on the style being suited to older workers who benefit from the interpersonal nature of the interaction (Dello Russo, Miraglia and Borgogni, 2016), and positive benefits of coaching to employee self-esteem (Burdett, 1998; Gilley and Gilley, 2007). By incorporating changes to the resource management style, the collaborative engagement nature of a coaching-based approach should facilitate greater mature IT field engineer input into skills and career development discussions (Duffy and Autin, 2013), thereby increasing possibilities for the higher level of career ownership indicated by the research participants.

However, the adoption of a coaching-based style may not be natural to all resource managers with development also required to acquire this new skill and to incorporate it effectively. This research additionally recommends that the resource managers undergo explicit training to onboard the coaching capabilities required to adopt such a style (Tjosvold *et al*., 1991; Leisink and Knies, 2011). Doing so will equip them with the skills needed to effectively apply coaching techniques to manage mature IT field engineers within CompanyX.

#### 8.4.3.4 Measurement and enhancement of IT field engineer self-worth

The mature IT field engineers as knowledge workers placed significant emphasis on their value and worthiness (Petroni, 2000). This increases the need to understand and make positive steps to enhance the mature IT field engineer's perception of *self-worth and value*, which was related to them feeling that their skills, capabilities and contributions were valuable, emerged as a key finding of this research. Existing research positioned the measurement of self-esteem, which is an important internal determination of an individual's *self-worth* (Crocker and Knight, 2001) as a viable employee measurement activity. However, the potential for self-esteem measurement to be distorted due to the variances apparent within the differing measurement approaches (Baker and Gallant, 1984) and the potential for an individual to plot favourable results for self-protection reasons (Tharenou, 1979).

Therefore, this research recommends that CompanyX resource managers focus instead on the measurement of the evaluation of the mature IT field engineer's perception of *self-worth and value* guided by mutually defined characteristics of value across multiple dimensions that includes skills and capabilities, valuable contributions to the practice, such as mentoring and coaching other team members in addition to productivity centric measurement. By adopting this approach to consistent self-worth measurement which benefits all parties, it which will offer a fabric for ongoing engagement between the resource manager and mature IT field engineer to capture 'value based' feedback beneficial to the employee and the manager.

### 8.4.4 Contribution to engineers

#### 8.4.4.1 Increased IT field engineer accountability for skills and career development

This research established the mature IT field engineers remained positive about a technical career in the IT industry. The findings highlighted no evidence of the engineers as older workers reluctant to learn new technologies positioned by Van Vianen *et al*., (2011) or affected by cognitive speed decline indicated by Salthouse, 2004) that reduced their ability to absorb complex topics (Ackerman, 1996). Therefore, this reinforces the mature IT field engineers as well placed to continue delivering valuable work aligned to the historical professional identity subject to an appropriate investment in relevant skills and capabilities.

Therefore, is a recommendation of this research that the mature IT field engineers must take greater accountability for their skills and career development working in collaboration with the resource managers to ensure they continue to fulfil their personal self-worth needs and align with company service expectations. This approach is a shift from the existing manager led engineer career development pathway which historically positioned the manager in a dominant role to one with an increasingly mature IT field engineer self-directed approach (Defillippi and Arthur, 1994) guided by the engineer. The coaching-based management style mentioned in the previous section will help with this by opening a channel for collaborative bidirectional dialogue (Latham and Locke, 2006) aligned to skills and career investments. However, the mature IT field engineers must also acknowledge key to the success of this approach is the greater responsibility placed on the worker also found by Gussek, Schned and Wiesche (2021) to offer relevant recommendations for training and development.

#### 8.4.4.2 Future focussed mature IT field engineer skills development

This research identified the mature IT field engineers were affected by technical and professional obsolescence due to their skills and knowledge depreciating over time (DeGrip and Smits, 2012). The CompanyX field engineer training and skills development path was historically biased towards traditional IT hardware-centric field engineers due to decades of traditional IT engineering work available. However, the decline of these technical requirements (Litecky *et al*., 2009; Hawk *et al*., 2012), in favour of cyber security and sophisticated software configuration needs from companies that include Microsoft, has led to IT software skills now exceeding hardware in significance (Halal, 1993).

Therefore it is a recommendation of this research that the mature IT field engineers via their increased accountability of career development working in collaboration with the CompanyX resource managers, initiate a skills and capability development programme that incorporates meta-skills or soft skills as these depreciate slowly and increase future career adaptability (Sunarto, 2015; Schultheiss and Backes-Gellner, 2022) in addition to an emphasis on emerging technology skills to replace the existing historical skills that have depreciated over time (Fossum *et al*., 1986). It was considered outside of the scope of this study to define a recommended IT field engineer-specific skills development path due to the contextual nature of such decisions. However, this research recommends that CompanyX prioritises the IT field engineering skills investment in recognised emerging technology areas, such as networking, automation, coding (Jones *et al*., 2018), and cybersecurity (Braw, 2021), to equip existing and future ageing IT field engineers with the capabilities required to remain effective.

It is also an additional recommendation by this research that resource managers allocate additional training time (Picchio, 2015) to ensure the mature IT field engineers as older workers who may be slower when absorbing advanced technical skills (Charness and Czaja, 2006) are not disadvantaged when investing in future-focused skills within appropriately structured roles (Tripathi, Dhingra and Srivastava, 2019). The acute skill shortage apparent in the IT industry (Freeman and Aspray, 1999) in specific specialist domains highlighted suggests that CompanyX may benefit by viewing its substantial pool of mature IT field engineers as a potentially overlooked older worker demographic to gain access to new talent (Burrell, 2020) which will contribute to the mature IT field engineer's positive personal perception of *self-worth and value*.

#### 8.4.4.3 Evolution of the mature IT field engineer professional identity

The findings indicated self-worth and value was positioned by the mature IT field engineers as a significant element of the at the core of the evaluation of their professional identity. However, this research also suggests the changes positioned to equip the mature IT field engineers with the skills, capabilities and job flexibility required to remain effective in the IT industry and correspondingly enhance their perception of self-worth and value may threaten their existing professional identity (Chen, Currie and McGivern, 2022).

Therefore, it's a recommendation of this research for the mature IT field engineers to influence job redesign and skills investments by aligning it to their personal values (Baczor and Zheltoukhova, 2017) working with the resource managers who can help to reduce engineer professional identity conflict by endorsing the evolution of their current on-job identity (Chen and Reay, 2021). The manager plays an important role in the shaping of the professional identities of the members of their teams (Alvesson and Willmott, 2002) therefore positive resource manager reinforcement of the importance and value enhancement (Wiles, 2013) to the mature IT field engineers of the potentially destabilising skills and careers development activities will help the IT field engineers to formulate revised and beneficial professional identities.

### 8.4.5 Contribution to professional and accreditation bodies

#### 8.4.5.1 The British Computer Society (BCS) to focus on the impact of older IT worker skills obsolescence.

The research recommends the British Computer Society (BCS) as the chartered professional standards organisation for the information technology profession (Weiss, 2003) should build on its existing research positioning the industry implications of a steadily increasing population of older workers in the technology industry (BCS, 2017; BCS, 2021). Future BCS research and policy guidance should consider one of the significant findings of this research, that determined the perception held by older mature IT field engineers of reduced self-worth and value as a result of job or skill obsolescence (DeGrip and Smits, 2012) will result in modification to their historically stable certified IT field engineer professional identity.

By undertaking an activity to amplify the importance of positively affecting the older workers' perception of their self-worth and value aligned to skills development, the British Computer Society (BCS) will offer value to organisations who employ older IT engineers and technology workers but lack information and guidance on the optimal employee technical development and career support systems that will underpin the redefined future focused mature IT field engineer professional identity.

#### 8.4.5.2 The British Computer Society (BCS) should elevate its brand and the value of membership to help with IT worker professionalism and status enhancement.

The IT industry must take greater steps to proactively elevate the public perception of professionalism of IT workers and reinforce the value of membership to an industry agreed professional body that is a universally accepted as the endorsement of a recognised professional identity. At present, whilst information technology is recognised at government level as a significant area for investment and discussion (Holderness, 2017) inconsistency is evident in the IT professional arena with a number of competing bodies, including the British Computer Society (BCS) and internationally the IEEE (Olifin and Emeagi, 2015) as examples, but with none of them acting as the universal industry verification of an IT workers professional identity and status in the similar mould as the legal or medical profession (Weiss, 2003).

Therefore, it is recommended by this research for the British Computer Society (BCS) as an existing organisation operating via UK royal assent (BCS, 2017; BCS 2021), to increase its proximity within large public sector and enterprise organisations to become the recognised and the 'industry requested' endorsement of status for individual keen to practise as IT professionals. At present no mandatory licensing requirement exists prior to an individual working as an IT practitioner (Weckert and Lucas, 2013). By publicly amplifying and reinforcing the role and value of the British Computer Society (BCS) as the face of 'new professionalism' in the IT industry at a time when existing and incoming employees are forming a professional identity for the future, the possibility exists to elevate the perceived status and 'worthiness' of IT professionals and the broader IT industry.

## 8.5 Limitations

This research was bound to the identified areas of inquiry which were guided by the research question and, therefore, is not a ubiquitous study with a broad scope. The intentional selection of a specific population, age segmented in this instance, resulted in a systematic bias (Price and Murman, 2004) research limitation. However, this should not be considered negative, with the areas of inquiry explicitly included to deliver the focus required for this research to understand the experiences of mid-life IT field engineering workers and to meet the research aims and objectives.

The initial age range used to segment the field engineering population was intentional within this research to target a particular cohort of older technical engineers. The age range, 45 years and older, was used within this research to define the 'mature IT field engineers' segment, utilising input from numerous sources to determine an appropriate career intervention time frame. The findings indicated the age range was appropriate and selection was aligned with existing studies investigating later stage employee or pre-retirement considerations (Berger, 2009; Barnham, 2010). However, it should be acknowledged as a limitation that chronological age is only one measure of how old an individual feels (Depergola and Manuti, 2013). Therefore, chronological age used alone may exclude relevant future candidates or potentially include candidates who choose not to identify within the age range based on their own view of life stage or behavioural outlook (Kooij *et al*, 2011). In addition, further research may need to be undertaken within similar engineering communities to compare findings and to determine if the recommended practises from this research could also be applied using similar age boundaries.

The IT industry is a male dominated profession (Adam, 1995), with a proportionally smaller female population. A limitation of this research is the normalisation of gender and, thus, focusing on the workforce experiences and expectations of a mature IT field engineer without emphasis on gender specific implications. Gender was identified during population selection and sampling to ensure that a stratified workforce was considered for the study. However, the feedback from the small population of female engineers who met the mature IT field engineer criteria indicated that they also normalised gender by undertaking standardised and consistent tasks. Therefore, career development differences of mature IT field engineers across gender was not the focus of this study, resulting in research findings aligned to a predominantly male engineer population. Future research using similar IT engineering cohorts may consider the use of both age and gender to highlight commonality and difference.

The initial literature scoping activity and subsequent literature searches indicated a research gap (Robinson *et al.*, 2011) by exposing few examples of research aligned to mature IT field engineers in a skills development context. Therefore, a limitation of this research may be the intentionally narrow scope aligning to a particular subgroup of the IT engineering population, therefore limiting inputs from adjacent or similar technology areas. This is challenging to avoid in part due to the lack of uniformity in the IT industry when describing selected technical concepts or outcomes (Freeman and Aspray, 1999), with terms including IT, Information Technology, Information Systems describing similar topics but frequently discerned only by domain understanding and context.

The research was undertaken from the position as an insider researcher or native (Kanuha, 2020) employee of CompanyX and could be considered a limitation based on the potential for bias and researcher positionality (Holmes, 2020). With prior knowledge of the organisation and with individuals in the interview cohort aware of the researcher's position within CompanyX, possibilities existed for the participants to distort the research data based on the researcher's role. In the case of this research, the insider researcher position had a beneficial effect, with the participants feeling comfortable to discuss topics without limitations, guided by a level of assumed trust (Chammas, 2020). In addition, this research was guided by constructivist ideals, with the co-creation of the research acknowledged from the outset and researcher reflexivity extensively documented by memos to acknowledge positionally and views (Gentles *et al*., 2014). On reflection, the cocreated nature of this research is one of its greatest strengths rather than a limitation, with the researcher's IT domain understanding ensuring familiarity of industry-specific terminology, which increased possibilities of understanding and extracting the meaning hidden within the data created.

## 8.6 Further Research

This study investigated the skills and career considerations of mature IT field engineers within the IT industry. Due to the lack of prior research focusing on mature IT field engineering personnel, the study highlighted additional areas of inquiry that fell outside of the scope of the primary research question, including the impact of gender, younger IT engineers, or other IT engineering job families, as examples. Professional identity, a topic initially positioned in chapter two and theoretically integrated within this research, whilst benefiting from a substantial body of existing research and literature in the educational and medical fields, was found to be limited from an information technology perspective. Therefore, additional research building on this IT field engineering focused study will deliver beneficial value to the body of academic knowledge within the IT engineering community.

The female workforce in IT engineering, and the broader IT industry, is a notably smaller proportion of the overall technical population. This research normalised gender due to the IT field engineers in the participant interviews indicating that gender-related impacts were not a prevailing concern in relation to their workforce experience as mature IT field engineers within CompanyX. However, it may be valuable to the IT industry for future research to also understand the mature IT field engineer future career expectations from a gender perspective to identify if differences exist across genders related to career development choices including, retirement age, workforce exit and external life factors.

This research was guided by the use of a predefined age range (45 years and older) to intentionally identify a population of IT field engineers to define a particular segmentation within the field engineering workforce. Future research may utilise the findings generated by this study with the intent of determining age significant characteristics across the IT engineering community to understand the skills, career development and organisation-supported activities required for IT field engineers, across the corporate age spectrum, to remain effective in the ever-changing information technology landscape.

Reward frameworks were briefly highlighted in the findings with mature IT field engineer personal value and *self-worth* identified within the research as key points. However, the design of an applicable rewards framework was beyond the scope of this project. An explicit study to understand reward frameworks for IT field engineering personnel who possess technical, experience-based, customer-facing, and knowledge-centric skill sets but who perceive value, should be measured and recognised differently is a recommendation of this research. This may help with the technical engineering generations following behind the mature age demographic studied within this research.

## 8.7 Closing statement

The research fulfilled its main aim, which was to understand the skills and knowledge that mature IT field engineers in CompanyX perceive are required to remain effective within the continually changing information technology industry. This research captured the voices and experiences of the engineers via participant interviews to create a ground-up research viewpoint that provides CompanyX with a previously unheard perspective on the career and development needs of an increasing community of mature IT field engineers.

Generalisation was not the aim of this research. However, the findings will be valuable to the broader IT community and potentially to other engineering workforces to augment existing technical engineer development programmes that may anchored to historical skills and concepts. Urquhart (2007) highlighted a lack of theories were created in information systems using the grounded theory methodology. A similar statement may also apply in the IT engineering arena with the technical disciplines similar, which reinforces the academic contribution of the grounded theory created by this research.

It is hoped, in a similar manner that the original information systems work of Urquhart (1999) and Orlikowski (1993) acted as catalysts for the growth of grounded theory research in information systems, that this study will introduce information technology engineering concepts to the academic grounded theory research lexicon to act as a foundational study for future IT engineering research. My aim is to continue to research a selection of the identified topics to a greater degree, academically or professionally, to be able to contribute valuable insights on topics relevant to information technology industry.

### 8.8 Personal reflection

The reasons for undertaking this research were to improve the level of understanding in CompanyX around an area of concern that was highlighted to me by internal IT field engineer professionals and from others across the industry, similar to those who were interviewed for the research. This research was my way, as an IT professional, to give back to an industry that has been highly rewarding to me on a personal level for many years but, at the time of the research was facing hidden challenges of how to positively affect a maturing IT field engineering workforce who had served the IT industry so well. The insight derived from this research will help CompanyX to develop, retain and maximise both the current and future potential of a population of the IT workforce, 'the mature IT field engineer community', that remains valuable but may be overlooked if the status quo is retained. I would like to believe the findings created from this research have achieved my personal and academic objectives.

My personal reflections of my doctoral academic journey are all favourable. At times, it has been challenging, most notably the endless context switching from my professional understanding and dialect into an academic mode – I was unaware how challenging this would be. My job position in CompanyX has helped by offering flexibility and latitude to undertake this research effectively and I remain hopeful, even with my role not spanning the IT field engineering group at the heart of this research, that the insight within will offer theorical and practice-based recommendations that will deliver a positive impact. From the start of my research to the conclusion, the academic approaches learned, the discipline required, and the outcomes finally delivered have now become behaviours that underpin and enhance my day-to-day work activities.

I have become a better professional for my organisation, and this was a handy bonus and by-product of a truly personal journey and one I will build on and continue to enhance. I cannot end this without sending my heartfelt thanks to all the lecturers at the University of Worcester from the very start and most notably to my final supervisors Catharine Ross and Lynn Nichol. And lastly, I would be remis to conclude without thanking CompanyX for allowing and trusting me to undertake such an important and beneficial activity.

Colin Williams

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# Appendices

## Appendix 1 – Preliminary Literature search - "search engine search terms"

**Preliminary Literature Search – March 2018**

**Research Question:** Include

**Search sources:** scholar.google.com, Worcester university library (Online & in person), Worcester University Meta search capability, Researchgate.com, journals.sagepub.com, link.springer.com, core.ac.uk, the Google.com search engine (located sources cross check via Worcester University Online library meta search engine).

**Search strings** (full terms used below). Individual words lack content and recovered a vast data set

| Search rationale | Search terms used |
|---|---|
| The objective is to locate extant research or relevant documents of an academic or professional standard using Generation X as the age identifier to describe engineering workers who by virtue of being born within the Generation X timeframe (1965) places them within the correct age range and profession for the research. IT engineering role definition lack consistency. A number of job role examples used within the IT industry are included to create a relevant search term. | Generation X IT engineers<br>Generation X IT consultants<br>Generation X IT specialists<br>Generation X IT resources<br>Generation X IT workers<br>Generation X IT employees |
| This is the same search criteria as above but using the term ageing instead of Generation X to indicate an older IT worker | Ageing IT engineers<br>Ageing IT consultants<br>Ageing IT specialists<br>Ageing IT resources<br>Ageing IT workers<br>Ageing IT employees |
| This is the same search criteria as above but using the term mature instead of Generation X or ageing to indicate an older IT worker | Mature IT engineers<br>Mature IT consultants<br>Mature IT specialists<br>Mature IT resources<br>Mature IT workers<br>Mature IT employees |
| The objective is to locate extant research or relevant documents of an academic or professional standard using Generation X as the age identifier to describe engineering workers who by virtue of being born within the Generation X timeframe (1965) places them within the correct age range and profession for the research. Information technology replaces the abbreviated IT designation. | Generation X Information Technology engineers<br>Generation X Information Technology consultants (done google scholar)<br>Generation X Information specialists<br>Generation X Information resources<br>Generation X Information workers<br>Generation X Information employees |
| This is the same search criteria as above but using the term ageing instead of Generation X to indicate an older information technology worker | Ageing Information Technology engineers<br>Ageing Information Technology consultants<br>Ageing Information specialists<br>Ageing Information resources<br>Ageing Information workers<br>Ageing Information employees |
| This is the same search criteria as above but using the term mature instead of ageing or Generation X to indicate an older information technology worker | Mature Information Technology engineers<br>Mature Information Technology consultants<br>Mature Information specialists<br>Mature Information resources<br>Mature Information workers<br>Mature Information employees |
| Digitisation and the use of technology systems and software is a substantial driver of IT industry and business change. This search was used in a broad sense to locate content that may discuss relevant skill changes. | Digitisation IT skills<br>Digitisation IT engineering |

## Appendix 2 – Invitation to participate form

Colin Williams<br>00 Someplace Road<br>Someplace<br>S1S1 123

Research Participant
30 Something Road
Somewhere,
AB12 111
28th April 20XX

Dear R Particpant,

I am undertaking a research project to understand the skills or capability required by mature IT engineers to remain effective in the information technology industry.

A number of face to face interviews with Company x engineers will be undertaken to capture the views of the group aligned closest with the research purpose. A random sample of potential interview candidates were drawn and you were randomly selected.

Your views as a Company X engineer are extremely valuable and the interview will collate them for use within the research to generate findings that may ultimately lead to the formulation of new theories to affect issues identified.

At the beginning of the interview you will be asked if you consent to take part. There is no obligation to take part and if you do take part, you have the right to stop participating in the interview at any time, and to have your responses discarded.

All data will be stored confidentially and securely for 10 years and will be used for the contracted research purposes only. After 10 years, all data will be securely destroyed.

Please see overleaf for more details on the Participant Information Sheet, and please contact WILC9_15@UNI.WORC.AC.UK if you have any queries/concerns.

Yours sincerely,

Signature

Colin Williams

# Appendix 3 – Research Aims – general information sheet

SAMPLE DOCUMENT

RESEARCH GENERAL INFORMATION SHEET (Form 4)

"To understand the skills or capability required by mature IT engineers to remain effective in the information technology industry"

A Grounded Theory Qualitative research study

**Overview**

I would like to undertake an internal academic research study for a university degree programme within the Technical Resource Group engineering team.

**Introduction**

The information technology industry with endless innovation and change continues to be one of the most dynamic and exciting working environments. As new products and solutions appear that affect the personal, social and professional lives of all, continual learning to remain current has become a normal operating mode in the IT field. However a double edged sword of confusion and opportunity is now evident driven by the digitisation wave of the past decade that spawned new use cases for technology, a change to the skills required to implement and maintain technology and coupled with a new generation of IT literate candidate keen to obtain employment.

**Research Detail**

As a 30 year veteran in the IT industry I am passionate about the importance of retaining existing IT skills, enhancing them and maximising the potential of the IT workforce as a whole. However, I would like to focus my research study activities on IT engineers aged 45 and over to understand a perspective from the engineer's point of view of the skills required to remain effective in this changing IT industry.
Data will be collected via individual face to face interviews over the course of a year (to cover a sufficient amount of engineers) and to a limited degree follow up interviews if further clarification of a particular theme is required. The field based interview phase is projected to commence January 2018.

**Objectives.**

The research aim is to obtain a level of deep understanding based on inputs from a group of the IT community with powerful views and a wealth of experience and insight.

I look forward to engaging with you directly when the research activities commences.

**Contact Details**

Feel free to contact me using the details below if you have further questions.

Thank you

Colin Williams – Chief Technologist
Tel: xxxx-xxxxxx Email: WILC9_15@UNI.WORC.AC.UK

## Appendix 4 – Interview participation form

SAMPLE DOCUMENT

PARTICIPANT INFORMATION SHEET (Form 2)

"To understand the skills or capability required by mature IT engineers to remain effective in the information technology industry"

A Grounded Theory Qualitative research study

Dear Participant,

This document will present an overview to help you to determine if you would like to participate in my qualitative research study.

- ***What is the purpose of this research?***

  The research purpose is to understand the skills or capability required by mature IT engineers to remain effective in the information technology industry. The research will utilise information collected from a number of qualitative interviews to gain understanding from engineers undertaking an information technology role within Company X.

- ***Why have I been asked to take part?***

  A number of randomly selected engineers are required to generate the research information. You are 1 of minimum of 30 initially selected participants but more engineers may be required as the research progresses.

- ***What if I don't want to take part?***

  You are under no obligation to take part in the research. Before the interview commences you will have the opportunity to opt out.

- ***What exactly will I be required to do?***

  You will be asked a number of open questions with your answers captured as a collection of interview notes. Your personal perspective related to the research topics is welcomed and doesn't require a specific question for you to share your viewpoint. The experience should feel like a semi structured conversation.

- ***Is there any risk to me participating?***

  There is no foreseen risk to you participating. You are free to withdraw from the interview or research process at any time.

- ***How will my responses be captured?***

  The interview will be undertaken face to face (alternative platforms including Webex may be used if distance or other considerations limit the potential for an in person interview). The researcher will capture the conversation as a series of research notes and audio record the interview to ensure consistency information is collated.

- ***How long will it take?***

  The interview will take no longer than one hour.

- ***How exactly will my anonymity/confidentiality be ensured?***

Your responses will be anonymised using codes to meaning your personal details are not contained within and all participant responses are aggregated together making them unidentifiable to an engineer by name. Quotations made that may identify a person by style or format will be removed from the research.

- ***How will the results of the research be disseminated?***

  Your unidentifiable responses and those from the other participants will be utilised to create themes and theories from the data. The completed research will be shared with Worcester University for academic purposes. It may be shared with Company X with participant information in anonymised form and used in part or full within articles/reports stemming from the research[CW1].

- ***What do I do if I want to stop half way through?***

  You can withdraw from the interview and overall research activity at any stage. Let the researcher know during the interview if you no longer want to participate or at any stage through the research activity and if you would like your interview responses discarded.

- ***How will my data be stored?***

  It will be stored anonymously and encrypted on a secure server belonging to the researcher and within secure facilities at the University of Worcester for 10 years, after which time it will be securely destroyed.

- ***I have some more questions or concerns, who should I contact and how?***

  Please contact the researcher at WILC9_15@UNI.WORC.AC.UK if you have any concerns about the interview process or research. If you would like to speak to someone who is not a member of the research team, please contact the Worcester Business School Ethics Co-ordinator at wbsethics@worc.ac.uk.

## Appendix 5 – Interview informed consent form

***SAMPLE DOCUMENT***

**PARTICIPANT CONSENT SHEET (Form 3)**

"To understand the skills or capability required by mature IT engineers to remain effective in the information technology industry"

A Grounded Theory Qualitative research study

**Research Working Title - "To understand the skills or capability required by mature IT engineers to remain effective in the information technology industry"**

**Please initial each box**

| | | |
|---|---|---|
| 1 | I understand the research aims | ☐ |
| 2 | The research process has been fully explained and I understand what my participation will involve | ☐ |
| 3 | I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason | ☐ |
| 4 | I agree to the interview being [audio] recorded | ☐ |
| 5 | I agree to the use of [anonymised quotes/aggregated results] in publications | ☐ |
| 6 | I understand and agree to how my responses will be used and stored | ☐ |
| 7 | I agree to take part in the study | ☐ |

Name of Participant: ______________________________

Signature: ______________________________

Date: ______________________________

Participant Consent Sheet - Form 3 - Draft. Colin Williams - June 2017 v0.1

## Appendix 6 – Interview questions template

# INTERVIEW PREPARATION SHEET JUNE 2018

**"To understand the skills or capability required by mature IT engineers to remain effective in the information technology industry"**

**A Grounded Theory Qualitative research study**

**Interview Format**

Duration: 1 hour (plus 15 to 30 mins post interview for review and clean-up)

**Interview Approach.**

Opening Statement: "Thank you for agreeing to participate in this interview. My name is Colin Williams and I am a chief technologist in company X. Your time and input is valuable and your involvement appreciated. This study aims to understand the skills or capability required by mature IT engineers to remain effective in the information technology industry. I have spent nearly 30 years in the IT industry and most notably the activities of mature technical personnel. The initial research objectives are based on my awareness of the changing market conditions that affect the IT industry and modern business as a whole.

The interview will last a maximum of one hour and will be based on a semi structured format and will be audio recorded to ensure information is captured accurately. You will be asked a number of positioning questions for you to answer as opening and frankly as you can (I have no expectation of any particular answer) and equally you are encouraged to share any additional views you have relevant to the topic for consideration".

Please note you are free to withdraw from this interview or the research process at any time with no concern of negative impact to you or your role. Additionally you can request a review of the documented work throughout the study and remove your personal information if required.

## RESEARCH PURPOSE

The research purpose is to understand the skills or capability required by mature IT engineers to remain effective in the information technology industry.

## RESEARCH QUESTIONS

- What is your name, if you don't mind me asking how old are you?
- How would you describe your role, maybe a day in a life of you?
- What was your background?
- How do you feel about your current career as an IT engineer?
- How has your IT engineering role evolved since you entered the industry?
- What career aligned challenges are currently faced by mature IT engineers in the workplace?
- What do (YOU) believe are the skills required to be productive?
- What support should organisations put in place to enhance the careers of mature IT engineers?
- What is your current level of emotional engagement, is this just a job for pay or are you on a career journey
- How has the incoming younger generation of IT engineers affected your working practices and if so how – give examples?
- How is the emergence of digitisation in enterprise organisations affecting the skills required within the mature IT engineering workforce?

## CONCLUDING SECTION

I think that conclude the questions I wanted to ask. Is there anything you would like more you would like to ask or share with me?

## CLOSE

Thank you for taking the time to participate in this. My hope is to create a piece of work that helps us to understand how to positively change the fortunes of the engineering and consulting community.

I may contact you again to review ideas and findings as the research progress. On completion of the study I will make the research summary available to you to peruse.

Please note you are free to withdraw from this interview or the research process at any time with no concern for negative impact to you or your role. Additionally you can request a review of the documented work throughout the study and remove your personal information if required.

## Appendix 7 – University Ethics approval

University of Worcester

**HUMANITIES, ARTS AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE (HASSREC)**
**CONFIRMATION OF APPROVAL**

22 January 2018

PROJECT TITLE: **To understand the skills or capability required by mature IT engineers to remain effective in the information technology industry.**

REC CODE: **HCA17180028**

Dear Colin,

Thank you for your application for proportionate review ethical approval to the Humanities, Arts and Social Sciences Research Ethics Committee on the 19 December 2017.

Your application has been reviewed in accordance with the University of Worcester Ethics Policy and in compliance with the Standard Operating Procedures for proportionate ethical review.

The outcome of the review is that the Committee is now happy to grant this project ethical approval to proceed.

Your research must be undertaken as set out in the approved application for the approval to be valid. You must review your answers to the checklist on an ongoing basis and resubmit for approval where you intend to deviate from the approved research. Any major deviation from the approved application will require a new application for approval.

As part of the University Ethic Policy, the University Research Committees audit of a random sample of approved research. You may be required to complete a questionnaire about your research.

Yours sincerely,

*Bere*

BERE MAHONEY
*Chair - Proportionate Review Committee*
Humanities, Arts and Social Sciences Research Ethics Committee (HASSREC)
Ethics@worc.ac.uk

## Appendix 8 – Interview participation (confirmation email)

### INTERVIEW PARTICIPANT EMAIL CONFIRMATION

Send

To: test user@testuser.com

Cc:

Subject: Participation in my University of Worcester research project - (Consent Form))

Colin Williams Qualitative Interview Particpant Consent Form 3 - 090718.pdf
272 KB

Colin Williams Qualitative Interview Particpant Information Sheet Draft 180418.pdf
285 KB

Hi xx

Thank you for agreeing to participate in my research project. It is greatly appreciated with the field based research element fundamental to the completion of my doctoral degree.

I have enclosed an information sheet with commonly asked questions and an outline of the interview process, feel free to peruse it to further your understanding.

My research is an academic degree therefore placing ethics and data handling high on the agenda. Can you **print and sign the enclosed consent form**, photographing it on your smartphone (because none of us use fax machines anymore) and sending the picture back to me via Email for my university records.

The interviews will be hosted by Webex and take no more than an hour (the pilot interviews were circa 40 minutes). With such a variance of the working styles and times of all participants, I would appreciate a suggestion from you of the times, dates that align best for you (and I will make myself available – days, evenings, anytime).

Thank you again for helping me with such an important activity.

Contact Colin.williams@computacenter.com or WILC9_15@UNI.WORC.AC.UK if you have any queries/concerns.

Yours sincerely

Colin Williams

## Appendix 9 – Initial coding sheet (example)

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | | **Initial Codes - March 2019 (first pass)** | | | |
| 2 | | | | | |
| 3 | Role confusion | Accountable for task outcomes | Qualities of a real engineer | Influence of family circumstances | Skills based development and branding |
| 4 | Length of service | Deskilling of role | Change skills to remain relevant. | Remuneration impact on decision making. | Self worth |
| 5 | Ever-changing roles | Benefits of multi skilled personel | The management pathway (change of role) | Building relationships | Role Variation |
| 6 | Self-motivated | Career change into IT | The pace of change | Career advancement | Role fluidity |
| 7 | Self-Trained | Less fulfilling role. | Career goals | Stalled advancement. | Technical grounding |
| 8 | New Opportunity in life | Benefiits of a troubleshooting background (fault finding) | Company career guidance | Development pathway lacking (formal) | Loss of engineering motivation |
| 9 | Diminishing tasks | Employers less proavtive at training. | Age discrimination. | Lack of awareness (other opportunities) | Move to management |
| 10 | Role has changed | Changing format change to online | Knowledge level | Age related difference | Changing role |
| 11 | New for new skills | Phyicsal demands of the role with age | The attraction of security roles | Skills development | Changing environment |
| 12 | Role is no longer diverse. | Look for attitude over attitude when selecting new staff. | Analytical Thinking | Graduate development programmes | Driven by customer satisfaction |
| 13 | Changing technology landscape | Soft skills now important. | Self-Learning | Young engineer impact | |
| 14 | Age not a factor | Move to a management role | Role variety | Hybrid role | Loss of interest in technology |
| 15 | Shift of skills offshore | Line manager confidence in the engineer. | Interest in technology | Internal development | Driven by customer satisfaction |
| 16 | Convenient to remain in role | Renumeration. | Development pathway | Research engagement level | |
| 17 | Company reluctant to retrain staff | Visblity of retirement | Personal Motivation | Role type | Industry constant changes holds interest |
| 18 | Less to learn in the new age | Lack of empowerment. | Career ceiling | Changing role | Personal change to survive |
| 19 | Old tasks no longer undertaken | Company no longer thinking customer first | Lack of manager encouragement | Role confusion (definition) | Encouraging personal development |

Sheet1 Sheet2

# Appendix 10 – Theoretical memo example (personal value)

**Personal Value**

Theoretical Memo – 19/10/20

Personal value is a code created that may become a category. All participants described concerns about their own reduced sense of personal value and how the organisation acknowledged the value they delivered and frequently untapped capacity that existed within. The views displayed were so strong with examples commonly cited that cannot be described due to confidentiality and anonymity when discussing personal and professional milestone events across the tenure of the engineer. Self-worth is also documented as a stand alone focussed code but may be combined with personal value due to both used interchangeably by the participants.

The emotive storytelling persona of the participants when describing personal value from their initial employment into the IT industry to their current mature, state suggested value has become increasingly important as task centric skill sets diminished and their accumulation of experiential and knowledge skills increased. Recognition and acknowledgement of personal value changing over time or the recognition of value contributory to a successful job move from IT engineering to other technology teams within CompanyX or a role outside of the organisation will benefit the mature employee.

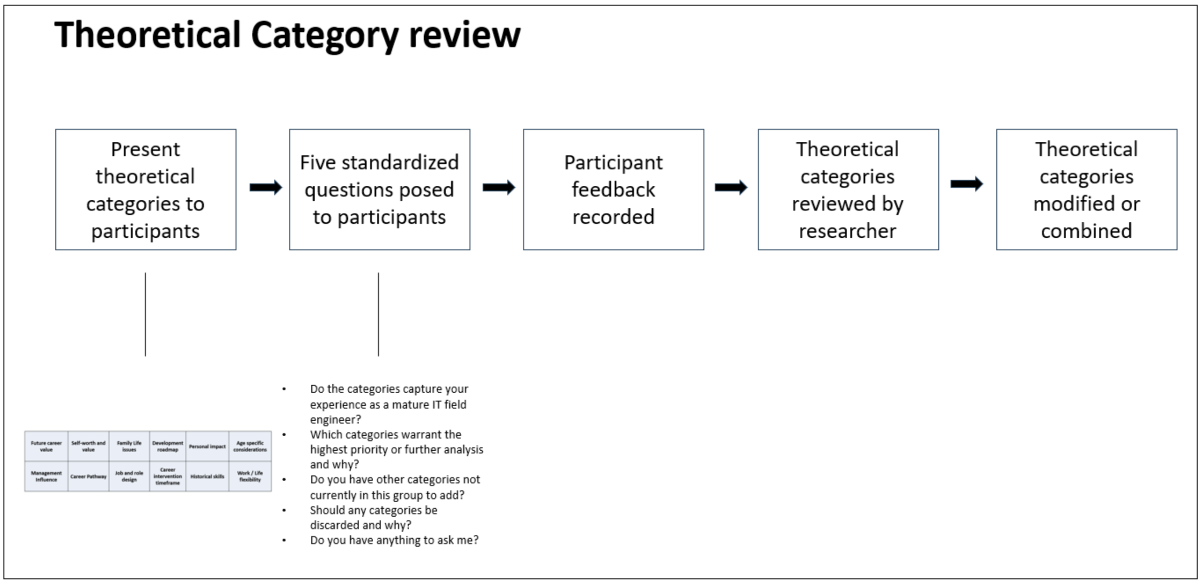
*"I only felt valued when I sat at the table at the recognition of 10 year employment company dinner".* Anon

The level of commonality of story across participants describing diminished feelings of personal value was unexpected, surprising and not considered an area of enquiry prior to the research.

A selection of the codes used to create the personal value category includes:

Prioritise actual skill over accredited skill
Surviving not enjoying role
Self-worth
Not feeling valued
Ten year reward milestone (valued recognition)
Lack of value centric rewards
Perception of line managers
Perception of exec leadership
No longer feeling challenged
Working on autopilot
Less important than sales employees
Dumbing down of role
Technology simplification
Task simplification
Increased technology reliability

## Appendix 11 – Theoretical Category review process




### Theoretical Categories

Pre-Theoretical category review

| | | | | | |
|---|---|---|---|---|---|
| **Future career value** | **Self-worth and value** | **Family Life issues** | **Development roadmap** | **Personal impact** | **Age specific considerations** |
| **Management Influence** | **Career Pathway** | **Job and role design** | **Career intervention timeframe** | **Historical skills** | **Work / Life flexibility** |

**Primary Research Objective**

"To determine the skills, support and development required by mature IT field engineers remain effective in the future"

Mature is defined as aged 45 years old and over.

**Interview Questions (the categories above will be discussed)**

- Do the categories capture your experience as a mature IT field engineer?
- Which categories warrant the highest priority or further analysis and why?
- Do you have other categories not currently in this group to add?
- Should any categories be discarded and why?
- Do you have anything to ask me?

## Appendix 12 – Theoretical Category review participation sheet.

# INTERVIEW PREPARATION SHEET

**"To understand the skills or capability required by mature IT engineers to remain effective in the information technology industry"**

**A Grounded Theory Qualitative research study**

THEORETICAL REVIEW ACTIVITY

**Interview Format**

Duration: 30 minutes

**Interview Approach.**

Opening Statement: "Thank you for agreeing to participate in this interview. My name is Colin Williams, and I am a chief technologist in CompanyX. Your time and input are valuable, and your involvement appreciated. This study aims to understand the skills or capability required by mature IT engineers to remain effective in the information technology industry. I have spent nearly 30 years in the IT industry and most notably the activities of mature technical personnel. The initial research objectives are based on my awareness of the changing market conditions that affect the IT industry and modern business as a whole.

The interview will last a maximum of 30 minutes on a semi structured format and will be audio recorded to ensure information is captured accurately. You will be asked several positioning questions about the categories created based on the interview transcripts of you and the other engineers.

Cisco Webex audio and video conferencing will be used as the communications platform for this interview. If the call fails prior to the end of the interview, please dial back in via the published details.

Please note you are free to withdraw from this interview or the research process at any time with no concern of negative impact to you or your role. Additionally, you can request a review of the documented work throughout the study and remove your personal information if required.

**Theoretical Categories**

| | | | | | |
|---|---|---|---|---|---|
| Future career value | Self-worth and value | Family Life issues | Development roadmap | Personal impact | Age specific considerations |
| Management Influence | Career Pathway | Job and role design | Career intervention timeframe | Historical skills | Work / Life flexibility |

## RESEARCH PURPOSE

The research purpose is to understand the skills or capability required by mature IT engineers to remain effective in the information technology industry.

## RESEARCH QUESTIONS

- **Do the categories capture your experience as a mature engineer?**
  - Aligned.
- **Which categories warrant the highest priority and why?**
  - Family issues, self-worth and value
  - Happy to go for the role they are in.
  - Some engineers don't want a personal development plan. Few seem to want to drive their careers Content in the role. Lack the desire.
- **Should any be discarded and why?**
  - No
- **Do you have others to add outside of this group?**
  - Reward frameworks could be a separate category.
- **Do you have anything to ask me?**
  - No.

*Participant Answers retained*

## CONCLUDING SECTION

I think that conclude the questions I wanted to ask. Is there anything you would like more you would like to ask or share with me?

## CLOSE

Thank you for taking the time to participate in this. My hope is to create a piece of work that helps us to understand how to positively change the fortunes of the engineering and consulting community. When I complete my write-up of this interview including any transcription, I will make it available to you to correct any that may be misinterpreted.

Thanks again and have a great day.

## Appendix 13- Theoretical Research categories.

| | | | | | |
|---|---|---|---|---|---|
| **Future career value** | **Self-worth and value** | **Family Life issues** | **Development roadmap** | **Personal impact** | **Age specific considerations** |
| **Management Influence** | **Career Pathway** | **Job and role design** | **Career intervention timeframe** | **Historical skills** | **Work / Life flexibility** |

## Appendix 14 – Literature search main – academic search strings (example)

| Search criteria | Primary Search Engine (number of hits) | Retained | Significant Authors |
|---|---|---|---|
| ("JOB DESIGN" AND "mature" and "engineering") | 4080 | 52 | |
| ("JOB DESIGN" AND "mature engineering") | 7 | 0 | Herron unpublished thesis |
| ("JOB DESIGN" AND "mature engineer") | 1 | 0 | |
| ("JOB DESIGN" AND "mature" and "engineer") | 1420 | 17 | |
| ("JOB DESIGN" AND "mature employee") | 32 | 3 | |
| ("role DESIGN" AND "mature" and "engineer") | 191 | 12 | Kranz, Lisa Hunter (possible)<br><br>Lots of designer (product) hits. Problem |
| ("role DESIGN" AND "mature engineer") | 0 | 0 | |
| ("role DESIGN" AND "mature" and "engineering") | 420 | 4 | Peach martins |
| ("role DESIGN" AND "mature engineering") | 0 | 0 | |
| ("role DESIGN" AND "employee") | 1160 | 18 | |
| ("job DESIGN" AND "employee") | 73000 (excluded) | Not used | |
| ("job state" AND "mature" AND "engineer") | 44 | 2 | Van Rensburg, |
| ("job state" AND "mature" AND "engineering") | 142 | 2 | 21.14 on |
| **("job state" AND "mature engineer")** | 0 | 0 | |
| ("job state" AND "mature engineering") | 0 | 0 | |
| ("role DESIGN" AND "mature employee") | 0 | 0 | |
| | 7497 | 110 | |

## Appendix 15 – The Grounded theory – Emergence of self-worth and value